gradually subsides under anodyne and tonic treatment. Thus, many cases are overtreated, although the original state required treatment, this being kept up beyond the real cure, because the patient was still feeling pain.

Now, we will suppose a patient of naturally sensitive emotional temperament to have an affection of this kind for a year or two. We well know that, especially if the uterus be involved primarily, the stomach will sympathise by reflex irritation of the sympathetic nerves; and dyspepsia in its varieties will arrive, and even vomiting. And thus we must conclude that the nerves of the stomach are, in their way, as tender and irritated as those of the skin over the sacrum. An exaggerated instance of this is seen often in pregnancy; and then, the greater portions of the ganglionic system being already in a state of irritation, it is not difficult to understand that other organs in their turn become troubled, and headache, hypochondriasis, palpitations, etc., follow in their wake. The whole body in consequence suffers; for, the stomach and digestive organs failing duty, there must ensue debility; and thus the emotions assert superiority, and paroxysms of hysteria are not remote.

The distress of such a condition is often increased, in cases of uterine abrasions and hypertrophy, by the hæmorrhages frequently attending them; and thus anæmia intensifies the liability to neurosis and its sequents.

Of course, I do not deny that the state of the nervous centres themselves, both cerebro-spinal and sympathetic, may give rise to the same phenomena as when derived from eccentric irritation. Mental depression, impoverishment, anxiety, etc., or actual disease of the centres, may doubtless set up such troubles as we have been considering; but I think that, in the large majority of cases, there is a reflex cause to be found after careful observation.

In our research after it, we must bear in mind that it may seem to us, who are in health, slight; and that pain, depression, exhaustion, etc., will magnify its power of annoyance. The study of these matters has been carried on by the male sex, most of them in good health, who personally can but slightly appreciate the susceptibility of the female economy. These phenomena have been viewed rather from the masculine than the feminine aspect; and some have gone so far as to deny these well-known facts. Yet one might appeal to those who have suffered severe and chronic ailments, whether the train of symptoms just narrated have not a reality for all.

Supposing, then, a train of symptoms similar to those instanced from uterine or rectal irritation to arise from abrasion or irritation of the stomach, ultimately reducing the patient to a highly sensitive state with dysæsthesia of many kinds, discomforts, and exaggerated complaints, so that finally the whole balance of the reason and emotions becomes disturbed; can we in fairness call the *whole* of such a state "hysteria"? But it surely cannot be called a disease peculiar to woman. With less emotional disturbance and more rational force the man suffers, and then we call it dyspepsia in its milder forms; but, supposing the man had been previously depressed by overwork, anxieties, watchings—added to, perhaps, by tea-drinking to excess—then, if he were overanxious about himself, and overvalued the importance of his trouble, he would be called an hypochondriac.

But there is a reality in the pain; there is a reality in the causation; a man in this state will, on excitement, soon show the susceptibilities of his emotional system.

Yet one more instance. It is a very common thing for women to complain of pain in the groins; and some put it down to ovarian irritation or ovarialgia. If it continue a long time, the patient is worried about it, and in her mind it attains a prominence it does not deserve as regards danger. But it is much increased at monthly epochs, when it may be very severe for a few hours or days. After a time, the general system is disturbed, there are neurotic pains and aches; more emotional disturbance, and the stomach begins to complain, and even vomiting to occur. If this go on for one or two years, gradually increasing in severity, then we find globus hystericus, hysterical paroxysms, and an instability of the balance between the reason and emotions; and, if the patient be originally of firm will, she may preserve a moderate appearance of quiet, but otherwise there will be the usual phenomena of the hysterical state.

But is this only irritation of the ovary? In the vast majority, there is some definite trouble. Look at the function of the ovary; how many Graafian follicles are maturing in various stages; see how dense a tissue each has to penetrate; consider the congestion, beginning some days before the bursting, and then the actual extrusion of the ovum with a drop of blood, or sometimes more, into the peritoneum, even if taken up well by the Fallopian tube; supposing the tunica albuginea to be unusually dense, or the Fallopian tube prevented by adhesions from grasping the ovum, then the latter falls into the peritoneal

cavity. And does it require much imagination to conceive that pain, excitement, and reflex phenomena should be present to develop by reiteration the hysterical phenomena?

But ought we not to call this in all its stages hysteria? In some cases, these latter symptoms would never be developed; and thus we can only say that hysteria may arise out of this as out of other irritations. Again, suppose that previously the whole nervous and general system were depressed by the many troubles of life, then we should find that the case would proceed with greater rapidity.

May I not say, with your acquiescence, that any source of irritation in any organ or part of the body existing and continuing, other parts in nervous relationship with it are influenced, till a condition of hyperæsthesia, dysæsthesia, and overaction ensues, tending in various ways to reduce the patient; so that, sooner or later, there is a greater prominence given to the emotional system, which may or may not be subject to the control of the will?

[To be continued.]

THE GOULSTONIAN LECTURES

ON

PHARMACOLOGY AND ITS RELATION TO THERAPEUTICS.

Delivered at the Royal College of Physicians, London.

By T. LAUDER BRUNTON, M.D., D.Sc., F.R.S.,

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LECTURE III.

In my last lecture, I described some examples of the method by which medicine is at present advancing, and to-day I purpose to enumerate some of the gains already achieved by the employment of this method. These are fourfold in their character. We have new remedies. We are taught how to use our old remedies. We learn what to do. We learn what to avoid. We discover that the action of *casca* on the heart and vessels indicates it as an useful remedy in defective circulation. At the same time, we are cautioned that the drug may disturb the digestion and cause an unpleasant surprise if carelessly given.

If *casca* is to be beneficial in one form of heart-disease, why not in another? If it is to do good in mitral, why not in aortic, incompetence?

To answer these questions, let us consider the pathology of the disease. During the normal condition of the cardiac diastole, the left ventricle usually receives only the blood which pours into it from the auricle. When the aortic valves are incompetent, the ventricle receives in addition the blood which flows back from the aorta. It thus becomes filled to a much greater extent than usual. The quantity of blood, therefore, which is propelled by it into the arterial system by each systole is very large, so that the arteries become tense. During the diastole, the blood which ought to be retained in the aorta by the sigmoid valves is allowed to flow backwards into the ventricle; so that the arterial system may be compared to a vessel open at both ends—viz., at the capillaries and at the heart—instead of at one end only, as in health. It thus becomes much emptier during the heart's pause than it should be. The condition, indeed, is comparable to that of a man from whose artery a jet is allowed to flow between every pulsation, only that the blood flows back into the heart instead of out of the body. The differences between the tension of the arteries in their full and empty states are thus very much greater than in the normal condition; and we get the full and bounding pulse first recognised by Corrigan as characteristic of the valvular lesion we are now considering. We all know how difficult it is to break a cord by steady strain, and how easy by a sudden jerk. The arteries in aortic regurgitation are subjected to a greater strain than usual by the great variations in tension which occur. Supposing, then, that we were to increase the force of the heart by such drugs as digitalis and *casca*, we would increase the strain upon the arteries. But, besides the increase in the force of the heart, these remedies would make it pulsate more slowly, and more time would thus be allowed for the blood to flow into it both from the auricles and from the aorta. The ventricle would thus become fuller than usual; a greater volume of blood would be poured into the arteries at each beat; and the tension would be increased by the size of the wave, as well as by the rapidity of its pro-

pulsion. But the increased length of the diastole would also allow the arterial system to become emptier both from the onward current through the capillaries and the backward flow into the heart. The variations in tension would thus be rendered still greater. At each pulsation of the heart, the tension would become exceedingly great, but at each pause exceedingly low—so low, indeed, that the current through the capillary system might cease entirely, especially in those parts of the body, such as the brain, where it is counteracted to the greatest extent by the force of gravity. Syncope would, therefore, be likely to ensue, and might pass into death if the cardiac diastole were much prolonged. We see, therefore, that the use of *casca* in such circumstances would be highly injurious. But if the ventricle, subjected to constant strain by the blood flowing into it under pressure from the aorta even during its period of rest, should begin at last to yield and dilate, so that the bicuspid valves become incompetent to close the enlarged mitral orifice, the regurgitating blood will obstruct the circulation through the pulmonary vessels, the strain will be transmitted back to the right ventricle, and we shall have all those symptoms of obstructed respiration, oedema, etc., which we have already considered. The danger now is, not of death from syncope, but death from suffocation. The condition now approximates to that which we have already considered under the head of mitral disease, when *casca* or *digitalis* proves most beneficial.

The recognition of *digitalis* as a cardiac stimulant is one of the great advantages which we have derived from experiment; for, although clinical experience seemed to show its utility in cases of cardiac debility, yet, until its power to strengthen the cardiac pulsations was actually shown by experiment, many practitioners were afraid to employ it even in those cases in which it would have been most serviceable.

But it is not only in the treatment of organic diseases of the heart that we have gained much from scientific pathology and pharmacology. One of the greatest obstacles to the successful employment of any general empiric rule, such as *contraria contrariis curantur*, or *similia similibus curantur*, is, that symptoms do not always arise from disease of the organ apparently most closely related to the disordered function. Thus we have seen that, although the laboured respiration may be the most urgent symptom in mitral disease, the heart, and not the lungs, is at fault. In the same way, we sometimes may have the heart palpitating and the pulse irregular or intermittent, when the disorder is really in the stomach. But physical diagnosis enables us to ascertain the absence of organic lesion, and experimental pathology has shown us the mechanism by which gastric disturbance produces cardiac irregularity. The irritation from the stomach is transmitted up the afferent nerves to the medulla oblongata, and down the vagus to the heart, interfering with its pulsations. It is evident, then, that, instead of meddling with the heart, the proper treatment is to remove the irritation of the stomach; but, if we cannot immediately do this, we may prevent its effect upon the heart in two ways. As the action is reflex, we may lessen or destroy it by diminishing the activity of the centre through which it occurs. Since it is produced through the vagi, we may stop it by destroying their power. So far as I know, no experiments have been made on the influence of drugs over this particular form of reflex action; and we must, therefore, use one which we know to lessen reflex action generally, such as bromide of potassium, opium, or chloral, without being able at once to select the best. But we do know that, if the long intermissions should threaten danger, we can avert it by a free use of atropia; for this alkaloid completely paralyses the ends of the vagus in the heart, and no amount of stimulation to the nerve, either direct or reflex, can then stop the pulse.

Nor is this the only action of this drug. It has another of considerable importance, for it paralyses the sensory nerves of the heart. Increased pressure of blood in the arteries has a double action on the circulation. It stimulates the heart to quicker and stronger pulsation; but it also stimulates the medulla, and thus, through the vagus, tends to retard and weaken the heart's action. In health, the vagus has the upper hand and restrains the heart's action whenever the blood-pressure rises; but, should the heart become irritable from any cause such as strain, the conditions may be reversed, and the heart, breaking loose from its usual bonds, responds to the stimulus by palpitation. During violent muscular exertion, the blood-pressure rises enormously; and it is in persons who are subjected to such strain by their daily avocations that the so-called irritable heart is found. In animals with the vagi divided, rise of pressure excites the heart, because the usual restraining influence is destroyed; but in such animals the blood-pressure may be raised to three times its usual amount without any effect on the pulse, if a dose of atropia or belladonna have been given somewhat larger than suffices to dilate the pupil (Schiff, *La Nazione*, 1872, No. 235). Belladonna is, therefore, theoretically indicated in irritable heart; and I have been informed that at Netley Hospital it has practically been

found very efficacious. I have myself prescribed it with great advantage in such cases; but, while successful when given shortly after the first appearance of the symptoms, it failed to benefit at a more advanced stage of the disease.

Besides the mechanism which we have already considered in the vagus, there seems to be another nervous apparatus for regulating the blood-pressure. This acts, not upon the heart, which the blood is forced into the arteries, but upon the arterioles or capillaries, through which it flows out of the arteries into the veins. The veins form a great reservoir, large enough, when dilated completely, to hold all the blood in the body, as they indeed do after death. From the heart sensory fibres proceed to the vaso-motor centre, and when they are irritated they cause the arterioles to dilate, so that the blood flows freely into the veins, and the pressure sinks in the arteries. Increased pressure in the heart is probably the normal stimulus to these fibres. As regularity of motion in a steam-engine is obtained by governing balls, so regularity of the blood-stream appears to be obtained by the nerves which act upon the heart and vessels. When the regulating mechanism is disturbed, either in the steam-engine or circulation, danger is the result. This is the case in angina pectoris. Some years ago, I was placed in exceptionally favourable circumstances for studying this disease. I was able to watch a patient at every hour of the day and night, and to observe every phase of the attack. By the aid of Marey's sphygmograph, I discovered that, during the paroxysm, the blood-pressure rose and the pulse became quick. I might have imagined that the rise in pressure was due to the quickness of the heart's pulsations; but the experiments of Marey and Chauveau enabled me to say, from the form of the tracing, what I could not have discovered by the finger, that the arterioles were excessively contracted.* As the pressure rose, severe pain came on in the heart, and when the pressure fell the pain disappeared. It was, therefore, natural to look upon the pressure as the cause of the pain, and my opinion was confirmed by the effects of bleeding; for this lowers the pressure, and each bleeding prevented an attack. The pathology of the disease thus seemed clear, and the next question was how to treat it. The remedy wanted was one which would dilate the vessels, and this the researches of Richardson and Gamgee supplied. Nitrite of amyl they had shown to possess the very power which I desired, and thus their experiments on the pharmacology of the drug and my observations on the pathology of the disease, united, led to successful therapeutics. I administered the remedy, and the pain disappeared. In the hands of others it has usually produced similar results; but sometimes it has failed. The failure has been used as an argument to prove that angina does not always depend on excessive blood-pressure. This may be the case, but the proof is insufficient; for in some patients the nitrite ceases to act after it has been kept a few days, while the newly made drug always affords relief. Had such a case been treated with old nitrite only, it would have been recorded as one of failure. Whether the loss of activity is due to conversion of the nitrite into nitrate or to decomposition or evaporation of some nitrous compound present in the newly formed nitrite, but still more active and unstable than it, must be determined by future research.

While angina seems to depend on spasmodic contraction of the vessels generally, local spasm may cause pain or disturbance of function. Du Bois Reymond's observations of the contracted condition of the arteries in migraine led me to use the nitrite in headache, and sometimes with success. On the hypothesis that epilepsy depends on spasm of the cerebral vessels, I administered it during the fits of epilepsy, but without result. By giving it before the fit comes on, Dr. Crichton Browne has been more fortunate, and has succeeded in averting the paroxysm. But in this disease the remedy *par excellence* is bromide of potassium, for the extended use of which we are much indebted to the late Dr. Begbie. How it acts in epilepsy we do not as yet know; but experiment has shown that it lessens reflex action generally, and we thus have a general rule to guide us in its use. It is not an astringent in the usual sense of the term, yet it may sometimes check diarrhoea. In a patient where the looseness of the bowels seemed to depend upon reflex irritation from the uterus, the general rule I have just mentioned led Dr. Ferrier to use it, and his success was complete.

Various researches have shown that the substance of the nerve-centres may be affected by drugs independently of the circulation, but the experiments of Durham have shown the connection between sleep and anæmia of the brain. The difficulty which the congested condition of this organ, after poisoning by opium, was supposed to present to Durham's theory, has been explained by the experiments of Hammond. He finds that in the sleep produced by a small dose of opium, the brain is anæmic, but, as the sleep passes into coma after a large dose, the anæmia gives place to venous congestion, slow circulation to stagna-

* See woodcuts of tracings in JOURNAL of January 13, 1872, page 45.

tion. Knowing, then, the connection between anæmia and sleep, active circulation and mental activity, we are able to choose our remedies accordingly. If the patient constantly fall asleep when standing or sitting, and cannot sleep when lying down, we know that the vessels are probably flaccid and allow the blood to gravitate to the lowest point, away from the head in the upright and to it in the recumbent posture. In such cases, we know that digitalis will probably be useful by giving contractile power to the vessels and chloral injurious by weakening them. But when the tight arteries and powerful heart seem to be driving the blood rapidly through the brain, then we have recourse to chloral, for its weakening action on the heart and vessels will now aid its action on the nervous tissue.

Nor is it only on the nerve-centres that we are able to act. As Bernard showed, we can influence peripheral nerves also by our drugs. It is impossible to look at the jerking limbs and irregular movements of chorea, without wishing that we could load every muscle with lead, and still its useless and disturbing movements. Sleep will do this and opium will produce sleep, but we cannot keep the patient constantly in a state of insensibility; we wish to leave their activity to the mental powers, and only to quiet the muscles. This we might do by curare, but we have another remedy, which seems still more suitable; for conia acts on the motor-nerves in the same way as curare, and methyl conia lessens the functions of the spinal cord. Ordinary hemlock contains both, and thus the succus conii, by deadening the motor-nerves and enfeebling the cord, should render movement more difficult and wearisome, the very result which we desire to produce. We should thus be able to ameliorate the symptoms, even though we may not touch the real source of the disease.

Let us now pass on to the respiration. The object of respiration is to give oxygen to the tissues, but these are far removed from the outer air and, therefore, must have the oxygen brought to them. This is done by the blood, and internal respiration consists in the interchange of gases between it and the tissues. If this go on quickly, a necessity arises for increased contact of the blood with the outer air, so that it may give off its carbonic acid and take in fresh oxygen. The necessary correspondence between the internal respiration in the tissues and external respiration in the lungs, is effected by the respiratory centre in the medulla oblongata. The activity of this centre increases or diminishes with the venosity of the blood which circulates through it, although it may be reflexly affected by various nerves. When the blood is exceedingly venous, the respiratory movements become great or convulsive; when it is excessively arterialed, they cease altogether. If the blood be deficient in hæmoglobin, as in anæmia, it cannot carry a sufficient quantity of oxygen to the medulla, and thus such patients pant and blow after slight exertion. The administration of iron has been shown to render the blood-corpuscles more numerous, to increase the hæmoglobin they contain, and augment the oxygen-carrying power of the blood. Iron is consequently the remedy indicated in anæmic dyspnoea, and clinical experience shows how beneficial is the result of its administration. We have already seen how cardiac disease may prevent the blood from sufficiently getting to the air, but obstructions to the respiratory passages may also prevent air from getting to the blood. The former condition required remedies which act upon the heart, the latter those which will affect the lungs. In bronchitis the air-tubes are clogged with mucus, which interferes with the passage of air through them, and by its constant irritation causes troublesome cough. Cough being a reflex act, we can diminish it, like other acts of the same sort, by drugs, which, like opium, will act on the reflex centres. But in old and debilitated persons, this centre, though irritable, lacks power, and the expulsive expiratory efforts require increase rather than diminution. Clinical experience has shown the value of carbonate of ammonia in such cases; but it is pharmacological experiment which informs us that ammonia stimulates the respiratory centre, and thus gives us a reason for our treatment. But atropia combines two qualities likely to make it useful in the cough of debility. It stimulates the respiratory centre, but at the same time it lessens the irritability of the sensory nerves of the lung, and will thus, while increasing respiratory efforts, diminish the sensibility of the lung to irritation. Hyoscyamus has an action almost the same as that of atropia, and often proves a valuable remedy in chronic bronchitis. But here the question of dose comes in, and although experiment assures us that certain drugs have certain actions, we may not get the result we desire when we administer them in disease, because we give too small doses, either from ignorance, timidity, or from the action of the drug upon other organs of the body preventing its being pushed to a sufficient extent. Regarding the action of drugs upon the bronchial secretion, we have no experimental knowledge. We know that something to eat and a drink of warm fluid before rising generally lessen the troublesome morning cough of chronic bronchitis better than any expectorant; but still experience shows that

tartar emetic, ipecacuanha, and iodide of potassium will also diminish the tenacity of mucus, and aid expectoration, while balsams will lessen the profuse secretion in bronchorrhœa. But how these drugs act on the bronchial glands we do not know, and it is a comfort to turn from our unsatisfactory acquaintance with the action of expectorants to the action of remedies on digestion. For here we are acquainted with the chemical processes which go on and the agents which originate them. We have a good knowledge of the mechanism of secretion in the various glands of the alimentary canal, and in the case of the stomach we have the great satisfaction of being able to see what our drugs are doing inside the body. It is cheering, too, for the physician who has been giving cough-mixtures without success until he has nearly lost all confidence in medicine, to have his faith re-established by a sight of the wonderful relief given by rhubarb and soda in flatulent dyspepsia.

Hope rises in our breasts when we compare the wild fancies of our predecessors with our own certain knowledge, and we look forward to a bright future for medicine. Mayow, for example, thought that digestion was performed by the vital spirits which came down from the head to the stomach, did their work, and then returned to the head again. Thus he explained the drowsiness which comes on after eating, and the digestive disturbance which deep thought and anxiety occasion. For the vital spirits could not be in two places at once: so when they were digesting the food in the stomach they left the head, and so caused drowsiness; when they were busily engaged with cogitations or passions in the head, they neglected their work in the stomach, and the food remained undigested. It would be impossible to bottle up such intangible beings as Mayow's vital spirits and make them do their work in a water-bath or oven, but we can do this with ptyalin or pepsin; it would be difficult to localise the paths by which the spirits ran backwards and forwards, but we know the vessels by which the blood flows to the stomach and brain, and we are beginning to learn the exact nerves which cause it to flow to the one rather than the other.

[To be continued.]

ABSTRACT OF A CLINICAL LECTURE

ON THE DISTAL LIGATURE IN AORTIC ANEURISM.

Delivered in University College Hospital.

BY CHRISTOPHER HEATH, F.R.C.S.,
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THE history of the application of the distal ligature for the treatment of aortic aneurism is briefly this. There were certain cases on record of a ligature having been put on the left carotid for what was assumed to be carotid aneurism low down; and in some of them, notably those recorded by Tilanus and Rigen of Amsterdam, the patients recovered from the operation, living many months afterwards, and then died from some other disease, the aneurism being cured. In both these cases, it was proved after death that the diagnosis had been incorrect, and that the aneurisms had been aortic, and had been cured by being filled with clot. In 1829, a surgeon named Montgomery tied the left carotid for an aneurism which proved to be aortic, and it was nearly cured when the patient died some months afterwards. Mr. Samuel Lane tied the left carotid for an aneurism, partly carotid and partly aortic, in 1852; and Pirogoff appears to have had two similar cases.

These facts were known, but no special conclusions were drawn from them for the cure of aortic aneurism by surgical interference of this kind till Dr. Cockle wrote a paper in the *Lancet*, in 1869, where he recommended the application of a ligature to the left carotid as a means of treating aneurism of the arch of the aorta.

I have for some years taken considerable interest in the treatment of aneurisms of the root of the neck. I had a patient at the Westminster Hospital, in 1865, on whom I performed the operation of simultaneous ligature of the carotid and subclavian arteries for a supposed innominate aneurism; and, although the patient was under very unfavourable circumstances, she lived four years after the operation, and at her death the disease proved to be an aortic aneurism.

In 1872, with Dr. Cockle's concurrence, I tied the left carotid in a case of aortic aneurism, and the patient derived very great benefit, the aneurism subsiding immediately, and all urgent symptoms passing off until he renewed hard manual labour, when the sac again enlarged and killed him in September 1876. The preparation, which is in the College of Surgeons, shows a large sac arising from the first or ascending portion of the arch of the aorta. In 1874, I again placed a ligature on the left carotid in a case of aortic aneurism which had baffled treatment, but the patient died a few hours after from want of blood-supply