THE CLINICAL VALUE OF A NEW REFLEX IN CHOREA *

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A boy, aged 9, was sent home from a boarding school because his behaviour was peculiar, and his teachers were unable to manage him. He was brought to me by his mother, who was more concerned about his mentality than about his general health. The school medical officer had noted that his heart was not normal, and for this reason had suggested I should be consulted.

On examination I found his mental condition sound, but sluggish. His heart beat was heaving, and the sounds were abnormal, having a relative value, as estimated by my cardioscope, of $1-\frac{1}{2}$ instead of $1-1$. The boy was restless, and his pupils were widely dilated. His blood pressure by my method was 170/90, the basic pressure being very high. The urine contained no albumin. Over his back, from the third dorsal spine to the buttocks—the shaded area in the figure—there was hyperaesthesia and a marked superficial reflex.

Diagrammatic representation of the dorsal reflex.

point was that he disliked milk, which contains a high percentage of lime.

THE DORSAL REFLEX

The presence of the dorsal reflex helped me to diagnose without any hesitation that the boy was suffering from chorea. During a recent investigation of this disease the dorsal reflex arrested my attention. The first case in which I observed it was that of a boy, aged 8, who had a red oval patch, about 6 inches long, over the hip-joint on which he had been lying. This patch was hypersensitive, but as the area of this abnormal condition extended higher up the boy's back it was obvious that the redness was due to pressure and not to a trophic lesion. On both sides of the spine hyperaesthesia was found extending as far up as the third dorsal vertebra, and down to and including the area supplied by the second sacral nerve. In addition to hypersensitivity there was also a marked superficial reflex, the trapezius, latissimus dorsi, and glutei muscles responding readily when the overlying skin was pricked lightly with a pin. The nerve supply of this hypersensitive area is the third to the twelfth dorsal, the lumbar, and the first and second sacral nerves. This reflex can be demonstrated in nearly every child suffering from chorea; it does not seem to be dependent in any way upon heart disturbance, because

(1) it occurs in chorea patients whether the heart is affected or not, and (2) it is not found in patients suffering from acute rheumatism with acute carditis.

BASIC PRESSURE AND TOXAEMIA

In the first boy referred to it will be observed especially that the basic pressure was very high. This is a consistent factor in chorea. We define the basic pressure as that pressure left acting on the blood in the brachial artery after the systolic pressure has been stopped by the inflated armlet; my method of estimating it has been previously described.¹ By my method the normal basic pressure is found to be about 50 mm. Hg, but in children suffering from chorea the basic pressure is raised to 70 mm. or upwards. A rise of this sort is due to some toxin probably introduced into the blood. This fact is proved by some experiments I made on men before and after taking glasses of whisky. Furthermore, in spelter furnace-men whose urines contain lead, I have found that the basic pressure rises in a way that seems to correspond with the amount of lead in the urine. The basic pressure can thus be raised by both organic and inorganic poisons, and it is quite justifiable to infer that in chorea this results from a toxæmia.

One effect of a poison on a living cell (such as a white blood corpuscle or an amoeba) is the modification of its surface tension. This is readily demonstrated by adding a trace of chloroform to a slide on which is a living amoeba; the latter takes up the smallest possible space by becoming spherical. When the surface tension is altered, it is found that the osmotic forces are disturbed, and that the intake and output of the corpuscles are greatly modified; in other words, the metabolic processes of the organic unit are completely altered. A particular poison in the blood affects the surface tension of the individual corpuscles, and by so doing produces a metabolic change corresponding exactly to the poison introduced—that is, the antigen is essentially specific. It is important to remember that when the basic pressure is raised, the entrance of the blood into the vasa vasorum becomes more difficult, because the added force tends to compress the mouths of the vasa vasorum, the obstruction being proportional to the increase. Consequently the muscular fibres of the arterial wall are ill-nourished and cannot contract and dilate with a normal response to stimuli. When the arterial wall is affected in this way the supply of blood to the parts or organs is unsatisfactory, functions are seriously disturbed, and, after a period of sufficiently prolonged malnutrition, arteriosclerosis sets in and the condition becomes chronic.

One important point which seems to have been overlooked is that although the basic pressure is taken over the brachial artery, it does not follow that the reading in this part is a figure representative of the basic pressure in the arteries of the lung, heart, brain, or abdominal organs; the basic pressure varies with different parts of the body, whereas the systolic pressure, being that due to the pumping pressure of the heart, must be the same for all parts. The basic pressure is lowest in the lungs and brain, and highest in the coronary vessels, because of the contraction of the powerful heart muscle. It follows, therefore, that with an increased pressure in the coronary arteries the supply of blood to the heart muscles must be unsatisfactory, with the result that the heart muscles contract irregularly and give us the signs we find in toxic conditions of the body. When the amount of blood toxin is considerable, especially in a patient in whom the normal condition of the blood is poor, a slight increase of basic blood pressure will easily bring about some malnutrition of the heart muscles.

I have often pointed out that chorea and acute rheumatism occur in the type of child whose intake of

* A paper read to the Swansea Division of the British Medical Association, December 18th, 1930.

lime-bearing food is low but whose intake of acids is high. The blood of such a child is in a very unstable condition and apt to be upset by the introduction of protein poisons conveyed by the bite of an insect. Proof of this is shown by the early rise of the basic pressure.

BASIC PRESSURE AND CHOREA

It follows from the above statements that in chorea with an increased basic pressure the supply of poor blood to the walls of the cerebral arteries must diminish the blood in the brain. As a result, the brain cells act irregularly and so set up irregular stimuli, producing a corresponding choreic effect on the muscles. This statement is especially applicable to the chorea associated with pregnancy, in which toxic conditions are known to be present in a very pronounced quantity, affecting powerfully both brain and heart.

In order to try to add to the value of the above statements I think it desirable to draw attention to some observations I have made regarding Raynaud's disease. All the cases which I have examined have a relatively high basic blood pressure. This point is important, because if the basic pressure be 50 (which is the normal figure) and if the systolic pressure be only 90 the power to force blood into the vasa vasorum is as difficult as if they were 100 and 190 respectively. My findings in connexion with the inflow of blood into the vasa vasorum and the consequent ill supply of nourishment to the arterial muscular fibres are consistent with the facts put forward by Lewis and Kerr² when they state that "undue cooling of the hand failed to bring on an attack" because, as they point out, "the minute vessels of the skin of these patients react, as do those of normal skin, to excessive cold by dilating." In my experience, excessive cold has been sufficiently stimulating to make even these badly nourished arterial walls respond.

The observations of Lewis and Kerr have driven them to the conclusion that there is an abnormality of the vessel wall, and also that the closure of the vessel is not reflex. They therefore confirm my conclusions and, indirectly, my work on the basic blood pressure itself.

It seems to me that one can say that chorea is a sort of Raynaud's disease or "spasm" of the brain arteries, while the cold white fingers of a man with an "alcoholic" nose which is bluish red is also a Raynaud's arterial disturbance. I differ from Lewis and Kerr when they apply the word "spasm" to the state of the vessel in Raynaud's disease, because it suggests a hypercontractability of the muscular fibres of the arterial wall. Such a hypercontractability is not to be expected in a badly nourished muscle, but rather a weakness of its tone. The difference is of great importance. As I have pointed out elsewhere,³ "To suggest that the diseased muscular fibres of the auricle are capable of developing fresh centres of excitation seems to be contrary to the usual rule regarding dying matter, whereas, on the other hand, the diseased muscular fibres forming the thin wall of the auricle lend themselves to be thrown *passively* into a state of tremor." It is interesting to compare this observation with the action of the heart in acute carditis, in which badly nourished muscular fibres in the wall of the auricle, influenced by raised blood pressure, allow of the onset of a passively produced tremor, usually called "fibrillation."

THE "ENTITY" OF THE SYMPATHETIC SYSTEM

In chorea, the raised basic blood pressure is responsible for a disturbance of the nourishment of one or more parts of the body. A "choreic reflex" is interesting as suggestive of some interference with the blood supply to the afferent parts of the nervous system, especially in the neighbourhood of the mid-brain, and the fact that I have

seen this dorsal reflex in a case of encephalitis tends to support my doctrine. The interest of the reflex lies in its extent, since this corresponds with that part of the sympathetic system below the lower cervical ganglion. Here we have, so to speak, an entity of the sympathetic system in close co-operation with the solar plexus and the hypogastric plexus. The parts or organs supplied by this "entity" are those which are so readily affected in all temporary nerve storms (for example, hysteria), when the vascular reactions of the skin of the back and abdominal wall are so very active. It seems to me that this "entity" of the sympathetic acts as a centre for controlling the balance of all the basic blood pressures in various parts of the body, a presumption that is supported by the fact that in Addison's disease, with its low basic blood pressure, the semilunar ganglia are irritated or destroyed. If this suggestion has any value in it, it helps to emphasize the great desirability of having the basic blood pressure taken in all cases, because when it is raised it is certain that the balance of basic pressures is disturbed. At present, however, most medical officers who work for insurance companies hesitate to accept any of the estimations of the basic pressure, knowing that the majority of practitioners find a great difficulty in taking it. Personally, I am convinced that the auscultatory method is fundamentally wrong, both in theory and in practice. We need an objective method which will enable all medical men to make an estimate of the basic pressure quickly, correctly, and easily, because an increase in this pressure means that the body is upset by a poison which has been introduced into or developed in it.

TREATMENT

When we consider treatment there is an additional interest added to the whole problem. We must recognize that the disorders are due to a shortage of calcium in the first instance, and must understand that until that shortage of calcium is reduced we cannot hope to get much success. Treatment should therefore consist in giving salts of lime in a way which allows of its ready absorption, because although the calcium may be sufficient in quantity, its form may be very unsatisfactory. Much depends upon whether the lime is merely in solution as an inorganic salt, is combined with some organic base, or is in the colloid form. My experience in a large number of cases of chorea and of acute rheumatism is that calcium lactate given with parathyroid extract tends to lower the basic blood pressure; as the latter falls, the other signs and symptoms quickly diminish. In the more chronic varieties of raised blood pressure due to internally produced toxins the response to calcium and parathyroid is often equally satisfactory.

We know the value of lime in cases of disturbed exudation, and it must surely follow that when the basic blood pressure is raised the exudative processes are seriously affected. This is the condition in many of the urticarias and similar exudative disturbances, so that by working from either end of the argument we come to the conclusion that the exhibition of lime salts with parathyroid is useful in cases of raised basic blood pressure.

Finally we must remember that there is a unity linking up all diseases or disorders of the body, or, as I prefer to express it, "disease is in all cases merely an intensification of a normal process at a point where the pressure has been increased, just as electricity is the intensification of the normal motion of electrons giving rise to a pressure which bursts all restraint."

REFERENCES

- ¹ Arbour Stephens: *British Medical Journal*, 1930, i, 242.
- ² Lewis and Kerr: *Ibid.*, 1929, ii, 111; 1930, i, 82.
- ³ Arbour Stephens: *Practitioner*, May, 1929.