A LECTURE

ON

THE PATHOLOGY AND TREATMENT OF RIGORS.

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The Phenomena of Rigors—The various Circumstances under which they occur—Their Relation to Epileptic Convulsions—Both Rigors and Convulsions may result from Toxæmia or from a purely Nervous Reflex Influence—As Epilepsy has for its Proximate Cause Anæmia of the Cerebrum, so the Proximate Cause of Rigors is Anæmia of the Spinal Cord—Rigors are Spinal Epilepsy—Comparison of the Cold Stage of Ague with the Collapse of Cholera—Explanation of the Rigors which follow Hot Saline Injections into the Veins of Cholera Patients—The Prognosis and the Principles of Treatment—Chloroform stops Rigors as it stops Convulsions.

THE subject of Rigors as a symptom of disease is one of considerable interest both to the physician and the surgeon. Rigors occur under a great variety of circumstances, and their significance is very diverse in different cases. In one case, they may result from a formidable blood-infection; while, in another case, they may indicate nothing more than a transient nervous irritation. Whenever they occur, they demand immediate and careful attention; and it is always of the highest importance that their true significance be ascertained.

The phenomena of rigors are mainly these. The patient has a sensation of cold, which is sometimes positively painful, and which is often referred especially to the back. A common expression is, "I feel as if cold water were running down my back." With this sensation of cold there is associated a general tremulousness of the muscles; the teeth chatter; the whole body is shaken and agitated by the muscular shudderings; and the limbs are the seat of aching pains, of greater or less severity. The surface of the body often appears shrunk and livid; the hands shrivel; and the nails are blue. The pulse is usually small and feeble; the breathing is often quick and difficult. With all these appearances of coldness of the body, and with the subjective sensation of cold, the thermometer commonly indicates that the temperature is some degrees above the normal standard. After a time, the shivering ceases, and the patient begins to feel hot; while it may be that the temperature is no higher than it was before. The features now become full and florid; the pulse is full, as well as quick; there is dryness of the mouth, and thirst; then a moisture begins to appear on the skin, and soon this becomes a profuse sweat. With the commencement of the perspiration, or even before it, the temperature begins to fall, and soon reaches the normal point, or even passes below it. This is the usual course of an attack of rigors; but they vary in degree from a transient feeling of chilliness to semi-convulsive shudderings.

Now, in order that we may be enabled to give a physiological interpretation of the phenomena, we must consider the chief circumstances under which they occur.

First, then, a paroxysm of ague is a typical example of rigors followed by what is called the hot and the sweating stage of the fever.

Then the onset of many diseases, which are with good reason believed to result from a blood-infection, is usually marked by rigors occurring once or oftener: for example, small-pox, typhus, erysipelas, pyæmia, puerperal fever, etc.

Again, rigors occur at the commencement of some inflammatory diseases in which there is reason to believe that not only the distribution of the blood is altered, but that the quality of the blood is also abnormal. I refer to such diseases as acute rheumatism, pneumonia, and pleurisy. And rigors are not unfrequently associated with the passing into the circulation of crude and undigested materials from the alimentary canal.

Then there is a totally distinct class of cases, in which rigors of great severity result from a purely nervous impression. Thus rigors may be excited by the passing of a catheter through the urethra, or by the passing of urine over the abraded surface of a torn urethra. Again, severe rigors often occur during the passage of a renal calculus through the ureter, or of a gall-stone along the bile-ducts. Frerichs states (*Diseases of the Liver*, New Sydenham Society, vol. ii, p. 516) that, in one case of supposèd ague that occurred in his practice, he tried quinine for a long

time without benefit; and the cause of the rigors was not discovered until after death, when numerous calculi were found in the hepatic duct.

If we can ascertain that any one essential condition is common to all these diverse cases, we shall have arrived at the true physiological interpretation of rigors. Let us consider this question as we recently discussed that of the pathology of epilepsy. (See *BRITISH MEDICAL JOURNAL*, March 21st.)

Now, in the first place, I would remark, that there is certainly some not very remote analogy and relationship between epileptic convulsions and rigors. This is shown by the fact that, in certain cases, they merge into each other and replace each other. Thus the initiatory fever of small-pox, which is commonly heralded by severe rigors, is not unfrequently, in children especially, associated with convulsions, which may recur again and again, and then finally cease when the eruption appears on the skin. Convulsions occasionally occur during the cold stage of a severe ague-fit. Pyæmic infection is usually marked by the occurrence of severe rigors; more rarely it is associated with convulsions. Mr. Paget has remarked upon this relationship (*BRITISH MEDICAL JOURNAL*, August 16th, 1862); and he states that once, having cut a gentleman for stone, there occurred soon after the operation a terrible rigor, followed by heat and sweating, and then by extensive suppuration in the cellular tissue over the chest. Again, some days after, there occurred another rigor; and this was followed by similar suppuration, and by other symptoms of pyæmia. Then, some days later, he had a severe epileptic seizure; and this was followed, in about the same time and in the same way as the rigors had been, by another suppuration. Then, after phlebitis and other mischievous results of pyæmia, he ultimately recovered. Another case referred to by Mr. Paget is that of a woman at St. Bartholomew's, who had relapsing erysipelas. The earlier relapses were preceded by rigors of various severity; the last was preceded by violent epileptiform convulsions, and these were followed by three days of complete coma, which seemed to be relieved when the erysipelas appeared. During the rest of her life, she showed no sign of brain-disease, and she died exhausted.

In the cases to which I have just now referred, the alternating rigors and epilepsy have been the result of toxæmia; but the same close relationship between rigors and convulsions is shown by the fact that both may be excited by a purely nervous influence. We have before seen that rigors are frequently excited by the irritant action of biliary and renal calculi. Convulsions are a less frequent result of the same irritation. Thus Frerichs states (*op. cit.*, vol. ii, p. 518) that, as a result of the passage of gall-stones, "in irritable individuals, reflex cramps occur, which may become aggravated into the most violent convulsions, resembling epilepsy." And Dr. Prout says (*Stomach and Renal Diseases*, 5th ed., p. 322, note) that he has known the irritation and pain attending the passage of a renal calculus "accompanied in one or two instances by epilepsy".

Convulsions have sometimes, though rarely, been excited by the operation of catheterism. Mr. Holt tells me that, in three or four instances, he has seen men of nervous temperament thrown suddenly into a state of unconsciousness and convulsions by the passing of a catheter through the urethra.

It is plain, then, from these facts, that rigors and epilepsy have this feature in common—that both the one and the other may result from a blood-infection (toxæmia), or from a purely nervous reflex influence. On a former occasion, I referred to a number of facts which point to the conclusion, that the immediate cause of epileptic convulsions is sudden and extreme anæmia of the brain. Now, a careful consideration of the phenomena of rigors renders it probable that they result from anæmia of the spinal cord. The evidence upon this point is not demonstrative, but it amounts to a high degree of probability. There is an *à priori* probability that convulsions and rigors, distinct as they commonly are, yet sometimes associated in the same case, result from an identical or a similar condition of the nervous system; but that different portions of the nervous centres are concerned in the production of each. In epilepsy, it is certain that the encephalon is mainly affected; and loss of consciousness is one of the most constant phenomena of the disease. On the other hand, during the severest rigors, the cerebral functions may be quite unimpaired. Then, in the case of rigors, there is positive evidence of the implication of the spinal cord in the fact that the sense of coldness is very commonly referred to the spine, which is often also the seat of severe pain. The severe backache, which is associated with the rigors during the initiatory fever of small-pox, is a familiar symptom; and a similar spinal pain frequently accompanies the rigors which mark the onset of other febrile diseases. Not long since, I attended a young lady with what proved to be only a catarrh; but the attack commenced with rigors and backache of so severe a character, that I feared the disease might be small-pox.

A superficial view of the subject might suggest the erroneous conclusion, that rigors result from an interruption of the function of respiration, and a diminished circulation of blood through the systemic arteries. The phenomena of an ague-fit apparently are consistent with this theory. During the cold stage of ague, there is undoubted evidence that the functions of respiration and circulation are both impeded; yet that the respiratory functions are not necessarily implicated in the phenomena of ague, is proved by a curious case referred to by Sir Thomas Watson, in which a pregnant woman "had tertian ague, which attacked her, of course, every other day; but on the alternate days, when she was well and free, she felt the child shake; so that they both had tertian ague, only their paroxysms happened on alternate days." (Watson's *Lectures*, vol. i, p. 744.) Now it is certain that, in the causation of intrauterine rigors, an impeded respiration could have had no share.

Let us for a moment compare the cold stage of ague with the collapse stage of cholera. On a hasty view, the two pathological conditions appear strikingly similar; but, in some most important particulars, they are extremely unlike, and even opposite to each other.

In the cold stage of an ague-fit, and in the collapse stage of cholera, there is evidence of impeded pulmonary circulation, and of embarrassed breathing. In these respects the two diseases resemble each other; but now let us consider the differences between these morbid states. A patient in the collapse of cholera complains of burning heat in his epigastrium, and tosses away the bedclothes; yet the thermometer shows that the temperature of the axilla is several degrees lower than normal. On the other hand, in the so-called cold stage of ague, the thermometer indicates a considerable elevation of temperature; yet the patient, shivering with a sense of cold, begs for additional clothing and warmth.

And now observe what happens to the cholera patient after the injection of a hot saline liquid into his veins. I have elsewhere endeavoured to prove that the hot liquid overcomes the spasm of the minute pulmonary arteries, and allows a free passage of blood through the lungs, and then through the systemic arteries. At any rate, the result is, that the symptoms of collapse rapidly pass away; the pulse becomes full, and the temperature normal, or even higher than normal. But now it is most remarkable that, in a large proportion of cases, coincident with this greater freedom of the circulation and with this rise of temperature, the patient begins to feel cold, and has severe rigors. Upon this point, Dr. Mackintosh, who in the year 1832 injected the veins of one hundred and fifty-six patients, says that "rigors, severe rigors, almost invariably followed the saline injection. They generally commenced a few minutes after the completion of the operation, sometimes during its performance." (Mackintosh's *Practice of Physic*, vol. i, p. 369.) The same phenomena have been observed by others. Thus Mr. Little, who injected twenty patients in 1866, states that rigors occurred in the most promising cases; and that all those who recovered had one or more severe rigors, during which "the teeth chattered; the bed shook; the patient complained bitterly of cold. At the same time, the temperature rose several degrees in the axilla; and, but for the cold, the patient expressed himself as infinitely better, and was so." (*Medical Times and Gazette*, April 1847, p. 355.)

What, then, is the explanation of this very remarkable phenomenon? The most probable explanation appears to be this. During the collapse stage of cholera, a large amount of morbid blood accumulates in the right side of the heart and in the venous system, while comparatively little blood is circulating through the systemic arteries; hence arise the thirst and the dyspnoea—a cry from the tissues for liquid and oxygen. When the pulmonary obstruction has been overcome by the hot venous injection, an abundance of morbid blood is suddenly conveyed through the systemic arteries; and, reaching the spinal cord, this contaminated blood excites contraction of its arteries; hence spinal anæmia, a sense of cold, and rigors.

It is manifest, from a consideration of these facts, that rigors do not depend upon a partial arrest of the pulmonary circulation, or upon any impediment to the respiratory changes. For, in the collapse of cholera, rigors do not occur until this arrest and impediment have been suddenly removed; and it is in a high degree probable that rigors depend upon an anæmic condition of the spinal cord. The sense of heat in a tissue is closely connected with the amount of blood in its vessels. The sensation of burning in the epigastrium experienced by a cholera patient is probably dependent on the large afflux of blood to the stomach and bowels; and, on the other hand, during the occurrence of rigors, it is probable that the anæmic spinal cord conveys to the sensorium the impression that the whole body is cold, when, in reality, it is several degrees above the normal temperature. During the so-called "cold stage" of ague, the temperature of the body is usually as much increased as it is during the subsequent hot stage; but the brain, receiving through the anæmic spinal cord its information as to the state of the tissues, appears to be deceived by the abnormal condition of the conducting medium.

Then, during the succeeding hot stage, the spinal arteries relax; a fuller supply of blood reaches the cord at the same time that it reaches the skin and the other tissues; and a sensation of heat is conveyed upwards to the cerebrum. The sensation of heat and of cold in various morbid states of the system apparently depends, not upon the actual temperature of the body, but upon the condition of those parts of the nervous system through which impressions reach the sensorium.

This, then, is the theory which I submit for your consideration: that, as epilepsy is a result of anæmia of the brain, so rigors result from anæmia of the spinal cord; that the immediate cause of the anæmia of the nervous centres is the contraction of the minute arteries; and, further, that this arterial contraction in both classes of cases—namely, in cases of epilepsy and of rigors—may be a result of blood-poisoning (toxæmia), or of a purely reflex nervous influence. If, then, this theory be well founded, rigors might be designated *spinal epilepsy*.

These doctrines, if true, have important practical applications, with reference especially to prognosis and treatment. The purely nervous rigors are usually of far less serious import than those which are of toxæmic origin; and they require a different method of treatment. In the nervous cases, narcotics and anæsthetics are of great value; and additional evidence of the analogy between convulsions and rigors is afforded by the fact that both the one and the other may surely be arrested by chloroform, which is especially useful in cases of purely nervous reflex rigors.

On the other hand, in cases of toxæmic rigors, we have to study the natural method of cure, and to assist that, if possible. The vomiting and purging which often precede or accompany toxæmic epilepsy, as well as toxæmic rigors, are probably the result of an effort to expel from the circulation the noxious materials which are exciting the arterial contraction. These symptoms, therefore, often afford valuable indications for treatment.

THERAPEUTICAL MEMORANDA.

THE USES OF BROMIDE OF POTASSIUM.

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ABOUT twelve months since, my youngest child, aged nine months, was put down one day from his nurse's lap on the floor. The child began to cry slightly, and for not more than half a minute, when the nurse noticed that it suddenly ceased to breathe, and turned black in the face. She caught it up, shook it, slapped its back, etc.; but the child simply fell over, apparently quite lifeless, on her arm. She then ran screaming with the child to me, in another part of the house. The impression I got, in the hurry and excitement of the moment, was, that the child had, unseen to the nurse, swallowed something that was choking it. The little patient, when he reached me, showed no sign of life; his lips were blue and swollen; his face a livid grey; his eyes half-closed and glassy. He had, indeed, the appearance of a recently drowned person. Hastily I thrust my finger between his teeth to the fauces, thinking I might feel some obstructing body, when the child gave a short heave and gasp. I repeated the movement, and this was followed by a stronger heave and a decided inspiration; and, in a few more seconds, the child was breathing and living. I feel pretty certain that, without the manoeuvre I had had recourse to (though with a different end in view, as I discovered no foreign body), the child would never have breathed again. On two more occasions, at intervals of two or three weeks, the child was similarly attacked. The occlusion of the larynx was on each occasion as complete as at the first; and both times he was brought round by the same proceeding on the part of the nurse.

The physiology of the process is, I think, pretty evident, and I need not enlarge on it; but, as a mode of treatment in the actual fit, it may lay claim to some novelty. Laryngismus stridulus, of which this case was an extreme instance, is generally fatal when it assumes the complete form; and in most instances, partial or complete, it is a very intractable disease, and one very apt to recur without any warning. My present communication, therefore, is intended, besides incidentally mentioning what I have found so useful in the fit, to suggest to my professional brethren the great probable value of bromide of potassium in the constitutional treatment of the affection. Reasoning on the affinities of the disease, its likeness to epilepsy must be apparent; and with this view, after my child's third fit, and finding that what I had hitherto tried had been useless, I resolved to give him the bromine salt. I commenced it in doses of one grain twice a day, and gradually have increased it to two grains. He has now been taking it for from ten to eleven months, has never had another fit, and has otherwise been in excellent health. I shall continue it until he is well over teething.