CLINICAL LECTURE ON TWO CASES OF MALARIAL NEURITIS WITH TREMORS.

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THE ordinary forms of malaria, the fever—quotidian, tertian, or quartan, we occasionally have examples of in our wards, and there still more frequently we see also the more remote effects of the malarial poison—the anæmia, and the organic changes in spleen, liver, and kidney. But, as you all know, there occur less frequently the so-called concealed malarial diseases. These mostly affect the nervous system, manifesting themselves specially as forms of neuralgia. Of these neuralgias, that affecting the first division of the trifacial—brow ague—is the most common, but other divisions and other nerves may be involved, and there may be also neuralgias of some of the visceral nerves, cardialgia, gastralgia, etc. In addition to painful affections of the sensory nerves, there may be localised paræsthesia, or anæsthesia, and disturbances of some of the special sensory nerves.

But the malarial poison may also affect the motor nerve mechanisms and cause paresis, paralysis, tremors, cramp-like muscular contractions, and even convulsive movements. These motor disturbances are usually localised, and, like the sensory disturbances, are most frequent on the face—mimic spasm—but they may be more general, and cases even of epilepsy due to malaria and, mended by quinine, have been reported.

Now, in connection with all these manifestations of nervous disease we have to remember two points. The first is that that they are all brought about by the malarial organism or its products irritating the nervous tissues. In some instances distinct neuritis—malarial neuritis—has been demonstrated on *post-mortem* examination, but in most cases it is probable that the irritative pathological changes are not sufficiently marked to be capable of microscopical demonstration, although their existence may be with certainty assumed. The second point is that in cases in which the malarial element is not very prominent it may be overlooked, and the nerve symptoms may appear to be the result of some cause more serious because less amenable to treatment. This was, indeed, the case with the two patients whom I propose to show you to-day. In both of them the malarial element was obscure, and in both the sensory, motor, and other symptoms closely simulated serious organic nervous disease. All this, however, will be understood more clearly after the cases have been discussed in detail.

CASE I.—J. R., aged 39, a postman, who was admitted to Ward 30 on December 8th, 1896. His complaint was a "shaking of the arms and legs," and he stated that he had been ill for about six months. His family history is fairly good, and his home is comfortable. He has always been accustomed to good food, and has been temperate in the use of alcohol. Between the years 1876 and 1883 he served as a soldier in India; since his discharge he has acted as a postman. With the exception of an attack of ague and dysentery in India in 1880, he has had no illnesses. This attack lasted for six weeks, and since then he has enjoyed perfect health.

Present Illness.—This seems to have begun in August last, as the result of an exposure to cold. He suffered severe pain in the back and loins, and there was a slight return of his dysenteric symptoms. For this he was treated in Ward 30, and discharged after a residence of three weeks. After a residence at the convalescent home for three weeks more, he attempted to resume his work, but in a few days he noticed that he was unfit for this. With a feeling of great weakness in his limbs, he observed the supervention of tremblings. At first these were most marked in the legs, but soon they occurred equally in the arms. At first also they tended to occur only when he was fatigued; later on they occurred even when he lay quiet. Finding himself becoming weaker and less fit for work, he returned, and was admitted to Ward 30 on December 8th.

State on Admission.—Nervous system: He complains of pains in the back and loins, but there are no other sensory disturbances; sensibility to touch, pain, and temperature being unimpaired. The special senses are unaffected; there is no nystagmus. Voluntary motor power in arms and legs is markedly deficient. There is considerable atrophy of the muscles of the limbs, and tenderness on deep pressure. The plantar, cremasteric, abdominal, and epigastric reflexes are all well marked. The knee-jerks are exaggerated, ankle-jerks are present, and both knee and ankle clonus are readily elicited. The supinator, biceps, and triceps jerks in the arms are well marked. Co-ordination and equilibration are unimpaired. There are almost constant tremors in the legs and arms. These occur when the patient is lying still in bed, but they tend to increase when any voluntary act is attempted, or when the patient is watched or excited. In

the face an occasional tremor is seen about the eyebrows. As regards cerebral or mental functions, all that need be said is that he seems depressed, and his intelligence and memory seem to have become rather defective. His other systems, with two points of exception, are fairly normal. These exceptions are, first, that with an impaired appetite there is a tendency to alternations of diarrhoea and constipation, and this we regard as the effects of his old dysenteric trouble. The second point is that whilst his urine is normal he has since his illness commenced had some difficulty in connection with micturition. He tells us that some time elapses before he can start the flow; on one occasion the delay was so great that the catheter had to be employed.

CASE II.—E. W., aged 48, a sailor and fireman, who was admitted to Ward 30 on November 7th, 1896, complaining of weakness and shakings in the limbs, and stating that he had been ill for about nine months. His family history is very good, as also is his personal history. He has been at sea since the age of 14. Up till five years ago he was a seaman, since then he has been stoker on board a steamer. In this way he has been exposed to great changes as regards heat and cold, but he has had fairly good food, and has always been very moderate as regards alcohol. Previous illnesses: With the exception of what appears to have been typhoid fever and slight rheumatic fever as a boy, and gonorrhoea at the age of 15, he had enjoyed perfect health. His present illness seems to have begun about nine months ago. He felt a weakness in the legs and arms when at work, and he felt that he got more easily tired. At this time his equilibration seems also to have been below par. He tells us that he had to be careful when going about in the dark—that, for example, he would not attempt to walk across a narrow plank in the way that he would never have hesitated to do previously. He also seems to have had some trouble with his water; he had to pass it more frequently during the day, and at night it would sometimes come away involuntarily. Feeling unfit for work he obtained admission into the Bristol Infirmary. After treatment there for two months he was discharged feeling somewhat better. He remained at home for six weeks, and then went to sea again. He did fairly well for a time, but soon he again began to feel his weakness, and the trouble with the water returned. He then sought admission to the infirmary, and was admitted to Ward 30 as above.

State on Admission.—He is a fairly well-built man, but there has been some loss of flesh. His weight is 10 st. 7 lbs., about one stone less than when in good health. Nervous system: Sensory symptoms. He complains of a feeling of numbness in the hands and feet, and he has the "girdle" sensation in the waist. He has also pains in the back, and these occasionally shoot down from the back of the neck to the legs and feet. They feel like electric shocks, and he tells us that he sometimes has a feeling in both arms as if he had hold of an electric battery. Sensibility to touch, pain, and temperature is slightly impaired in hands and feet. The special senses are all fairly normal. Motor: Voluntary motor power is considerably below par. The muscles are somewhat wasted, and show fibrillar contractions readily on tapping. They are also somewhat tender on deep pressure. Reflexes: The superficial reflexes are hardly present. As regards the deep reflexes the knee-jerk is well marked, and knee clonus can readily be elicited. Slight ankle-jerk and ankle clonus are present. The elbow-jerks are present, and both biceps and triceps contract readily on tapping. Tremors of the muscles of the limbs generally are markedly present; they occur when the patient is lying quiet, and are increased when any voluntary motion is attempted. Equilibration is impaired. Standing with his feet close together and his eyes shut, he tends to fall, usually towards the right side. In walking he keeps his eyes fixed on the ground, and his walking is impaired by the tremors which tend to occur in the legs when he brings his feet to the ground. His other systems are fairly normal, with the exception of the bladder trouble previously referred to.

ETIOLOGY.

In the first patient, R., you will all I think be disposed to admit that to ascribe his malady to malaria is justifiable enough. He had ague some seventeen years ago, and although he has had no attacks since and although there are now no malarial changes in his spleen and other organs and tissues, we have to remember that the malarial poison, having once gained an entrance into the body, may yet manifest its presence at any time subsequently. As long as the general health is kept good, its potency for harm is kept in abeyance. So soon, however, as something occurs to lower the health, it may assert itself, and in our patient this something was an exposure to cold in August last. It is interesting also to note that not only did this exposure seem to light up his old malarial mischief, but it lit up his old dysenteric trouble as well, as evidenced by the occurrence of abdominal pain, diarrhoea, straining, and blood in the stools.

In the second patient, W., the acceptance of the malaria as the origin of his symptoms might seem a little more difficult, for not only does he now present none of the ordinary pathological changes of malaria in spleen, liver, blood, etc., but he tells us positively that he has never had malaria at all. He has, however, as a sailor been much in malarial districts. Now we have to remember that it is no uncommon thing to meet with patients becoming affected with malaria after they have left the malarial district. Only last summer I saw a very good example of this here in Edinburgh. As the instance was interesting and rather puzzling at first, I shall detail it to you.

A young, healthy, and vigorous American student had come to Edinburgh on a visit, and had gone out on one of the coaches to see the Forth Bridge. The day, like many summer Edinburgh days, was cold, wet, and

windy, and he had got thoroughly chilled. Next day he was ill, and I was asked to see him. I found him feverish, with a temperature over 104° , and complaining of pains all over. Believing that it was one of the influenza cases then prevalent, I advised salicin, and expressed the opinion that he would be better in a few days. Next day he was so much better that when I saw him he was wishful to get up and go about. I prevailed on him to keep his bed, however, telling him he might get up on the following day. When the following day came, he was again fevered, this being ascribed to his having got up and exposed himself early in the morning. Salicin was again resorted to, and on the next day he again felt quite well. But next day again he was fevered, and my suspicions were aroused. I ascertained that the shivering onset of the fever had occurred at the same hour each morning, and that although in New York he never had had fever, yet that some of his college friends living in the same locality had had fever ascribed to some building excavations in the neighbourhood.

Although in this case the plasmodium was not found in the blood, the subsequent amendment with quinine proved the correctness of the diagnosis, so that this was a case in which the malarial virus had entered the body some months previously, and had there remained latent until its powers for harm had been set into action by cold and exposure. But with our patient, W., it is to be noticed that not only had the virus remained latent for at least eight or nine months (it being that time since he was in a malarious district), but when it did assert itself it was not by producing fever, but by producing symptoms of neuritis. This, however, cannot be regarded as any argument against the malarial origin of his disease, and in his case also, as we shall see further on, our diagnosis was verified by the beneficial effects of quinine. Of course it is to be remarked that in both of our patients we took into consideration the possibility of other causes—alcohol, syphilis, lead poisoning, rheumatism, etc.—but we were able, on careful inquiry, to exclude the first three of these altogether, and to subordinate the last as an etiological factor to the malaria.

Next as regards the symptomatology. In a typical case of neuritis, from any cause, the gross pathological changes are found, as you know, in the peripheral nerves. As the result of irritative changes, an interruption of continuity in the axis cylinders occurs, and so the main symptoms are pains, paræsthesia, anæsthesia, tenderness of the muscles and nerves on pressure, impaired or lost voluntary motor power, wasting of the muscles, and diminished or absent reflexes. We know also that all these symptoms are believed to be the result of the toxic substance inducing inflammatory or degenerative changes in these axis cylinders. But, as I have often pointed out to you, this toxic substance—malaria, alcohol, lead, or whatever it may be—must be carried by the blood, not only to the peripheral nerves, but to the nervous tissue of the centres as well. Moreover, we must also bear in mind that, although the pathologist tells us that in neuritis the gross lesions are found in the peripheral nerves, we are not to be debarred from supposing that these peripheral changes may really be due to causes acting on the centres. We know what trophic centres are, and we know of ascending and descending degenerative processes.

Hence, then, although in a so-called typical case of neuritis the symptoms may be those above mentioned, we must be prepared to meet with great variations at different stages of the disease and in different individual cases. Thus, in our first patient, R., it seemed as if the pyramidal tracts were specially involved, and we got symptoms somewhat like those of lateral sclerosis—namely, impaired voluntary motor power, increased reflexes, and clonus. In the second case the sensory parts of the cord seemed also markedly affected, and we got in addition to motor troubles, sensory and equilibrium disturbances somewhat like those of ataxic paraplegia. Again, in our first patient we remarked that the toxic substance seemed also to have been acting specially injuriously on the grey matter of his cerebral convolutions; indeed, I have to confess to you that before I had really got a grasp of his case I was for a time harbouring the idea that there were some gross degenerative changes going on in his brain as well as his cord, and that it was possible that we should have to contemplate the necessity of asylum treatment for him. In cases of neuritis, therefore, we may meet with a great variety of symptoms, but if we only bear in mind the general structure and functions of the various parts of the cerebro-spinal axis, we shall have little difficulty in interpreting the phenomena in any individual case.

But now in our patients there are two symptoms which require special notice—namely, the tremor and the bladder

disturbance. Let us consider the latter first. Observe that in most cases of neuritis the bladder, like the other visceral reflexes, seems to escape. In both of our cases, however, but especially in the patient W., it was from the first a source of trouble. That the bladder nerve mechanism should usually escape in neuritis cases is, we may suppose, the result of causes similar to those which, as a rule, impede the involvement of the still more important respiratory, cardiac, and deglutition centres. But just as these centres are occasionally involved, so we may suppose may it be with the bladder. If you ask for any reason why in the patient W. the bladder trouble is more marked than in the patient R., I should say that it is probably due to the weakening results of a very severe gonorrhœa which W. seems to have suffered from many years ago.

Next, as regards the tremors. Just as other kinds of poisons, notably alcohol and mercury, tend to set up tremors, so it is with malaria, and our patients demonstrate this in a very marked manner. When you looked at them in bed you could see the tremor of the bedclothes; when you touched the beds you could feel the tremors. When the patients sat in chairs, with their feet on the floor, ankle clonus was practically always present; when they stretched out their legs, or stood on their feet, the tremors showed like knee clonus. In the upper limbs you could notice tremors like clonus in the fingers, hands, and wrists—at one moment flexion and extension, at another moment pronation and supination, whilst in both cases the hand placed on the heads felt continuous tremor-like movements. These tremors were present when the muscles were passive, and were intensified by voluntary movement or excitement.

We devoted some time in the ward to the investigation of these tremors. By means of receiving and recording tambours, a chronograph, and a revolving cylinder, we timed them, and we found that as regards their time, they agreed in the main with what we previously had expected. Knowing that, as a rule, the farther the muscles concerned are from their centres in the cord, the slower is the clonus or tremor we expected to find that in the legs the ankle tremor would be slower than the knee, and that in the upper limb, the finger tremor would be slower than the elbow. We found, however, considerable difficulty in actually timing the various tremors, owing to the tendency of one tremor to run into the other, as it were. Thus, for example, on taking a finger tremor, wrist and elbow tremors were very apt to supervene, and so cause confusion.

With the head tremor the confusion in this respect was perhaps greatest. You know that with a little practice most healthy individuals can induce a tremor or clonus of the head, and if this be timed it is found to be about 12 or 13 per second. In one of our patients (R.) the head tremor was found to be much slower, namely, about 7 or 8 per second. We concluded from this that we were timing, for the most part, not a true head clonus, but a clonus communicated from arms or legs. The following, however, represents the rate per second of the tremors or clonuses which we were able to obtain with fair accuracy in the two patients:

	Ankle.	Knee.	Finger.	Elbow.	Head.
R.....	7	7	8	10	12
W.	7	9	—	10	12

Let us now answer the question which some of you have asked—What is tremor? Supposing that a healthy, vigorous man braces the muscles of his arm, and keeping the limb semiflexed at the elbow-joint, places his hand on the button of a receiving tambour, the lever of the recording tambour will describe on the smoked surface of the revolving cylinder an almost perfectly straight line. But supposing that this man is fatigued, or excited, or under the influence of some toxic substance, it will be found that the lever describes a zig-zag tracing, that is, a tremor, often quite regular, and usually about 9 per second in its rate of vibration. Now, in the first instance, we have to suppose that the motor cortical centre for the arm muscles was functioning normally, so that the nerve impulses sent down produced equal and co-ordinate contraction in flexor and extensor muscles. In the second instance, however, we have to suppose that the vitality of the motor cortical centre was below par as regards strength and co-ordinating power, so that the nerve impulses passed down to flexors and extensors not continuously but alter-

nately. In this way the occurrence of clonus would seem to entail the action of opponent muscles, that is to say, the required tension of flexor muscles will be induced by the contraction of extensor muscles, and *vice versa*. But we have to remember that clonus may be induced in muscles without their opponents contracting. Probably the best example of this is seen in the induction of knee clonus by pushing down the patella, as can be done readily in cases of lateral sclerosis or descending degeneration. Here the desired tension is obtained by pushing down the patella. In both of our patients knee clonus or clonus of the quadriceps can also readily be induced in this way. Hence then in tremors or clonus we have to recognise in the functioning of the motor centres disturbed conditions as regards strength and co-ordination, whereby opponent muscles are caused to contract alternately, or single muscles or sets of muscles intermittently. Further, we believe that the maximum rate of these alternate or intermittent contractions varies in different muscles according to differences in their distance from their nerve centres.

So much for the symptoms in our patients. Let us now consider the progress and treatment. Here I have to confess to you that for some weeks I failed to recognise the malarial element in their causation. Our treatment, therefore, consisted in efforts to improve the general health and to counteract what we thought to be a rheumatic element. In addition to rest, good diet, and hot-air baths, the patients were therefore getting mainly iodide of potassium, salicin, and arsenic. Practically no improvement followed, and then we gave quinine (5 gr.) thrice daily. The amendment was as distinct as it was immediate: both patients felt stronger, physically and mentally; the tremors diminished and the bladder troubles improved.

Recognising then that we were dealing with a form of malarial neuritis, I, after two weeks, prescribed in addition strychnine hypodermically—I had withheld it previously owing to the evidence of nerve and muscle irritability—and this appeared also to act beneficially. Within the past few days I have substituted anarctotin for quinine in R.'s case, with good effect, as he had been complaining of deafness. Both patients are still somewhat feeble, but they are now looking forward with confidence to being able shortly to resume their occupations.

A PROBABLE DIAGNOSTIC SIGN OF TRICUSPID STENOSIS.

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In the study of the symptoms of heart failure far too little attention has been devoted to the consideration of the regurgitant waves of blood sent back from the heart and made manifest by movements in the veins and in the liver. If we consider for one moment the opportunity given for observing what is taking place inside the heart from a comparison of the venous pulse with the arterial pulse, we shall realise the value of more careful study of the venous pulse. When we feel the radial pulse, or when we take a tracing of the radial pulse, we obtain a glimpse of what is going on inside the heart only during a very short period of the cardiac revolution, namely, during the time of ventricular contraction, from the time of the opening to the time of the closure of the aortic valves. (Space *x* in the tracings 1, 7, 14). On the other hand, when we observe the venous pulse we get a knowledge of what is taking place inside the heart during the whole cardiac revolution, and not only of what is happening in one chamber, but partly directly and partly inferentially of what is happening in both auricle and ventricle. Thus in Fig. 1 we see the effects of the auricular systole producing the wave *b*, immediately followed by the auricular diastole, during which time the blood in the veins pours into the auricle and causes the great fall in the veins (*x*). At this time the right ventricle is pouring blood during its systole back through an incompetent tricuspid orifice into the auricle. Hence before the ventricular systole is at an end the auricle is filled, and the overflow rushes back into the veins producing the wave *a*. The time of closure of the pulmonary valves is shown by the notch on *a*. Then the ventricular

systole being at an end the diastole of the ventricle begins, and permits the blood to flow from the auricle and the veins, giving rise to the fall in the vein shown on the tracing at *y*, which fall is interrupted by the recurrence of the auricular systolic wave *b*, and the whole series of events begins over again.

The pulse, when it appears in the veins, is very susceptible to change occurring in the heart, and from its study there may be gathered evidence of cardiac changes when little or no difference can be observed either from exploration of the chest or study of the arterial pulse. In cases, too, of pulse irregularity the venous pulse reveals what is occurring in the various chambers of the heart during irregular action in a manner instructive as well as surprising. In this paper I propose to demonstrate how the modifying influence of tricuspid stenosis on the right auricle is shown by the venous and liver pulses.

In cases of slight cardiac debility, such as occurs in fat people, chlorosis, pregnancy, pernicious anæmia, and other forms of functional heart failure, this debility of the heart is often made manifest by a pulsation in the jugular veins. If a tracing of this pulsation be taken, there is found to be a series of waves similar to that in Fig. 1, but not so large. If these waves be carefully timed, as in Fig. 2, where the jugular pulse is taken simultaneously with the carotid, it will be found that the wave *c* is due to the carotid pulse; preceding this is the wave *b*, which like the same wave in Fig. 1 can only be due to the systole of the auricle. In such cases, if the venous pulse persists until the patient dies, its form does not alter, except that the waves may become more or less conspicuous; and when the patient is dying, and the radial pulse is no longer to be felt, we may rarely remark in the veins at the root of the neck the wave *b* due to the auricle continuing to act, thus demonstrating the auricle's right to the title of *ultimum moriens*. In such cases, however great the heart failure may be, there is never produced pulsation of the liver.

On account of the fact that the wave due to the auricle persists in such cases, I have called this type of the venous pulse the auricular form of the venous pulse. In cases where there is organic disease of the mitral valves the backward pressure of the blood becomes so great that usually the venous pulse becomes much altered. In the first instance the type of pulse may be auricular, but the powerful action of the hypertrophied right ventricle pumping the blood back through a large incompetent tricuspid orifice profoundly modifies the character of the venous pulse. I have already pointed out that the wave *a* in Fig. 1 is due to the ventricle. Usually it appears later than the arterial pulse, as in Figs. 2 and 14, because the auricle in diastole, interposed between the ventricle and the veins, absorbed the first portion of the ventricular backflow. When this regurgitation takes place the ventricular backflow becomes so large and forcible that it distends the auricle; the auricular wall becomes so thin that it gradually loses the power of producing any effect by its systole upon the regurgitant blood. Its systole being ineffective, its diastole is ineffective, with the result that the wave due to the ventricle gradually increases, while that due to the auricle decreases, until finally the ventricular wave occurs coincidentally with the arterial pulse, and no trace of the auricular wave remains. Thus in Fig. 3 there is but one large

Fig. 3.—Venous pulse of the ventricular type taken synchronously with the radial pulse. As the jugular pulse is nearer the heart than the radial, the difference may be found by calculating the time between the carotid and the radial. In this and some of the other tracings a few beats of the carotid are taken along with the radial for this purpose. (From a case of mitral stenosis and tricuspid incompetence.)

wave synchronous with and due to the ventricular diastole. Whenever there is a venous pulse of this ventricular type there is almost certain to be a pulse in the liver of the same