"THE SOLDIER'S HEART" AND ITS RELATION TO THYROIDISM.

BY

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WHEN the Editor of the BRITISH MEDICAL JOURNAL accepted my offer to write on this subject I felt that it required some temerity to enter an arena where so many doughty champions had recently striven for mastery, and not one of them, in his own opinion, knocked out of the ring. I read all the letters and articles in the JOURNAL on their publication, and imbibed as little as I thought necessary. Unfortunately this has involved a second reading (a form of amusement which I do not much appreciate), in order to find out whether all the writers were dealing or intended to deal with the same cardiac affection, or whether each writer had a particular disease of his own to describe. However hazy the ideas of some of them may have been, I came to the conclusion that they all intended to deal with the old "irritable heart."

The contributions of Dr. Alexander Morison, and his references to the soldier's heart as part of a general state of nervous exhaustion are excellent so far as they go, but he does not carry us far enough, and is apt to leave us in that neurasthenic land of the destitute. On the other hand, I should like to employ to Sir James Mackenzie's article on "The Soldier's Heart" the language which he used to Sir James Kingston Fowler. It is "vague, immature, insisting on the immaterial, and neglecting entirely the essential." On causation he is not the only writer who flies to that resort for the destitute—microbes and their toxins—to explain all the ills to which flesh is heir. It is to be noted that there is not a single bacteriologist on whose evidence one would condemn the most harmless staphylococcus in support of this view; the reason, perhaps, is that bacteriologists have had a scientific training, which makes them less prone to jump to a conclusion than the clinician, who becomes very positive on the subjects which he least understands. The modern heart specialist often does not even consider an elementary knowledge of physics essential for his speciality.

It is well recognized that in diphtheria, in typhoid fever, and, in fact, in any case of prolonged high temperature, cloudy swelling of the myocardium, as well as of the liver cells, may occur. In rheumatic fever the myocardium is often involved, and this can readily be recognized two or three days before the appearance of any murmur by the delay in the transmission of the pulse wave. In the case of the irritable heart the sounds are short and sharp even when there is a murmur, and there is no delay in the pulse wave—the interval between the mitral first sound and the pulse at the wrist is barely appreciable. Influenza often gets the credit of causing heart mischief, but it usually seems to me more of the nature of a neurosis accompanied by pain than a myocardial infection. Moreover, the alcohol which is too frequently and too freely administered may have some share in the causation, especially in those cases in which there is dilatation. The heart's action is quickened, the sounds short and clear, and in these respects it differs from the myocardial condition in diphtheria.

Like the civilian the soldier is liable to all the varieties of heart disease, but what seems to me strange is that although almost any kind of heart, according to Sir James Mackenzie, is good enough for a recruit, a large number of recruits get bowled over with some functional disease of the heart even before they reach the trenches. So bad does this irritable heart seem to be for those who have passed the recruiting stage that Major Bradshaw goes so far as to say that they should be invalided out of the service. If this were an established order it would be a simple matter for any one who has no stomach for fighting to get released.

In all cases of irritable heart which I have seen there has been some enlargement of the two lateral lobes of the thyroid gland with increased function. I have also found that gland enlarged in a considerable number of cases of frost-bite, or to be fashionable I suppose I should say "trench feet"; and I hope to show some relation in the causation of these affections. I am well aware that the enlargement is not always very apparent. The thyroid gland is best examined with the patient lying on his back

with his shoulders and head supported on a gentle incline from the waist upwards; the two lateral lobes can then be easily felt internal to and behind the sterno-mastoid muscles. If the patient raises his head, so as to make the muscles and fascia tense, the whole gland disappears as if by magic. There is usually some throbbing to be felt in the carotids, and possibly also in the arteries supplying the thyroid.

HYPERTHYROIDISM.

In a paper on the functions of the thyroid, the suprarenal, and pituitary glands, I said:

Exophthalmic goitre is now, I think, almost universally acknowledged to be due to excess of function of the thyroid gland. In the case of marked exophthalmos a large pulsating thyroid, tachycardia, general nervous trepidation—the patient in an apparent state of fright, emaciation, a moist skin with consequent lessened electric resistance—any fool can tell what is the matter; but there are an enormous number of cases of hyperthyroidism in which there is no exophthalmos, no apparent enlargement of the thyroid, and no pronounced nervous symptoms. However, in these cases an intelligent observer will readily detect a tendency to emotional and vasomotor disturbance, a warm moist skin, warm extremities, active capillary circulation, rather high venous pressure, rapid action of the heart and the rate easily increased by any mental excitement, the knee-jerks and all the deep reflexes increased, and slight muscular tremor may be appreciable. In all degrees of hyperthyroidism the urine may contain a slight amount of albumin, especially after getting up; this corresponds to the so-called albuminuria of adolescence, and is associated with deficient vasomotor tone and a lessened amount of fixed lime in the blood. The free lime in the blood may or may not be increased, but there is always an excessive excretion, except when there is a very small intake. In cases of hyperthyroidism there is a state of unstable equilibrium; the individual is sharp, alert, even vivacious, but easily exhausted both mentally and physically, and so incapable of sustained effort.

The causes of the thyroid taking on this over-action, beyond the necessities of the system, are still rather obscure. This over-action cannot have any necessary connexion with the condition of the water in goitrous districts, because the large fibro-cystic masses are associated with lessened function of the gland, though of course in many such cases there may have been a primary excess of function, and we know that many cases of exophthalmic goitre end in myxoedema. However this may be, many are of opinion that the cause is water-borne, and can be destroyed by boiling, but the proof adduced in support of this contention is far from conclusive.

We do know that the active principle of the gland contains iodine, and that excess of function of the thyroid is always associated with excess of iodine in the gland. I have seen two cases of exophthalmic goitre, including well-marked exophthalmos, produced by a prolonged use of tincture of iodine, and both cases were rapidly cured by stopping the iodine and placing them on a calcium mixture. There may be sources of iodine difficult to trace in individual cases, but in every case one should keep his faculties of observation alert, try to find out the cause, and remove it. In every case the urine should be examined for iodine, though it is not often found unless the patient has been taking an iodide. Many medical men will tell you that they prescribe iodine and thyroid in such cases with advantage, but upon what grounds I cannot say, unless it be a hair of the dog that bit you, or the homoeopathic doctrine that like cures like; in that case, the more infinitesimal the dose the better. It may, however, most likely be that in such men's minds there is a confusion between over-action and under-action, exophthalmic and fibro-cystic goitre.

In the textbook etiology of hyperthyroidism the common cause, the female sex, is absent, but some men are as emotional as women. In the latter the thyroid gland is usually active about the menstrual period and during the early months of pregnancy. In men the suprarenal gland is ordinarily the more active, but in neurasthenia and in some febrile affections, such as diphtheria and pneumonia, the adrenalin function may be inadequate, and thus the controlling influence over the vasomotor system is lessened. In war other assignable causes are in force, such as mental and physical strain, worry, anxiety, and fear, vicissitudes of climate and temperature, want of sufficient rest and sleep, too much meat and not sufficient milk and cheese, and too much tobacco.

No wonder that under such conditions which go to make up the life of the soldier we should get great vascular disturbance and increased function of the thyroid gland. In great dread of any impending catastrophe the heart makes its presence felt by thumping against the chest wall. Anticipation is worse than action. When it was pointed out to the Irishman that, from his description of his wound, the bullet must have passed straight through his heart, he replied, "In faith my heart was in my mouth at the time."

The intensity of the symptoms varies very much, according to the excess of function rather than the mere size of the gland. In the cases of "the soldier's heart" the subjective symptoms are referable to that organ, but any careful observer should notice many other indications of increased thyroidism. The cardiac beats in these cases are frequent, usually from 80 to 120 in the minute, and the number is greatly increased by any emotional disturbance. This quickened action is accompanied by a certain amount of palpitation.

The eyes are, as a rule, not very prominent, but the sclerotics are frequently more than usually visible. The skin is warm and moist, except in cold weather, but even when the hands are cold the head is warm and the face often flushed. The tongue is rather tremulous and often indented at the edges by the teeth, there is usually some muscular tremor, a certain amount of trepidation and abruptness in manner. There is great dissipation of heat, and consequently when the body is much exposed to cold and wet the extremities become very cold and the fingers often dead, especially the distal halves. When the blood pressure is low the fingers and hands may get livid or purple and somewhat swollen from the slow capillary circulation, but this can be remedied by hanging the hands down and exercising them so as to increase the velocity of the blood in the capillaries. The toes may be a little livid when the patient is lying down, but not when he is standing up, as in the latter position the velocity of the capillary circulation in the feet may be at least quadrupled—always provided that the arterioles have not been so contracted by the cold as to shut off the capillaries. This condition of the circulation renders these men particularly liable to frost-bite, or the modern trench feet.

There is another strongly predisposing cause, a deficiency of lime salts in the circulation. This arises from insufficient intake and the excessive output which accompanies hyperthyroidism. The soldier's rations, in my opinion, do not contain a sufficient amount of calcium—the milk is scarce and each man only gets about 2 oz. of cheese daily. Whenever there is severe muscular work there should always be a large intake of lime. In mountain climbing I always increase my own supply. When there is hard work there is no danger in taking too much; a certain proportion is not absorbed, and any excess in the circulation is quickly excreted. In cases of "the soldier's heart" we get, as Dr. Jamieson Hurry would say, a vicious circle; the deficiency of calcium salts in the blood is a contributory cause in the production of hyperthyroidism and frost-bite, and the excessive action of the thyroid leads to great calcium metabolism.

So far as we at present know, the presence of free calcium ions in the blood and tissues is necessary for effective muscular contraction. The calcium ions increase the force of the muscular contraction, but diminish the irritability of the muscle, and, according to Loeb, inhibit the rhythmical contraction of muscle fibres, which he thinks does not depend on lessened excitability, but on some chemical combination of the calcium ions in the muscle which renders its rhythmical contraction more difficult or impossible. Sydney Ringer, in association with Dudley Buxton, showed that the effects of the salts of sodium, potassium, and calcium on skeletal muscles were somewhat different from their effects on the heart. The contractibility of skeletal muscles perfused with normal saline solution lasts longer, but when exhausted there is greater delay in relaxation. The contractions are strengthened and the relaxation delayed by potassium salts. On the other hand, the lime salts accelerated both contraction and relaxation. Personally, I have usually found that patients liable to cramp had a deficiency of lime in their blood, and thus the remainder contraction, so apt to occur in exhausted muscles, is not counteracted by a sufficiency of calcium. I still hold my former opinion that the calcium ions lessen the irritability of the heart muscle, and Blair Bell has shown that when a solution of calcium chloride was injected into the vein of a rabbit the rhythmical contraction continued, the amplitude of the contractions increased, but their frequency diminished, and when a poisonous dose was used the heart finally stopped in systole.

The late Ralph Mines showed how cardiac contraction was due to a difference in electrical potential between the ions within and without the cells.

We have many reasons for believing that the excitation process in muscle can be dissociated from the contractile process, and it seems clear that the electric variation is a direct index of the excitation process, while the contraction is a sequence, usual, but not quite inevitable. Just as in nerve, excitation occurs (but no contraction), so in muscle excitation occurs; if the contractile mechanism is in order excitation is followed by contraction.

In an experiment which I witnessed in his laboratory it was seen that the electric variation preceded the contraction of both the auricle and the ventricle, and, whether the cause or not of the contraction, it began the sequence of events, and, therefore, could not be the result of the contraction. In every case of excessive muscular action there is a great waste of lime salts, hence the necessity of a large intake.

The blood pressure in hyperthyroidism is very variable and merits special consideration. There is lessened peripheral resistance, the viscosity of the blood is diminished owing largely to a deficiency of fixed lime, the arterioles are relaxed, and the capillary circulation is active and free, all of which tends to lower the arterial pressure—at least the diastolic pressure. On the other hand, the capillary and venous pressures rise, the supply of blood to the heart is great, the ventricular cavities are large, and the systolic output great. Therefore, the systolic pressure may be fairly high, but as the arteries are large and the peripheral resistance low, there is a great fall in the pressure gradient, with a relatively low diastolic pressure. This great difference between the systolic and diastolic pressures means an inefficient circulation; it is therefore important that vascular tone should be maintained, and it is for this reason that adrenalin plays an important part in the treatment. When there is a great disparity between the systolic and diastolic pressures, and more especially when the systolic is relatively high, we get longitudinal straining of the large arteries, and marked recoil of the heart. It is this recoil which causes the thumping of the heart against the chest wall which is of frequent occurrence in hyperthyroidism, and is especially marked when a runner comes to a standstill after a strenuous race. In free aortic regurgitation this recoil often shakes the bed on which the patient is lying. It is often noticeable after an extra glass of spirits when the body is in a warm atmosphere. I do not mean that the extra glass, which develops the palpitation, is the only one which works the mischief, but it is the final straw, and the amount of the previous load will depend on the strength of the liquor and the capacity of the individual. This is an early stage in the development of the German beer-drinker's heart, which eventually ends with great hypertrophy and dilatation. "The soldier's heart" seems to be giving as much trouble in Germany as in this country. Dr. Goldscheider, in an interesting address, concludes that "the war had brought into unflattering prominence the ignorance of the medical profession of a group of symptoms with which a very large proportion of the soldiers in the German army were invalided."

The victims of the "soldier's heart" are easily exhausted and get short of breath on slight exertion, but pain in the cardiac region is not a very prominent symptom unless the heart be dilated. When lying in bed the heart gives very little trouble, unless the patient is suddenly startled or quickly assumes the erect posture. These patients are liable to febrile attacks, but that forms no part of the cardiac trouble.

The large class of cases of hyperthyroidism covers much more than "the soldier's heart." When the cardiac phenomena are prominent the diagnosis seems to be fairly obvious, but if the heart does not come into prominence, which it often does not, then the cases are pushed into the neurasthenic class. When one of these patients sometime back from the front is asked what is the matter he blurts out "NEURASTHENIA," and at the same time looks startled. It is then time to point out that there is no object in having neurasthenia at present, as although in civil life the shocks to which he had been subjected would be sufficient to satisfy any jury that he was suffering from traumatic neurasthenia, yet the Workmen's Compensation Act does not apply. There is no railway company to attack, and it is somewhat doubtful whether there will be any pensions for neurasthenia, or even frost-bite. Moreover, a neurasthenic patient should not suffer from a

flushed face, hot head, excitable pulse, and a general appearance of fright.

I recently saw a marked case of hyperthyroidism most unjustifiably dubbed neurasthenia.

A lieutenant, aged 25, joined the army soon after the commencement of the war, very keen and anxious to excel. He had hard work training, and on one occasion fainted at drill. Again in London he fainted in the street, was seen by a doctor, who said that he had a large heart. After this he spent some time in a nursing home under a physician who does not seem to have given any diagnosis except that his heart was not enlarged. He then went for a course of training at Winchester, and finally was sent to France in November, 1915. He had rather strenuous work, and as a bombing officer his duties were chiefly at night; he was seldom in the trenches in the daytime except to see that the bombs were all right. He had no fear of shells or other missiles, but he could not bear to see a man on a stretcher; if any one fainted he was apt to do the same. About the middle of January he collapsed in the trench, was carried out and invalided home; a medical board in London recommended his discharge from the army as unfit for further service owing to neurasthenia. He did not feel inclined to take this verdict; he went to his regimental surgeon, who said that there was nothing the matter with him, and ordered him to his dépôt. It was soon found that he was not able to stand the fatigue of constant drill, and his commanding officer requested him to see me.

He gave me the impression of having a somewhat startled, not to say frightened, appearance. He complained of being easily exhausted, getting short of breath on exertion, often troubled with palpitation and throbbing in the vessels of the neck. He gave way at the knees, and felt that he would like to lean against a support; any extra exertion caused exhaustion, and on suddenly assuming the erect posture he felt faint. He perspired freely and usually felt warm, but often the ends of his fingers became pale and dead. His head usually felt hot, and he was often confused in his thoughts, and incapable of sustained mental effort. He was emotional, and often felt inclined to cry without any reason. There was slight general tremor, muscular irritability, and *tache* easily developed and very persistent. The knee-jerks were excessive. Heart 2 in. to the right, and 4½ in. to the left of the mesial line; sounds short and clear, no murmur, second pulmonic sound rather accentuated. Pulse 84 recumbent, on assuming the erect posture 120, afterwards falling to 96. Blood pressure: diastolic 110, systolic 150 mm. of mercury. Urine 1024, acid, a trace of albumin, lime deficient, phosphates normal; appetite bad. Height, 5 ft. 8½ in. Weight in shirt and trousers, 10 st. 11 lb.; he had lost some weight. I ordered him a month's rest, a liberal diet with plenty of milk food, and a mixture of adrenalin and lime salts.

In this class of cases there is not only over-action of the thyroid but under-action of the suprarenals. The patient often feels faint, and there may be sickness, and even vomiting; on quickly assuming the erect posture he may feel giddy, and there is a great increase in the frequency of the pulse, which becomes small and feeble owing to the blood gravitating into the abdominal cavity and the failure of the vasomotor mechanism to adjust its action rapidly to the altered conditions; and there is frequently orthostatic albuminuria. These phenomena have been aptly termed "cardio-splanchnic paresis" by Albert Abrams. In these cases an abdominal belt worn tightly does good.

HYPOTHYROIDISM.

In many cases of frost-bite, even when the thyroid gland is enlarged, its over-action has disappeared before the patient reaches this country, and frequently there is a state of hypothyroidism, with feeble circulation and cold blue extremities. These cases are easily treated. There are also cases of hypothyroidism in stolid men who would not move a hair if shells were bursting all round them. I had recently a friend under my care—a distinguished officer of a high and well-merited reputation, mentioned in dispatches and honoured by the King. After twelve months' strenuous work, want of rest, and not troubling about his food, he lost over 4 st. in weight. His condition was noticed by his superior officer, who advised him to take a rest. He did not think it necessary, but in obedience to the command he returned to London, was examined by a medical board, which gave him two months' leave.

When I saw him he chafed under the long enforced idleness, but I told him that two months were little enough. I ordered him to bed, told him that I would see him when I thought it necessary, that he was to put on at least 2 st. in weight, otherwise he would require a new uniform. About medicine and diet I would speak to his superior officer, and she would see that my instructions were carried out. Notwithstanding his great loss of

weight I felt confident from his slow, feeble, intermittent pulse and other symptoms that there was deficient thyroid action, and among the remedies I ordered was a 5-grain thyroid tablet daily. He rapidly improved, gained over 2 st. in weight, and was soon fit for plenty of exercise. Before the two months were up he happened to be in London, and sought a medical board, the president of which told him that he could not pass him for foreign service. He then appealed to be examined by the junior member of the board who agreed with his senior. This seems to be a much more common custom in the army than in civil life. When I saw him he was annoyed, as he wanted to be back in the scene of action. I told him that it was his own fault, that he had thought himself too well and had stopped treatment. I had no doubt that his heart had astonished the examiners by intermitting a few times, and that had frightened them. There is an alderman in the city of Liverpool, aged 90, who can still do a long day's fishing and enjoy his dinner with the youngest of us, yet he has had an intermittent heart all his life and was several times rejected for life insurance. I told my friend that he was unfortunate in not having been examined by Sir James Mackenzie, because he might have told him that intermissions do not count, that he had an excellent heart for a recruit, and it might last him till the age of Methuselah if he did not die in the meantime. My own opinion was that his heart was good for this war and somehow on to the next if he did not get in the way of a shell. I told him that he should be like a medical student who always studies the idiosyncrasies of his examiners when going up for an examination. I told him to resume his 5-grain thyroid tablets, to take one every day of his life, and it would save him many medical prescriptions and keep him out of the hands of the modern heart specialist; but for a week before his next medical board he was to take a tablet night and morning and stop tobacco. In the meantime he should go off to Scotland and get some shooting. In a few weeks he passed another medical board, he told me, with flying colours.

I wish to take this opportunity of pointing out that there are large amounts of thyroid preparations on the market more or less useless. It is unfortunate that we should be so much dependent on the reputation of the druggists—wholesale and retail—for the quality of our drugs. Thyroid preparations should contain at least 0.2 per cent. of iodine, but in many samples I have failed to find a trace. Of course, it is easy enough to add iodine to the preparation, but whether the added iodine is as effective as that which should be naturally in the gland is another question. However, I often find that the effects of thyroid are enhanced by the use of iodine at the same time. A favourite prescription with me is a mixture of calcium iodide, tincture of iodine, and the syrup of lactophosphate of lime.

The treatment of these cases is that of hyperthyroidism and hypothyroidism, which every one should know. I see Dr. Florence Stoney strongly recommends *x* rays in cases of hyperthyroidism. I used the *x* rays in many cases with some benefit ten years or more ago, but latterly I have not done so, as all my cases have done very well without the rays. I have no objection to their use, but I think caution should be exercised for fear of overshooting the mark.

REFERENCE.

¹ *Practitioner*, April, 1914.

THE report of Major-General William C. Gorgas, Surgeon-General of the United States Army, to the Secretary of War shows that the admission-rate for sickness for the whole army in 1914 was 660 per 1,000, the lowest on record. The rate was highest in China and Panama and lowest in Alaska. The rate for discharge for disability for the entire army was 12.99, as compared with 12.77 in 1913. The death-rate was 4.40, as compared with 5.15 in 1913. Among the 98,649 men stationed in the United States, Alaska, the Philippines, Hawaii, Panama, Porto Rico, and China, there were but 7 cases of typhoid fever; only 2 had received the complete course of vaccine treatment. The admission-rate for tuberculosis had receded to 3.50, and for alcoholism 13.64, both the lowest ever recorded. The rate for malarial fevers was 29.48, said to be "a very creditable showing." The Act of Congress stopping the pay of men incapacitated for service by venereal diseases had held them in check, though the rate was slightly higher than that for 1913.