CRITICAL REVIEW

TYPES OF TACHYCARDIA AND IRRITABLE HEART.

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Since the war began the practitioner has had to deal with cases of cardiac disturbance which, in many instances, have presented new and difficult problems. The most common has been the “irritable heart” of soldiers, often labelled “D.A.H.” or “Effort Syndrome.” Influenza was followed by many instances of breathlessness, weakness, tachycardia, and unfitness, which appear to have had different explanations, including severe, and in some cases, permanent myocarditis. Pneumonia, malaria, and other infectious diseases often left symptoms in their train referable to cardiac conditions. The number of published papers dealing with such cases now numbers several hundreds, and the accumulation of experience has given considerable value to the more recent.

During the nineteen months which elapsed between the entrance of the United States into the war and the signing of the Armistice, approximately 4,000,000 soldiers were subjected to a special physical examination of their circulatory apparatus by officers specially selected for the work. As a preliminary to our review we may ask with Conner1 whether anything of permanent value has been added, by this enormous inquiry, to our knowledge of cardiac disorders and diagnosis. Conner unhesitatingly answers in the affirmative, and points out that the advance has been made not through refinements of laboratory technique but chiefly through the opportunity afforded to examine such an immense number of young men, and to learn the frequency and the extent of normal variations of the physical signs of the heart. This is regarded as the most important gain. Next to this is placed the gain in knowledge of the functional disorders of the heart, especially the so-called irritable heart; and, third, should be placed the advance in the diagnosis of the milder forms of organic valvular disease.

The types of cardiac disease which in civil life are among the most common were very rare. The rarity of syphilitic disease was notable. Among 1,000,000 recruits there were 11,562 rejections for cardiovascular disorders. Of these, twenty were rejected for thoracic aneurism. Aortic incompetence due to syphilis was also rare, and it might almost be stated as a law that in cases of acquired syphilis the clinical evidence of involvement of the aorta and heart almost never appears before the thirty-fifth year.

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**Variations of Physical Signs.**

The distinctness and the character of the cardiac impulse depend on the special conformation of the chest. In a flat chest the impulse may be prominent and the area of cardiac dullness may be large, and these signs may readily be taken as indicating some cardiac enlargement. Accidental or functional systolic murmurs were surprisingly frequent. Over the base the true nature of these murmurs is fairly readily recognised, but functional murmurs were frequently apical. Probably nine-tenths of all apical systolic murmurs in young adults are accidental or functional. An important diagnostic point is their inconstancy. They may be absent during rest and present after exercise or during excitement. They may be absent in the erect posture and present in the recumbent position. They have little tendency to be transmitted to the left of the apex. The murmur is obviously only the modified first sound and not something super-added to it as is often the case in mitral incompetence. The functional murmur is rarely so high-pitched or blowing as the murmur of incompetence. The basal systolic accidental murmurs have much the same characteristics. When heard over both aortic and pulmonary areas they may be mistaken for the murmur of aortic stenosis.

The teaching that accidental murmurs are always systolic in time is, in general, sound, even although the statement is not strictly true. The exceptions are rare.

*The Irritable Heart of Soldiers.*—Although almost every text-book has contained some account of this condition for fifty years, few physicians ever recognised it, and it was looked upon as an affection peculiar to war conditions and without a counterpart in peace times. From the very first day of the army heart examinations, however, this neurosis obtruded itself upon the consciousness of the examiners in no uncertain manner. It was by far the commonest disorder encountered, and transcended in interest and importance all the other heart affections combined. One of the surprising things about the "soldier's heart" was the discovery that in a majority of the cases the symptoms of the disorder were not first manifested under the strain and stress of the war, but had existed in the recruit for years before the onset of his military career. These cases made up the so-called constitutional type of the disorder.

In another large group of cases the symptoms appeared in previously healthy men after an attack of acute illness, such as pneumonia, dysentery, rheumatic fever, or influenza. In most of these "post-infectious" cases there is no reason to suppose that the fact that the patients were soldiers bore any direct relation to the development of the neurosis. The affection is far from being peculiar to the conditions of war or to army life. Only a small proportion of cases
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have their origin in such special conditions. The condition must be of fairly common occurrence in peace times, and with the knowledge of the disorder gained in the war there should be no question of its proper recognition in the future; and the dissemination of this knowledge will constitute one of the most important of the war's contributions to cardiac diagnosis. All the experience of the army heart examinations has shown the great danger of mistaking this neurosis for some organic disease of the heart, in contrast to the very rare error of mistaking such organic diseases for the effort syndrome. The "soldiers' hearts" were very apt to be diagnosed either as myocarditis or as mitral insufficiency or mitral stenosis. It was indeed difficult to believe that a soldier who, on even moderate exertion, showed an array of striking symptoms—dyspnea, exhaustion, precordial pain, tremulousness, cyanosis, and extreme tachycardia—could be suffering merely from a neurosis. Moreover, many of the physical signs bore a strong resemblance to those of mitral disease.

The widespread impulse often suggested enlargement. The first sound was often sharp and short, the second accentuated. A systolic accidental murmur might be heard, and the suggestion of a thrill was often given to the palpating hand. Because of the rapid heart-rate it was often possible to persuade one's self, erroneously, that this slight thrill was presystolic in time. It is therefore not surprising that a good deal of time was needed to educate the great body of medical officers to the true nature of these cases.

Diagnosis of the Mild Forms of Valvular Disease.—The instances of valvular disease encountered in the army examinations were nearly all of mild type. All the more serious had been eliminated by local boards. It was characteristic of these mild forms of valvular disease that symptoms, as distinguished from physical signs, were lacking. The men affected nearly all gave a normal response to exercise, showed the same physical strength and endurance as normal men, and could be distinguished from these only by the physical signs of the heart. It remained throughout the war an amazing paradox that a disorder in which the heart was known to be intrinsically normal should give rise to pronounced cardiac symptoms, whereas the cases of valvular heart disease were so completely free from symptoms.

The lesions of the aortic valve presented little difficulty. Aortic insufficiency was the one valvular lesion in which the tendency to err was in the direction of making the diagnosis too infrequently. In mitral cases the mistakes were in the direction of finding some valvular disease when it did not exist rather than in overlooking a real lesion.

The effort syndrome was commonly mistaken for mitral incompetence. The tachycardia of "soldiers' heart" is no part of the clinical picture of mitral leakage. One will probably make fewest mistakes in
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the diagnosis of mitral regurgitation by adhering to the rule of never venturing a diagnosis on the presence of a murmur alone, however characteristic it may seem to be. The distinction between mitral stenosis and effort syndrome might be very difficult. A rapid heart-rate during rest is very rare in mild mitral stenosis. On the other hand, anything approaching a normal heart-rate, even during rest, is unusual in "soldiers' heart." An unmistakable presystolic murmur is practically essential for a diagnosis of mitral stenosis, and in the mild grades of valvular disease there are lacking all the pronounced symptoms of dyspnœa on exertion, faintness, pain, palpitation, cyanosis, and sweating with tremor, which are so characteristic of the effort syndrome.

Cohn gives an interesting historical account of the "cardiac phase of the war neuroses," and pays a tribute to the work done for these cases in the British Army. He lays stress on the nerve aspects of the condition noting the coarse tremor, the areas of anaesthesia and exaggerated reflexes. The symptoms, in the main, are referable to the heart and circulation, but such symptoms occur in four groups of cases:

1. Chronic disease of the heart, both of endocardium and myocardium. 2. In relation to acute infectious disease. 3. In hyperthyroidism. 4. In the neuroses in peace as well as in war.

1. As regards chronic heart disease, the significance of murmurs has to be considered. The functional murmurs are usually smooth and accompany or follow the first sound, but rough murmurs immediately preceding or forming part of the first sound may occasion difficulty. A roughening of the first sound is common when the rate is rapid, and the second sound is often accentuated. These signs have been accorded too much importance, since their occurrence exceeds the incidence of mitral stenosis at autopsy.

The size of the heart may be misleading. Meakins and Gunson found the heart in the neuroses was actually smaller than in their controls when the relation to body weight was considered, but Cohn is unwilling to admit this, holding that in many soldiers, as the result of training, the heart tends to be large. The differentiation between some of the organic cases and the neurosis is often a fine one.

2. The experience is general that after acute fevers the rate of the heart remains increased. The tachycardia is often associated with pain and shortness of breath. Patients are unable to work as well as before. Fatigue or uncomfortable sensations soon terminate effort. When nerve symptoms are present they may be regarded as being superimposed on the cardiac ones. It is doubtful whether the nervous symptoms of the effort syndrome are common under those circumstances. The heart in convalescence from infection and the irritable heart are not the same thing.
3. Real difficulty arises in distinguishing irritable heart from hyperthyroidism. In both, the pulse is rapid, the size of the heart may be increased, abnormal sounds may be present due to the rapid rate, and tremor is common. The similarity is admitted but there are grounds for distinguishing the two conditions. In the first place in the heart cases there is no genuine exophthalmos, but there is often a look of anxiety which simulates it. The thyroid gland has actually been found to be heavier than usual in men killed in action. The tremor of the effort syndrome is coarser than that of Graves' disease, and increases when attention is drawn to it. The rate of the heart in Graves' disease is not continuously high and falls during rest and sleep, and in that condition the rate of metabolism is above normal.

That malfunction of the thyroid may underlie the condition called irritable heart is still open to investigation, but the specific knowledge so far accumulated fails to bear out the contention.

4. It remains to show on what grounds the irritable heart is regarded as neurotic. There are cases which it is agreed do not fall into the three well-defined groups first discussed. The patients all give the impression of nervousness of the type classed as states of anticipation or anxiety neuroses. The brow is furrowed, the eyes are troubled, the mouth is drawn. The reaction to unexpected noise is prompt and exaggerated. There is shakiness of head, body, and limbs. There is absence of mucous membrane reflexes and exaggeration of tendon reflexes. There is insomnia and disturbing dreams.

Mott calls them examples of neurasthenia. This is all borne out by the fact that other neuroses have caused difficulty in classification. Among these are gastro-intestinal and respiratory conditions. The anxiety state was readily induced during the war. Descriptions of its terror were familiar so that an anticipation of what he might experience was lively in the mind of the least instructed recruit. The influence of sights and sounds, and the experiences of actual warfare readily wore down the resistance of the timorous and, in time, affected many of the more hardy. Many men passed through the war psychically untroubled, but no one could predict which men were likely to endure. Constitutional predisposition must be taken into account, but as a complete explanation of failure it appears to be inadequate. Other factors bear on the probability that the symptoms of irritable heart depend on a neurosis. The symptoms were all but unknown in the severely wounded. The same may be said of the gassed, and it was commonly admitted that prisoners of war were free from such ailments. All these men were finished with the war.

Viewed as a neurosis, the outlook for rapid recovery is favourable. Recommendations for the care of the patients were based on British experience. The most important advice was the establishment
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of special camps away from the hospitals. The underlying idea was to give the man specific work, to give him back his morale, his cheerfulness, and his courage. He should emerge from camp ready to undertake his share of the burden willingly. The barracks and huts must be well arranged. Gardening, games, picture shows, athletics, and music were encouraged. The detailing for games and exercise was carried out by specially trained officers. For civil practice this experience has a lesson, and there are problems in therapeutic organisation awaiting solution.

Various attempts to associate some definite change apart from faulty nerve action in the effort syndrome have apparently failed, although some interesting data have emerged.

Adams and Sturgis investigated "Vital Capacity" and found that in 80 per cent. of "effort syndrome" cases there was a vital capacity of 90 per cent. or more, and that 93 per cent. of cases had a capacity of at least 85 per cent. of the normal standard. Tests of general muscular strength showed no relation between the muscular development and the vital capacity of the lungs.

Observations were also made on the carbon dioxide combining capacity of the blood plasma.

In fifty-four cases this was found to fall within the normal limits.

Mabon investigated the effect of measured work on the effort syndrome. Work was furnished by full extension from the shoulder of two 5-lb. dumb-bells. Extension and return occupied one second each, and the rhythm was maintained by a metronome. The changes in pulse-rate and blood pressure were observed in fifty patients after the hardest exercise which they could be induced to perform. For the most part patients had symptoms of some years' duration. The amount of work which they could do before becoming fatigued was much less than that done by normal controls. The pulse-rate at rest was higher than in the normal cases, but the rise after exercise and the time for the return of the rate to its resting value were not definitely abnormal.

No "delayed rise" of blood pressure suggesting myocardial inefficiency was observed. The amount of work which the subjects were able to perform usually corresponded closely to their physical strength as determined by tests of the skeletal muscles, and this indicates that lack of development of the skeletal muscular system is a factor to be considered in the cause of the fatigue following slight exertion in certain types of cases of "effort syndrome."

Smith of Chicago gives an account of cases of tachycardia following influenzal pneumonia. It was found that in many of the convalescents there was a rise in the pulse-rate to 80 or even 120. The rise dated from the time they were first allowed on their feet,
and some were promptly ordered back to bed. Some complained of shortness of breath, weakness, giddiness, and palpitation on exertion. The point of special interest was whether the influenza had produced some organic disease of the heart such as myocarditis, or had merely brought into the open tachycardias, which otherwise might have gone unnoticed. After careful analysis of the history further differentiation of the cases was made by means of graded exercises, the atropine test and the adrenalin test.

The atropine test was carried out in the same way as for typhoid. Patients were put to bed in a quiet room and the pulse-rate was determined. They were then given \( \frac{3}{16} \) gr. of atropine hypodermically. The reaction began in from fifteen to twenty minutes and lasted from forty to sixty minutes. Nineteen of the fifty men tested had an increased pulse-rate of from 1 to 12; twenty-one had an increase from 20 to 30; the remainder had an increase of from 30 to 40. There was no basis, however, for regarding that the action of the vagus in any case had resulted from the influenza pneumonia.

The same fifty men were given doses of adrenalin. After initial observations of pulse and blood pressure a dose of adrenalin was injected into the deltoid. Records of pulse and temperature were made every two minutes for ten minutes, then every five minutes for an hour, then every ten minutes for half an hour. A positive reaction depended on an increase of pulse and blood pressure of from 15 to 20 points, tremors, palpitation, and increased arterial pulsation. Twenty-five of the fifty men were sensitive to the test, but in the absence of knowledge of their reaction previous to the influenza no conclusions could be drawn. After all the observations on ninety-five cases a diagnosis of acute myocarditis was reached in only one instance.

Organic heart disease did not seem to be the basis of the tachycardia in these men. Many of the cases had an irritable heart before the illness. In twenty of the cases hyperthyroidism was suspected. The graded exercises were of distinct value in estimating the state of the myocardium, and in improving the general condition.

A study of the heart in broncho-pneumonia is germane to our present inquiry. Hart found that individuals with chronic valvular disease withstood the toxemia of the pneumonias of the epidemic very badly. Persons with normal hearts who took pneumonia did not ordinarily die from cardiac insufficiency, and post-mortem evidence offered no proof that the heart was essentially damaged. Digitalis acted on the cardiac apparatus in pneumonia in the same manner as in a similar series of heart cases without pneumonia. Digitalis reduced the heart-rate only in cases of auricular fibrillation and in cases where it was given in quantities sufficient to produce an actual auriculo-
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ventricular block. The administration of digitalis did not influence blood pressure.

In view of the widespread belief that death in pneumonia is usually due to heart failure, and the dependence usually placed on digitalis, a critical examination of the evidence is suggested in order that remedies better fitted to combat the true pathological condition may be discovered.

The study of the papers quoted, as well as others, brings conviction on at least the following points:

1. The frequency of the irritable heart even in civil life; the uselessness of the ordinary cardiac tonics in its treatment, and the benefit of graduated exercises and special institutional treatment.

2. The rarity of myocarditis or other organic heart disease following toxic conditions which might reasonably be expected to cause it, and the frequent explanation of the cardiac symptoms in most of such cases as a neurosis.

3. The distinction between irritable heart and hyperthyroidism, and the comparatively small number of cases of the latter condition.

4. The caution required in diagnosing mild cases of cardiac valvular disease.

5. The rarity of cardiovascular disease resulting from acquired syphilis under the age of thirty-five.

REFERENCES.—1 Conner, Amer. Journ. of the Med. Sciences, December 1919. 2 Cohn, ibid., October 1919. 3 Meakins and Gunson, Heart, 1918. 4 Mott, Lancet, 1918. 5 Adams and Sturgis, Amer. Journ. of the Med. Sciences, December 1919. 6 Mabon, ibid. 7 Smith, Journ. Amer. Med. Assoc., 13th December 1919. 8 Hart, Amer. Journ. of the Med. Sciences, November 1919.