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Neurocirculatory asthenia

John R. Curry
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NEUROCIRCULATORY ASTHENIA

By

John R. Curry, A. B.

The University of Nebraska
College of Medicine
Senior Thesis
1934
Introduction

A doctor's obligation to his profession is to serve humanity. By rendering this service he must cure sometimes, relieve often, and comfort always.

While these facts were brewing within my mind there suddenly occurred to me that a great injustice was being administered to patients upon whom, for some reason or other, a diagnosis of heart disease had been bestowed. Often times such a diagnosis is made without adequate grounds, and in other instances true heart disease is confused with only a functional disturbance. Mistakes in diagnosis, such as those mentioned, have caused many an individual's life to be ruined.

Deeming this problem as important, at least in my mind, I shall take it upon myself to review the literature on functional diseases of the heart and present this work as my senior thesis for the degree of doctor of medicine at The University of Nebraska.

If the information to follow will aid the profession in diagnosing this syndrome, I will consider my work as fruitful.

J.R.C.
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History

According to Da Costa, who was responsible for the first clinical investigation and report on the subject of irritable heart, this condition was known and probably has been known through all the ages. (11), He stated that similar reports, or merely mention of such cases, were made upon soldiers of the Crimean war. Such publication, he stated, can be found in the British Blue Book. He further added, that he had seen statements here and there among the medical literature which make it likely that the same affliction was noticed in India, among Sir Henry Havelock's gallant troops.

Looking at the causes which produce it, it must have occurred in the troops in Sir John Moore's retreat, where, as Napier tells us, some brigades covered the retreat, fighting for twelve days and traversed eighty miles of road in two marches, (11), or among the devoted band by whose energetic movements Lord Clive conquered India, or among the victorious columns which, under Napoleon's guidance passed by forced marches from the Rhine to the Danube, and compelled at Ulm, the surrender of an army, or among the shattered and harassed forces which found their way back from the disastrous invasion of Russia.

However Da Costa, in examining the documents bearing on these movements, could not find the subject mentioned. But
he further stated that just because the disorder is not recognized is not proof of its not having existed. For, when we reflect how almost entirely the accurate knowledge of disease of the heart is the knowledge of our times, we can readily understand how difficult or impossible it may have been to have distinguished the less marked group.

As was stated previously Da Costa was the first to report any clinical data on this subject. (11) & (60). In 1871, he reported some three hundred cases of this malady. His cases were taken both from patients who had served in the Civil war and private patients. Da Costa, however, recognized this condition in 1862, when in a communication addressed to the departement in December he intimated such a cardiac disorder. (3). But because of several reversals and setbacks his analysis of several hundred patients was not completed until the year of his publication of the subject. (11). His observations justified the conclusion that the condition was a functional one. (6).

During the interval up to the world war there are few if any references to this condition in the literature, but early in 1915, so many British soldiers affected with "disordered action of the heart" were sent back from the firing lines to the base hospitals that new investigations were begun on such cases by Thomas Lewis. (6). Out of these investigations come much of our knowledge of this subject to day. With
this knowledge large numbers of men were weeded out of the draft in army camps many of them coming from rural and mountainous districts and many of them being of the colored race. Lewis also noted that the condition was common in the civil life of both men and women, but made no effort to describe it thoroughly at that time.

Investigations on this subject have continued since then. Much has been learned, but because of the importance of the condition myriad of experiments have been carried out until the present status of the condition is soundly established, and it is referred to as that syndrome of ill health in which the symptoms and signs produced in normal subjects by excessive exercise are called forth in the patients by lesser amounts and in which no definite physical signs of structural disease are anywhere discovered. (16), The smaller the amount of work required to produce these symptoms and signs the more severe the malady. It is being emphasized more at the present time that this symptom or syndrome of neurocirculatory asthenia in not particularly a soldier's malady, but that it is a common condition among the civilian population where it is often called heart strain, and that its frequent appearance in soldiers during the war was in a large part due to its unveiling by circumstances which the civilian does not always meet. (16),
During the time that this condition was being recognized by the various investigators, there has been a gradual evolution in the nomenclature. Da Costa in 1871, referred to this syndrome as irritable heart, soldiers heart, and at times functional heart disease. When Lewis began his studies on the subject during the world war he felt that these names were not descriptive enough, so he first substituted disordered action of the heart and later effort syndrome.

Effort syndrome was chosen as the most satisfactory because in those patients who had no signs of structural disease it was found that the symptoms and signs which appeared were those appearing in a healthy person who undertook strenuous exercise. (42). It was also found in these patients that the degree of effort needed to call the symptoms forth was in inverse ratio to the malady and the signs and symptoms were the exaggerated physiological response to exercise.

As this condition became more prevalent a more descriptive term was in wanting. The results of many investigations, however, finally led to the adoption of neurocirculatory asthenia. (20). Although this nomenclature is not a clinical entity it is a descriptive, non committal term which is easily understood and not misunderstood throughout the whole profession. This term was later introduced into this country, and remains at present the most satisfactory designation. It has been accepted throughout the whole profession because it
expresses its abnormal character by referring to both neurasthenic state and circulatory symptoms, and at the same time doesn't limit the term to "effort," or "irritability," or "soldier," or make it too general by calling it by a vague inclusive designation "cardiac neurosis." (22),
Etiology

Lewis divides the principle etiological factors of this neuroasthenic condition into definite groups. (6), The largest group is composed of individuals of constitutional weakness, physical, mental or both. (16) & (15), Usually undernourished, undersized men of visceroptotic build with flat or elongated chest are especially likely to develop this syndrome, as well as those people who are of an inferior mentality and who give a family history of insanity or epilepsy. In a few instances effort syndrome develops in those who have been restrained from the usual activities of childhood by over zealous parents. A second group comprises those who are worn out from severe physical work of long standing together with improper food and lack of relaxation. The remaining group consists of the following:

1 Patients in the convalescent period of the infectious diseases including pneumonia, typhoid, rheumatism, tonsillitis, chorea, etc.

2 A smaller group composed of individuals suffering from unrecognized infection such as foci in the teeth, tonsils, gall bladder, intestinal tract or appendix.

3 A group consisting of those having incipient pulmonary tuberculosis, or an early organic valvular disease.

4 At one time heart strain was considered an important
cause, but is now generally conceded that the normal heart in a healthy person cannot give symptoms of effort syndrome as a result of strain alone. Alcohol, tobacco and syphilis play an insignificant part.

According to Da Costa, whose analysis was made purely on three hundred soldiers, the etiological factors concerned in the production of effort syndrome are:

<table>
<thead>
<tr>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Fevers --------- 34 --------------- 17</td>
<td></td>
</tr>
<tr>
<td>2 Diarrhoea ------ 61 --------------- 30.5</td>
<td></td>
</tr>
<tr>
<td>3 Hard field service -------- 69 --------------- 38.5</td>
<td></td>
</tr>
<tr>
<td>4 Wounds, injuries, rheumatism, scurvy, ordinary duties of soldiers life and doubtful causes - 36 --------------- 18</td>
<td></td>
</tr>
<tr>
<td>Total ----- 200 --------------- 100</td>
<td></td>
</tr>
</tbody>
</table>

Age also acted as a predisposing cause, as seen by this table:

<table>
<thead>
<tr>
<th>Age</th>
<th>Cases</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>From ----</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;</td>
<td>16 - 18 yrs.</td>
<td>24</td>
</tr>
<tr>
<td>&quot;</td>
<td>18 - 20 &quot;</td>
<td>26</td>
</tr>
<tr>
<td>&quot;</td>
<td>20 - 25 &quot;</td>
<td>86</td>
</tr>
<tr>
<td>&quot;</td>
<td>25 - 30 &quot;</td>
<td>34</td>
</tr>
</tbody>
</table>
Fully two thirds of the cases happened from the 16th to the 25th year. Here the majority occurred from the 20th to the 25th year; yet Da Costa states that if the question was considered with reference to the number of persons under 20 years of age in the ranks, these would be found to have furnished the largest percentage. Occupation was found to have no influence on the production of the malady. Painters, butchers, blacksmiths, carpenters and the city bred man were all fully represented in the long list of sufferers.

A more comprehensive view of the general causes of the malady shows that quick and long marches, heavy work, produce the condition, or even slight exertion in those whose strength has suffered, or condition of the heart been disturbed by diarrhoea or fever give the same disorder. (40). It is found to develop in those previously weak and unaccustomed to fatigue, or subject to readily quickened circulation. The mechanism of this disturbance, according to Da Costa, is as following: The heart has become irritable from its over activity and frequent excitement. The nervous disorder so set up is continued and gives rise to the effects. (11), DaCosta maintains that the special nerve center of the heart is stimulated by reflex impulses from other portions of the body carried by way of the sympathetics. These reflexs impulses stimulate the nerve center and cause a resulting pulsation of the heart.
If these impulses continue long enough the heart will become very sensitive and irritable to them.(5).

According to White (46), the etiology of neurocirculatory asthenia is not known. The fundamental origin of irritability and fatigue of the nervous system in so-called functional disorders, or neurasthenia, is still obscure. They have usually been called functional disorders, but the mechanism of such disorders is as yet unexplained. Abnormalities of central nerve cells induced by fatigue in experimental animals have been noted and may be possible factors. Moreover, why gastrointestinal symptoms are most prominent in some patients, cerebral symptoms in others and cardiovascular in others has not been explained. Variations in innervation or early accidental association with other trouble (indigestion, headache, extrasystole, or cardiac symptoms) may constitute the answer. Campbell (5), however, put forth evidence that these variable symptoms in individuals may be due to an idiosyncrasy of those patients. White summed up his opinion by stating that in the present state of knowledge that some patient's neuroasthenia is a disorder commonly found in some individuals, usually under special strain, who were born with an especially sensitive nervous system.

White's observations on the part that age plays in the etiology of this syndrome conform very closely to those of Da Costa (46). Out of 365 cases White found that over half
were between twenty and forty years of age. Twenty three and nine tenth percent of this total being in the third and twenty seven percent being in the fourth decay of life. While only a little over seven percent fell in the second decay of life with only a small percentage being found in either the early or late decays of one's existence.

Sex is also a factor. Females are affected more than males. The ratio in the series of cases by White and Jones was fifty nine percent female and forty percent males. Heredity is one of the most important etiological factors. It is common to find that a close relative of the patient has also has a sensitive nervous system. Besides heredity the one other etiological factor of great importance is that of strain. This may be the result of worry over business, social, or family troubles.

The toxic effect of tobacco, alcohol, tea, coffee, and other substances does not in itself cause neurocirculatory asthenia. Although it may aggravate, or perhaps even precipitate it. During the world war of 1914 - 18, it was thought that over indulgence in these things particularly in tobacco and alcohol, might explain the great frequency of this ailment, but actually the reverse was found, and it was observed that the victims of this disorder, realizing their sensiveness, indulged in these things less than did the average soldier. It is usually the combination of excitement, exertion,
and fatigue that precipitates the maximum degree of symptoms in a susceptible individual. And it is this combination in war times that occasions the great exaggeration of the disorder in so many nervous young men. Infections are the precipitating causes in many cases. Warfield and Smith who in 1918, examined two hundred and thirty-five soldiers with effort syndrome actually diagnosed eighty-eight cases of these as having pulmonary tuberculosis.

Roby and Boas in their observations on these patients concluded that the fundamental cause of neurocirculatory asthenia is due to a nervous instability of the patient that cannot be cured. According to these men such patients gave a family history of nervousness. Some member of their family may be easily upset. The patient himself if examined will reveal nervous symptoms dating back to childhood.

Francis Fraser and Wilson of England made a series of experiments on effort syndrome patients and normal men. Their experiments consisted of noting the affect adrenalin and apocodeine had upon these two different types of individuals. They observed through the course of the experiment that those patients of irritable heart reacted more strongly to these drugs than normal people. Their conclusion was that the mechanism of effort syndrome was due to the greater instability of the sympathetic nervous system whose hypersensitiveness allowed for a greater number of stimulations.
Wilson (50), has brought further evidence to light to support the theory as given above. His work was done about the same time that Cotton, Rapport, Slade and Lewis published the results of their experiments with atropine, pilocarpine and amyl nitrite on effort syndrome patients. (8), (9), (10). Their conclusions reached from these experiments are:

1. The effect produced by atropine and amyl nitrite on these patients was almost negligible.
2. Pilocarpine increased the symptoms.
3. The fact that pilocarpine has a greater affect on the patients than the normal control is quite indicative that the cause of the syndrome is the relative unstability of the nervous system.

B.S. Oppenheimer and M.A. Rothschild working in England during the world war based the etiology of neurocirculatory asthenia upon a psychoneurotic basis. (32). They determined that out of a series of one hundred cases that fifty one percent showed a personal history of psychoneurosis, and that fifty six percent showed a positive family history, and that only six percent of the controls showed any evidence of a psychoneurotic history. They concluded, therefore, that psychoneurotics were principally if not wholly the only ones affected. Davies (12), of England in a similar investigation found that about one tenth of the patients suffering with this syndrome were neurasthenic.
Dr. Venning of France after examining and following about seven thousand effort syndrome patients over a period of two years, during the world war, concluded that the chief cause of D.A.H. was that of mental and physical strain produced during wartime. (44). The next in importance was infectious diseases the majority of which began in civil life chief of which was rheumatism.

Dr. Brooks gives in addition to the above causes a racial influence. (4), From a study of the soldiers presenting themselves with this affliction during and after the world war, he finds that the Jewish race included fully two thirds of the cases, and of these the greater number are among the Russian Jews. Next in point of frequency stands the Italians, then the Irish, the Americans, the Scandinavians, and last of all the negro. The French and British are relatively not affected as frequently as those just mentioned. Another very striking finding by Brooks was the part that heredity plays. He found from these patient's histories that other members of their immediate family and near relatives showed some form of emotional disturbance. In by far the greater number of cases the trait had been transmitted from the maternal side, though by no means was it infrequent to see both parents, especially the Russian Jews, present perfectly clear stigmata of the condition.

Friedlander and Freyhof were strong supporters of the theory that foci of infection was responsible, at least in a
large part, for the precipitation of this condition of effort syndrome. (15), They gave as proof of this statement the observations, that out of the fifty men affected fifty to ninety percent had trouble with their teeth, sinuses and tonsils. These men also confirmed the findings of most men on this subject that no organic heart trouble could be elicited. Effects of tobacco and alcohol were found to increase the pulse rate and blood pressure, but as far as being the cause of the ailment they had no basis for such conclusion. They did, however, believe that these habits, if excessive, could help precipitate such an affliction.

A great deal has been written about the possibility of hyperthyroidism being the etiological factor of neurocirculatory asthenia. Brooks mentioned (4), such a possibility, but qualified his statement at the end by inferring that such a theory, as yet, was not securely founded. This theory was the basis of much diversity in opinion until Peabody came out in 1918, with his determinations of the basal metabolism on fifty seven previously diagnosed hyperthyroid cases. (36), He found that fifty two had a basal metabolism below the ten percent range above which is allowed for normal, and that fifty four were below the fifteen percent above normal range. Peabody's final conclusion on this subject was that all of these patients had a normal metabolic rate. According to him these observations eliminates the possibility that hyperthyroidism is the cause of neurocirculatory asthenia. If such would have been the case there would been an increase in rate.
Symptoms

The symptoms of this syndrome are quite definite. Da Costa's first description of these patients was so thorough that only modifications of the symptoms as described by him have been added. True the original symptoms have been elaborated on and the order of their occurrence changed to some extend. Nevertheless, the essence and significance of the symptoms, as described by him in 1871, serve as a basis of cardinal symptoms, as we have them today. Therefore, the symptoms as given here will first include the original description as given by Da Costa with a more elaborate discussion of the modifications and additional symptoms to follow.

Da Costa gave the following symptoms: (11),

1 Pulsitation usually comes on following exertion but not always. Sometimes the patient might be waken from a sound sleep, and cases have been reported where these attacks were worse at night and early morning. Fits of palpitation were not only associated with cardiac uneasiness and pain, but in some with headache dimness of vision, and giddiness. As a rule, the patient could not lie on his left side for fear of exciting fits of palpitation.

2 Cardiac or precordial pain is nearly always a constant symptom and often the first sign or symptom noticed by the patient. The chief location of the
pain was the lower part of the precordium, particularly near the apex. But it is not always limited to the region of the heart. It may be spoken of as shooting to the left axilla or passing down the left arm, or present under the left scapula. Friedlander and Freyhof consider pain as the most common symptom. (15)

3 Pulse is rapid varying from 100 to 140. In character it is small and easily compressible. It might or might not exhibit the abrupt or jerking character.

4 Respiration, according to Da Costa, is not disturbed much. The pulse respiratory ratio ranges from four to one to six to one.

5 Nervous disorders manifest themselves chiefly by headache, giddiness, disturbed sleep, and other symptoms which, though common, are not so constant as the ones mentioned.

6 Headache is not apt to be persistent, but to occur in spells, and is generally of a dull heavy character. It is more particularly noted after severe attacks of palpitation and might be associated with giddiness, and with increased heat and redness of the face. Dizziness is often complained of, and is increased by stooping or by exercise and sometimes precedes the attacks of palpitation.

7 Disturbance of the sympathetic nervous system as
shown by the presence in some cases of itching of the skin with excessive perspiration and sweating of the hands.

Digestive disorders are frequently found, and Da Costa from his analysis concluded that great abdominal distension and diarrhea were symptoms constantly encountered. Friedlander in his series of fifty cases found that the incidence of gastrointestinal disorder was present in nearly fifty percent of the cases. (15).

White gave as the three cardinal symptoms the following: (46),

1 Palpitation is for the most part but the keen consciousness of the forcible action of the heart beating rapidly. Arrhythmia occurs but is uncommon, but when premature beats or paroxysms of tachycardia do appear they usually aggravate the condition considerably.

2 Precordial pain, as White described it is a dull or heavy ache as a rule, lasting for hours and not radiating, but occasionally it is interspersed with sharp stabbing sensations.

3 Dyspnoea was found to be of more importance by White. Breathlessness is mostly subjective, there being an unpleasant consciousness of the ordinary respiratory act without much of any evident labour, distress, or
rapidity of respiration. Sometimes, however, there 
is a tachypnoea, and during the world war cases were 
noted with an extreme but temporary acceleration of 
respiratory rate, even to one hundred to more per 
minute. An interesting and commonly associated pheno-
menon is the abnormal increase of a tendency to sigh. 
In fact the presence of abnormally frequent sighing 
is a helpful sign when attempting to diagnose neuro-
circulatory asthenia from organic heart disease, for 
the heart disease even in the presence of cardiac fail-
ure is rarely attended by sighing unless it is comp-
licated by neurocirculatory asthenia.

Thomas Lewis, in his very extensive studies on this 
subject during and after the world war, gave the following, 
symptoms given in their order of frequency: (18), (23), (49),

1 Breathlessness which is provoked in an exaggerated 
degree by exertion.

2 Pain which varies in degree from a precordial discom-
fort to pain of anginal distribution and is associ-
ated with exercise.

3 Exhaustion which is provoked by exertion

4 Giddiness and fainting which is quite frequent and 
may come on at any time.

The above symptoms are the cardinal symptoms as given 
by Thomas Lewis. They may be accepted as the most recent 
and authentic list known on this subject to day. However,
it must not be forgot that other men were just as essential in completing this list as Lewis. Lewis just extended his investigations a little farther, and because of his predecessors was able to profit by their mistakes. Consequently this whole matter only refers back to the beginning of this discussion where it was stated that recent experimenters were only successful in modifying and adding a few remarks to the original findings of Da Costa's.

Besides the cardinal symptoms as given above Lewis makes mention of several less common ones which were found occurring only occasionally. These symptoms are as given:

1) Palpitation
2) Headache which was usually frontal
3) Lassitude
4) Coldness or sweating of the extremities
5) Irritability of temper, sleeplessness, inability to fix attention, shakiness, and flushing.
6) Stuffiness of the throat
7) Unpleasant dreams
8) Disturbance of speech and voice

The laboratory findings of Mrs Briscoe(18), showed that out of ninety three leucocytes counts made on thirty four patients that the average total leucocyte count was 12000, cells per cmm., the lowest being 6,800, and the highest 10,400. She noted that there was a considerable leucocytosis, the degree of which depended on the amount of exercise taken be-
fore count was made. The average count in the controls was found to be 7,400, in which the lowest was 5000, and the highest 10,400. Mrs. Briscoe further noted that in thirty eight counts made among rested patients the average was 10,600, while in thirty counts among patients who were up an about the average was 12,700. In seventeen counts immediately after a staircase excercise the average in healthy persons was only 1100, more. To show the response of the white count to exercise in patients and controls, Mrs. Briscoe gives the following figures:

<table>
<thead>
<tr>
<th></th>
<th>Thirteen patients</th>
<th>Seven controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before exercise</td>
<td>11,535</td>
<td>7,100</td>
</tr>
<tr>
<td>After</td>
<td>15,400</td>
<td>8,200</td>
</tr>
<tr>
<td>One hour later</td>
<td>11,150</td>
<td>7,457</td>
</tr>
</tbody>
</table>

The differential count showed a diurnal variation greater in patients than in controls and also a higher lymphocytic count in patients. The polymorphonuclear count was lower in patients than in controls. In ninety three out of two hundred and thirty five patients the polynuclear count was below fifty percent, whereas in controls the polynuclear count was only below fifty percent in one out of seventy cases.

From the bacteriological standpoint Mr. Briscoe in her first series of experiments reported positive blood culture in a greater share of the cases. Not being satisfied with the results she set out again to perform like experiments, and out of ninety six observations on forty three cases
she was able to get no positive growth. From these series of experiments she was able to conclude that bacteriemia does not play a demonstrable part in the pathology of the disease, and credited the findings in her first series of observations as due to faulty technique.

Mrs Briscoe(3), found that the urine in these patients is reduced from 20 - 60 percent. In sixty percent of cases the urine of the patients showed an increase acidity and in twenty percent deposits of phosphates were demonstrated.

The latest symptom of importance is that of hyperesthesia over the precordia and may even extend to the left shoulder (31). It is similar to the hyperalgesia found in angina pectoris. (27),
Physical Signs

Da Costa found, in his examination of these patients, that the impulse was almost always extended, yet not corresponding forcible, but rather it was quick, and abrupt or jerky. (11). When the hand was applied to the precordial region it could detect the quick impulse happening in a regular manner, or it would take cognizance of the irregularity of the rhythm of the irritable heart. The two sounds might be perceived by the hand, and on listening to these sounds the first may be lacking in volume and is feeble and short.

Sometimes the sounds of the heart are split and cases where the first sound was thought to be doubled was later found to be split. However, even where the rhythm of the sounds is normal there may be other modifications. (11). Thus the first may be dull and not deficient, but there is no cardiac enlargement. The sounds may be dull and heavy. The impulse may be rather forcible, but on percussion of the heart no hypertrophy is demonstrable. Murmurs obscuring or replacing the cardiac sounds are not as a rule present; yet they are met with, and are particularly systolic being located above the apex, but in no way are they connected with the venous hum or other signs of anemia.

Lewis finds that a number of these patients are often undersized or present long, narrow, or flat chest. (22), Many show signs of nervous instability as evidenced by the quickness of emotional responses and irritability. Coldness
of the hands and feet, and free sweating of these and of the 
axillae is common. The most significant signs are found in 
response of respiration and of the cardiovascular system to 
exercise. At absolute rest in bed and during sleep the res-
piratory rate is normal, but a simple hopping test deepens 
the excursion and raises the rate, according to the severity 
of the condition, to between 30 to 70, per minute, (26). 
In normal individuals of the same age the respiratory respon-
se to this test is scarcely noticeable.

Lewis further observed that the heart rate was affect-
ed very definitely. (18). He found that when the patients 
were completely rested the average heart rate would be about 
eighty five per minute and that the rate would be normal in 
sleep. In patients that were up and around the average rate 
would be higher being from 90 to 100, per minute. Concluding 
from this Lewis states, that the nearer the patients were 
to complete rest the closer to normal would be their heart 
beat. On exercise he found that the average heart rate of 
the patients would be from 20 to 30 beats higher than the con-
trol when only about one fourth to one sixth the amount of 
work was done. He also noted that it took the patients a 
much longer time to again get back to normal.

Roby and Boas working together bought out more emphat-
ically the findings of Lewis. (38). In all their cases the 
pulse rate was taken every day before the exercise, imme-
diately afterwards, and two to four minutes after. Usually the
pulse rate was accelerated, out of all proportion to the exercise, and does not drop to normal in four, or even in ten minutes. However, at times they found that the pulse would become slower after exercise, or that it might first slow then become rapid.

Cotton, working in association with Rapport and Lewis in behalf of the Royal Medical Research Committee during the war, noted in his studies of a large number of men the following response to a given amount of work: (7),

1. The pulse rate rises much higher than in controls, and the high rate is longer sustained,
2. The blood pressure rises higher and the raised pressure is longer sustained than in controls,
3. The summit of the blood pressure is not delayed.

By permitting these patients to go through a series of walking test, Meakins and Gunson found that their pulse rate varies out of proportion to the extent of the exercise. The exercise consisted of allowing the patients and controls to walk seventy five paces and then climb up twenty seven steps. (29), Their observations on fifty two cases showed that the pulse rate increased to an average of 132, per minute immediately after exercise and that the pulse rate of thirty cases returned to their previous normal in one minute and the others it took more than a minute. These men further noted that the degree of effort in response to exercise was greater in those patients whose pulse rate did not return to normal within a minute.
Parkinson made the same observations by recording the pulse rate on standing and on slight exertion. (34). He found that an increase in pulse rate of ten was registered by the control when they moved from a sitting to a standing position. And an increase of sixteen occurred when the patients went through the same procedure. On exertion the control showed an increase of eleven beats over the number registered when standing. Whereas the patient showed an increase of seventeen over the former position. A longer period elapsed before the normal rate was retained in the patient than in the control.

Blood pressure is another variable sign in these cases as proved by Roby and Boas and others. These two men in their study of the blood pressure of some four hundred and sixty-five cases of neurocirculatory patients in the period during and following the world war found that when the patient is up and about the systolic blood pressure is high, usually between 135 and 170. The diastolic pressure is generally normal. After exercise, however, the systolic pressure rises greatly and the diastolic drops. According to these men a frequent feature is the persistence and loudness of the fourth sound heard with the stethoscope when taking the blood pressure. Often a loud fourth sound can be heard down to the zero mark, and as a result makes the estimation of the diastolic pressure difficult at times. (38) & (12).
Barringer in his study of these patients in 1918, (2), noted that by means of blood pressure readings taken thirty, sixty and ninety seconds after a measured exercise that when the exercise overtaxes the reserve power of the heart there is a delay in rise of the systolic pressure after the exercise. He, therefore, concluded that patients with effort syndrome have a decrease in cardiac reserve power. (37) & (29).

As an illustration Barringer gave the following figures:

<table>
<thead>
<tr>
<th>Systolic</th>
<th>Diastolic</th>
<th>Systolic</th>
<th>Diastolic</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>155</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>16</td>
<td>135</td>
<td>65</td>
<td>165</td>
</tr>
<tr>
<td>17</td>
<td>145</td>
<td>65</td>
<td>185</td>
</tr>
<tr>
<td>43</td>
<td>150</td>
<td>90</td>
<td>170</td>
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<tr>
<td>44</td>
<td>140</td>
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<td>154</td>
</tr>
<tr>
<td>45</td>
<td>140</td>
<td>80</td>
<td>184</td>
</tr>
<tr>
<td>61</td>
<td>154</td>
<td>100</td>
<td>165</td>
</tr>
<tr>
<td>62</td>
<td>120</td>
<td>80</td>
<td>138</td>
</tr>
</tbody>
</table>

Probably the greatest problem of all in a study of this condition, is the determination of the efficiency of the heart and whether organic pathology is present. Austin Flint, in his work on such patients during the civil war, attempted to answer and possibly settle this question. (13) Flint divided his findings according to those found on percussion, palpation, and auscultation. (1).

On percussion one can show whether or not the heart is
enlarged, absence of which is evidence that the disorder is purely functional. By palpation it is found that in a functional disorder of the heart that the beat is quick and violent giving a sensation of a shock or blow. It is also possible to determine the position of the apex beat and whether a thrill is associated.

Auscultation furnishes important information first, negative by showing the absence of adventitious sounds and second positively, by showing that the natural sounds preserve their essential characters and normal relations to each other. A systolic murmur may be present, and by auscultation one can differentiate an inorganic from an organic murmur in the following way:

1. An inorganic murmur is always systolic and rarely rough in quality.

2. Assuming that the murmur is located at the base of the heart it may be referred to the aorta or pulmonic artery, or both; if the latter this fact renders its inorganic character almost certain provided valvular lesions are excluded.

3. An organic murmur, on the other hand, may be diastolic or systolic and diastolic combined. It is often rough and sometimes musical being referred to the aortic orifice occasionally.

The heart sounds in cases of functional disorder are intensified in proportion to the increased force of the
heart's action. Their intensity is often such that they are perceived by the patient with great distinction, especially at night. The valvular element of the first sound is in sound cases unusually marked. There are two reasons for this:

1. In the first place it is due to the force and quickness of the ventricular contractions.

2. And in the second place to the comparatively small quantity of blood within the ventricles at the time of ventricular systole.

The integrity of the heart sounds, the normal relative intensity of the aortic and pulmonic second sound, and of the mitral and tricuspid element of the first sound, constitute important evidence in cases of disturbed action of the heart. The apex beat, or systolic sound of the heart, is sometimes accompanied by ringing intonation called Laennex metallic tinnitus.

Additional auscultatory sounds which are or may be present in cases of effort syndrome were noted by King in his examination of some five hundred soldiers in 1918. His findings in these cases however did not, as he concluded, have any relationship to this disease. He based his conclusion on the fact that similar findings are found in about the same percentage in healthy individuals, and further stated that the majority of sounds were merely extraneous being due to changes in posture and respiration. Nevertheless King thought it best to keep the following findings in mind on auscultation of a suspected irritable heart
patient, for it helped considerably in arriving at a final diagnosis. Some of these findings are:

1. A third heart sound
2. Reduplication of the first sound at the apex
3. A systolic apical click
4. Heart sounds at the left sternal border
5. Systolic apical murmur in the recumbent posture
6. Cardiorespiratory murmur limited to inspiration
7. Cardiorespiratory murmurs heard in both inspiration and expiration
8. Systolic murmurs at the base of the heart
9. Cardiorespiratory diastolic murmurs
10. Extrasystoles
11. Reduplication of the second sound at the pulmonic area

Electrocardiographically the P-R. interval in these cases is found to be shortened. This finding is true in those patients who have had rheumatic fever, and those who are a severe type of neurocirculatory asthenia. It has likewise been shown that it is unusual for these patients to have a heart block. (35).

Clinically enlargement of the heart might seem to be present for the reason that a visible pulsation is commonly noticed in two or more intercostal spaces. Such an extension of the impulse may or may not be associated with increase force of the beat. The presence of extraneous sounds and
the prominence or breathlessness all tend to lend evidence
toward cardiac enlargement. (19),

The reverse of such expected findings are true however
as proved by Meakins and Gunson in their orthodiagraphic
observations upon irritable heart patients during and after
the world war. (25), These results, which are at present ac­
cepted as an explanation of cardiac size in these patients,
is given below:

1 The heart in cases of so called irritable heart
is on the average somewhat smaller than normal.

2 In cases with a diffuse apical impulse no enlarge­
ment is shown by the orthodiaphograph. On the contrary
the average measurement is smaller than normal, in
the same proportion as in those who do not exhibit
this sign.

3 When such cases rest in bed there is an average in­
crease in the transverse diameter of heart of 0.7cm.

4 After strenuous exercise in cases having no material
symptoms there is a decrease of one centimeter in the
size of the heart, while in cases showing consp­
icuous symptoms there is, on the average, no appre­
ciable change in the size of the heart.

Since orthodiaphographic examination does not show any en­
largement in the size of the heart it is generally accepted
as being the case, for thereason that this method is the
most accurate means of determining its shape, size and,
contour.
Diagnosis

The diagnosis of such a syndrome is quite easily made provided certain rules and limitations are kept in mind. The greatest problem of all is to differentiate between functional and organic heart disease. However, if one has both conditions in mind when examining a suspected patient, and when the symptoms and physical signs of each are accounted for no particular trouble should be encountered. Methods of differentiating between and organic heart trouble will be the prime consideration of this resume on diagnosis.

Back in 1855, Dr. Stokes published the points of differential diagnosis between nervous excitement of the heart and hypertrophy. Dr. Stokes, basing his works on Dr. Corrigan's experiments, concluded that the following points of diagnosis were important:

1. An impulse which is forciful and increased but still located in the normal position is indicative of nervous excitement, and as a result rules out cardiac hypertrophy, for the reason that he has never seen a case of post morten hypertrophy of the heart where the apex was not out of place.

2. The force of the heart as elicited over the apex is greater than the same force found at the pulse. This disproportion, as to force, between the impulse at the side and at the wrist is of great diagnostic value. But the mechanism of such derangement has
not been satisfactorily explained even though numer- ous theories have been introduced.

Da Costa listed, true heart disease, thyrotoxicosis, in- fections, anemia, and malingerers as the most important dis- eases to be differentiated from this condition of neurocircu- latory asthenia. These conditions are discussed as follow- ing: (11),

a From true heart disease by the absence in neuro- circulatory asthenia of:
   1 Cardiac enlargement
   2 Characteristic murmur of valvular disease
   3 Of hypertension
   4 Of angina pectoris
   5 Of signs of heart failure
   6 And of abnormalities of roentgen ray shadow and electrocardiogram indicates at once that neuro- circulatory asthenia is responsible for symptoms.

b From thyrotoxicosis by the absence of:
   1 Exophthalmos
   2 Thyroid gland enlargement
   3 High basal metabolic rate

c From infections by the absence of:
   1 Fever or other evidence of infections

d From anemia by the following:
   1 By history
   2 Anemic heart shows or has a murmur at the base
Presence of venous hum

By the general aspect of the patient

Absence of cardiac pain in anemic heart

From malingerers

They know nothing about the character of cardiac pain.

By making them lie down after undressing causes the heart to return to its natural beat, and then on his resuming the erect position, or walking around quietly, it will not as the irritable heart does regain its former frequency or irregular rhythm.

Typical physical signs are lacking.

Da Costa also gave as positive diagnostic signs of effort syndrome the following: (11),

If patient responds to treatment is diagnostic of effort syndrome.

Don't depend too much on signs of hypertrophy at first for these might be due merely to an engorgement of the vessels and heart.

Don't confuse blowing sounds due to excitement and exertion with true murmurs due to organic valvular trouble.

Dilatation of the heart may be diagnosed through percussion, palpation, and auscultation the findings of which have been given under physical signs.
It is also possible to detect irritable heart patients before they are drafted into service by noting the following signs and symptoms: (45),

1. First taking a careful history, paying particular attention to previous attacks of dizziness or fainting, exhaustion, precordial pain and pounding of the heart on the least exertion.

2. By noting the unusual physical response to the hopping exercise.

3. The increase of pulse rate which was out of proportion to the exercise.

Paul D. White, after examining many patients in private practice and civil life, concluded that in order to differentiate cardiac failure from effort syndrome the following observations should be made: (48),

1. Determine if heart is enlarged.
2. " whether systolic murmur is evident.
3. " whether diastolic murmur is present.
4. Presence of arrhythmia must be looked for.
5. Whether veins in the neck are congested.
6. Presence of enlarged liver and edema of feet and legs.
7. Whether cyanosis is present.

White emphasized that it was possible for a condition of heart failure and effort syndrome to be associated, and warned the medical profession against the too often made mistake of failing to diagnose this double syndrome. Merely
because the patients shows symptoms of effort syndrome doesn't rule out cardiac disease. Provided one of these positive findings are present one should be very suspicious of organic disease and devote alot of attention in an attempt to rule it out or definitely find such pathology.

White summarized his opinion as to differential diagnosis of effort syndrome and cardiac as following:

1. Cardiac failure is diagnosed if in the presence of diastolic murmur, cardiac enlargement, and a history of rheumatic fever.

2. While a diagnosis of effort syndrome is accepted when the absence of the above findings is evident in association with nervous symptoms.
TREATMENT

White recommends that the patient's situation be explained to him, and to take the patient wholly into your confidence by discussing seriously the condition with him. It is just as wrong to regard the whole trouble as negligible or imaginary, as it so often done, as it is to regard it as a dangerous or serious state which may threaten life and which demands rest in bed. Equally wrong and pernicious are the two extremes of the diagnosis that of myocarditis or cardiac insufficiency and no disease or imaginary trouble. (46)

A careless disregard of the disorder with hasty reassurance may make as much of a permanent cripple of the patient as the strict order to go to bed and take digitalis does. (46) & (24). A half an hour or an hour spent in explaining the situation will save many months of invalid existence and hundreds of dollars spent for all kinds of doctors and medicine none of which did any good for the patient.

Help the patient draw up his program and emphasize the importance of routine. Warn him against doing heavy work and keeping late hours. Forbid the use of alcohol, tobacco, coffee and tea. Take him under your control and make him see the case as you do, emphasizing always that it is for his good, and that it is the only chance he has of living a happy life. (46).

Symptomatic therapy for headache, insomnia, or extreme nervousness with bromides or hypnotics may be helpful but
should be discontinued as soon as possible. Digitalis usually makes the condition worse by increasing the force of the heart action or by producing toxic symptoms like anorexia. (46),

Da Costa used digitalis and found that it made no difference whether digitalis or its active principle was used, for each had the same affect on the heart. He found that digitalis lowered the pulse and gradually lead to permanent improvement. He was accustomed to giving ten drops three times a day of the tincture or from one sixtieth to one thirdieth grain of the digitaline t.i.d. These amounts were continued with slight intermissions from weeks to several months. (11),

Recent experiments, however, on the effects produced by digitalis on irritable heart patients have been run by Parkinson. (33), By running the patients through a course of exercises and noting the effect that digitalis had on the pulse rate and blood pressure, Parkinson concluded that digitalis scarcely influences these patients. These findings conflict with those of Da Costa, but additional experiments have proved that Parkinson's findings were valid and as a result digitalis is not considered at present of any use in these cases.

Da Costa also recommended aconite given in doses of one sixtieth to one thirdieth grain, and when used in conjunction with digitalis it reduced the forcible contraction of
the heart and was used for that purpose mainly. \(^{11}\), Veratum viride was used, and had a similar quieting effect as digitalis but was not as efficient for the reason that its effect was not as lasting. Belladonna and atropine given in variable amounts and doses was seen to help restore the normal rhythm of the heart. This drug was exceedingly valuable when given in conjunction with digitalis or when following digitalis. Opium was used with remarkable improvement in some cases, but was used with much precaution because of its habitual tendency. Additional drugs such as hyoscyamus, cannabis, indica, valerian, ergot, and the bromides were used the affects of which were mostly quieting but not permanent.

Neuhof treatment which he uses in general practice consists of an attempt to assure the patient that his condition is not as serious as he supposes. \(^{30}\), Rest and similar agencies given above are also recommended by him. Medicinally, however, Neuhof uses mixed bromides and suprarenal gland extracts and gives them as following: He gives one gram of mixed bromides well diluted in water three times a day after meals. Depending upon the progress of the case, the dose is correspondingly diminished and stopped. In cases that are annoyed by sleeplessness he adds ten grains of chloral hydrate or eight grains of veronal every night for a few days. He advocated the use of suprarenal gland extract given in five grain tablets only when symptomsof tachycardia or precordial distress becomes annoying.
One of the most successful methods of treatment used in the army was that of graded exercises. Men were examined and graded according to their tolerance to exercise. They were grouped according to their physical ability as mentioned elsewhere under physical signs. Those that were unfit were not allowed to continue in service. While those who showed only temporary symptoms, due to this syndrome, were classified and given graded exercises. By the following a set of graded exercises these patient's tolerance was slowly built up until they were again of normal physical condition. The system of exercises used were those purposed by Thomas Lewis. These consisted of a series of drills termed B.15, B.C. 30, C. 15, C.30, and D. 30. The letter indicating the stiffness of the exercise, and the number the duration of the drill in minutes. (21) & (28), B. 15, consists of simple movements, and calls for no considerable expenditure of energy; whereas D. 30, includes many of the stiffest exercises of the army exercise book and entails thirty minutes of hard work.

All those cases to whom drills are prescribed start on the easiest drill and progress from this to those of higher grades, according to their tolerance. (21), A few days or a week upon the two fifteen minutes drills suffices. A week is usually spent on each of the three thirty minute drills. Men who promise well may be kept a week or so longer on the highest grades of drill to harden them. All men on exercises C. 15, and B. 30, go regularly for route marches
in the early afternoon. These are short marches of one or two miles at a slow time. Men in classes C. 30, and D. 30, are taken for longer marches of four to five miles at a brisk pace. The exercises and marches are supplemented by outdoor games. At suitable intervals all men are examined as they come from drills or marches. Those men who feel the drill and fatigue easily are instructed to report to the medical officer at once. The results of such treatment are given by Lewis and Da Costa in the section of this paper dealing with course and prognosis.

Although no set of exercises, such as these given, have been advocated seriously for use in peace on civilians, it is only reasonable to assume that such gradation can be made to a great advantage, and probably are being used although nothing definite as to specificity has been published. (18), It must be carried in mind, however, that such cases exist in our daily life and that these must be recognized and treated as accurately as those found in war times.
Course and Prognosis

According to Da Costa this condition may gradually subside or it may pass by degrees of progress into cardiac enlargement. Whether or not they pass over to cardiac enlargement depends a great deal on the treatment. However, some cases show cardiac enlargement even though they were treated to the best of one's knowledge. The manifestations of cardiac hypertrophy are:

1 The impulse is extended
2 The first sound lengthens, its valvular character disappears and so does the great distinctness of the second sound.
3 The action of the heart becomes gradually slower, pulse fuller, the cardiac pain lessens, and the respiration bears a more natural proportion to the still excited action, but the breathing is more persistently oppressed.
4 The percussion note at first is still doubtful, but gradually the boundaries become markedly extended.(11)

Recent investigators have disproved Da Costa's idea of cardiac hypertrophy in effort syndrome, and it is the general opinion of the profession to day that organic pathology doesn't occur. The importance of Da Costa's findings, however, lies in the fact that there is a possibility that cardiac hypertrophy might be superimposed on a neurocirculatory asthenic patient. Credit, therefore, for this conclusion
must be given to Da Costa and always guarded against by the profession.

Da Costa investigated and published the results of two hundred cases of soldiers who were diagnosed as having effort syndrome. His results are tabulated as following: (11),

<table>
<thead>
<tr>
<th>Results</th>
<th>Cases</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Returned to regiment</td>
<td>76</td>
<td>38</td>
</tr>
<tr>
<td>Detailed for other service</td>
<td>13</td>
<td>6.5</td>
</tr>
<tr>
<td>Time expired</td>
<td>11</td>
<td>5.5</td>
</tr>
<tr>
<td>Uncertain</td>
<td>63</td>
<td>31.5</td>
</tr>
<tr>
<td>Veteran Reserve 1</td>
<td>18</td>
<td>9</td>
</tr>
<tr>
<td>Veteran Reserve II</td>
<td>5</td>
<td>2.5</td>
</tr>
<tr>
<td>Discharged</td>
<td>14</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>200</td>
<td>100</td>
</tr>
</tbody>
</table>

The seventy six who returned to their regiment did so for the most part only after they had done guard duty for sometime, and had been thoroughly tested. The thirteen who were detailed for other services, as clerks, orderlies, etc., were chiefly such who, for some ailment besides the cardiac malady, were judged unfit for field work. Of the eleven whose time expired about one half would have been sent back to their regiments, and in the same proportion would probably have been the disposition of the sixty three marked uncertain results. In the veteran reserve those men who where partly incapacitated were given light work in the garrison, but not in the field. While those who were dis-
charged were cases who it was certain wouldn't be of any service to the regiments again.

In an attempt to determine the immediate prognosis of neurocirculatory asthenic patients, Grant made a study of six hundred and one cases. His works, which covered a period of five years to complete, were published in 1925. (16). Of these cases 15.3 percent recovered entirely, 17.8 percent improved, 56.2 percent remained stationary, and only 2.2 percent became worse. The incidence of serious disease in the group was 8.7 percent; the most frequent infection was pulmonary tuberculosis which constituted 3.7 percent. The incidence of definite heart disease was only one percent. So far as is known there is no tendency for cases of neurocirculatory asthenia either to die or to develop organic heart disease. There is, however, a distinct tendency for them to live partially crippled lives.

Grant further concluded that the general prognosis is to some extent modified by age and tolerance of exercise. (16) For example it was found that the general prognosis is better, the younger the patient. Grant illustrated this by stating that the soldiers between the ages of seventeen and twenty had a percentage of recovery of 25 percent and an incidence of disease of 2.9 percent. Those between the ages of forty one and fifty had a corresponding figure of 2.1 and 16.7 respectively.
Prognosis is adversely affected by the presence of certain abnormal physical signs in the chest, particularly with regard to the incidence of pulmonary tuberculosis, which is 8.8 percent as compared with 2.9 percent in the absence of such signs. (16) It is considered, however, that the practical importance of these signs lies rather in diagnosis, and that such cases should be treated preferably as cases of actual pulmonary tuberculosis which in many cases is probably an unrecognized cause of the symptoms.

Grant, in his more extensive studies, found that the incidence of definite cardiac disease for the whole group during the period of five years is no more than one percent. It is felt that incipient cardiac disease cannot be regarded as the underlying cause of the effort syndrome in anything but a negligible proportion of the cases. In concluding his publication, Grant stated that there is no material difference in the development of cardiac disease or in general health between those patients whose cardio physical signs were normal and those who presented such signs as apical or basal systolic murmurs, a diffuse apex beat or extrasystole. It is felt that whatever diagnostic significance be attached to these cardio physical signs, they may be neglected at arriving at a prognosis, and that their chief value lies in directing attention to the cardiovascular system for the detection of other and more definite signs of the disease.
Thomas Lewis found that extension of the impulse in a patient was without value in these patients. Out of two hundred and thirty patients in whom the apex beat was normal one hundred and forty two or sixty one percent returned to duty, and of eighty six patients in whom the impulse was diffuse fifty one or sixty percent returned to duty. He also proved that out of forty six patients in whom the thrust was either forcible or forcible and diffuse twenty of forty three percent returned to duty. (18), Thus proving that a forcible heart beat had no prognostic value.

The course of neurocirculatory asthenia is a very variable one, but the prognosis is always good so far as length of life is concerned. The degree of incapacity depends on several factors but chiefly on the intensity of symptoms and adequacy of treatment. Recovery from a considerable degree of neurocirculatory instability is possible with care, but the patient is always liable to a return of trouble if there is a return of the causative factors. (46),

Of five hundred soldiers with this condition, reported by Lewis during the world war, two hundred and eighty six or fifty one percent were found to be unfit for all military service, and of the remaining two hundred and seventy two thirty eight had to be removed later. In civilian life complete incapacity is much less frequent for two reasons, one of
which is due to the degree of neurocirculatory asthenia which is less marked in civilians, and the other reason is that the strain of civilian life and the work to which the patient must return is less than that of military service. (19),
Case Reports

Six case histories will be given in all. Three of these will be taken from patients reported during the civil war, and three from patients studied during the world war.

Case 1

Patient was a soldier having done hard field service for a year. He entered the hospital complaining of:

1. Diarrhea
2. Precordial pain which was very severe sometimes causing him to throw himself down on the ground in agony
3. Dimness of vision and giddiness
4. Breathlessness on the slightest exertion
5. Palpitation

Physical signs:

1. Pulse was 96 going to 115, on exercise
2. Impulse extended and irregular
3. First heart sound feeble and the second very distinct

Treatment:

1. Rest, digitalis, and acronite

Course, Patient became better and returned to duty in six months. (11)

Case 11

Patient a soldier entered the hospital because of:

1. Breathlessness
2. Palpitation
3 Precordial pain
4 Giddiness and inability to concentrate

Physical signs:
1 Very nervous man
2 Pulse 112, irregular and extended
3 First sound was sharp and short
4 Cardiac diameter normal
5 Blood pressure showed a high systolic but a comparatively low diastolic
6 Apex beat forcible and diffuse

Treatment: rest, digitalis and acronite

Course: Returned to active duty in eight months (11)

Case 111

Patient sent to base hospital because of:

Precordial pain
2 Breathlessness
3 Palpitation
4 Flushing of face on exertion
5 Giddiness
6 Weakness

Physical signs:
1 Pulse 84, forcible with only a moderate jerk
2 Apex beat abrupt
3 First sound ill developed
4 Second sound distinct

Treatment: Digitaline and rest
Course: Patient was seen five years later and gave some of the same symptoms. (11)

Case IV

Symptoms and history:

This man was sent to the hospital with the diagnosis of chronic endocarditis. He had never had rheumatism, scarlet fever, tonsillitis, or venereal disease. He says he was never ill before he had his present trouble. While in the army in 1918, he was gassed, and every since that time he has had dizzy spells, fainting attacks, weakness, and short stabbing pains around his heart. He is very nervous, so much so that at times he cannot hold a pen in his hand on account of tremor. He sleeps lightly and the least little thing awaken him. (49),

Physical signs:

At the time of examination the patient looked apprehensive. His face was flushed. His knee jerks were very lively and his extended fingers showed a marked tremor. His pulse rate in a standing position was 130, sitting 106, and in the prone position 86. After fifty hops his face and neck became very flushed, and he felt giddy and fell over. Auscultation showed a short systolic murmur at the apex, not masking the first sound. The heart was not enlarged. The final diagnosis was effort syndrome.
Case V:

This man was sent to the hospital with a diagnosis of a valvular heart disease. History of diseases was negative.

Symptoms:

1. Pain around the heart
2. Shortness of breath
3. General weakness especially when he walked a lot
4. Nervousness
5. Palpitation especially noticeable when lying on the left side
6. Dizziness, sometimes when he arises from a chair everything becomes blurred
7. Sweating of hands and feet
8. Trembling

Physical examination:

1. His face was flushed and had an apprehensive expression
2. Knee jerks were lively
3. Tremor
4. Nervous and fidgety
5. Pulse was 104, with marked respiratory sinus arrhythmia
6. Auscultation showed asystolic murmur that did not masked the first sound.
7. No diastolic murmur was brought out
Case VI:

Patient entered the hospital with an admission diagnosis of valvular heart disease.

Symptoms:

1. Dizzy spells
2. Tired feeling all the time
3. Palpitation
4. Breathlessness
5. Precordial pains
6. Nervousness
7. Easily excited

Physical examination:

1. Pulse on examination was 160, at first but went down to 116, near the end of the examination
2. Knee jerks lively
3. Tremor
4. Systolic blood pressure 156, at first later 148, and at the end of the examination 142.
5. Short systolic murmur not masking the first sound.
6. No diastolic murmur heard
7. Heart not enlarged

Diagnosis: Effort syndrome
In concluding this paper, I think that it would be appropriate to include the following summary of the findings as they are discussed under the various headings:

1. By reviewing the history it was discovered that this syndrome has existed through out all ages, but it has only been since the civil war that any particular attention has been given to it.

2. In regard to the etiology it can only be said that definite predisposing factors seem to throw a strain on one's constitution, and after a period of a few months or years the heart becomes sensitive to it.

3. The symptoms of this disease are quite well defined. The five most important being breathlessness, palpitation, precordial pain, exhaustion, and nervousness.

4. The physical signs are mostly significant because of the absence of any form of cardiac enlargement when the above symptoms are associated. The increase pulse rate in response to exercise associated with high systolic and low diastolic blood pressure are likewise typical.

5. The diagnosis of this condition is easily made. The chief difficulty is to determine whether an organic or functional disease exists. This differentiation can be determined from the symptoms and physical signs.
6 The present treatment consists mainly of rest and a graded form of exercises. Such form of treatment must be associated with psychotherapy in which no mention of a possible heart disease should be made.

7 Provided adequate treatment is followed the patient will greatly improve with in a period of six to eight months. A complete cure is possible after this time.
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