THE HEART DISORDERS OF SOLDIERS—AN ANALYSIS OF ONE THOUSAND CASES.

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Among the numerous morbid conditions arising as a result of the stress and strain of warfare, one is not surprised to find that cardiac disturbances are fully represented.

The theme of this paper is a brief review of the heart disturbances directly associated with and caused by the active service conditions which nowadays exist, and though dealing mainly with disorders definitely traceable to some such condition, one must not forget the large number of cases in which it is quite clear that military service has but precipitated some pre-existing debility which may or may not have caused symptoms during civilian life.

There are, in fact, two main groups:—
(I) That in which the condition is clearly originated by some agency during military service, and
(II) That in which evidence exists of disease being present before enlistment.

The basis of the present paper consists of 1,000 consecutive cases of patients transferred from their units because of some heart debility, and of this number it is found that 614 belong to Group I, and the remaining 386 to Group II.

The nomenclature at present applied to the vast majority of all these cases is simple; they are massed under one heading, the all-embracing group "Disordered Action of the Heart" (D.A.H.), a title in itself singularly unfortunate, in that it is certainly unscientific, and, in addition, often quite inaccurate.

The full equivalent of the abbreviation is rapidly grasped by the patients and, firmly backed by the lay opinion, they become convinced that their condition is serious, and that their ultimate cure can only be compassed by months, and possibly years, of careful rest and treatment. The early interpretation of the term is, however, not its sole drawback by any means; it is also unfortunate in that it is extravagantly elastic, applicable equally to the trivial and the serious cases. Hence we find the same name applied to all cases, irrespective of the gravity of the condition. For instance, the harmless irregularity which depends upon the respiratory phases, the occasional occurrence of a premature beat, the tachycardia of anaemia or emotion, and other states equally unimportant, are grouped, from the very earliest stages, with really genuine disease, such as valvular mischief, infective processes of various kinds, and auricular fibrillation.

It is commonly accepted, and with perfect reason, that progress towards
recovery is largely influenced by the mental attitude of the patient, and it is quite obvious that the herding of the mild and trivial with the serious can only be prejudicial to the rate of recovery of the former.

The D.A.H. problem, from the nomenclature point of view, is an extremely difficult one, therefore, and very much more serious than may at first sight appear. High as has been the toll of the wastage from heart disorders of all warfare in the past, one is inclined to think that, in view of certain modern agencies which science has evolved and adapted, all the deadly refinements and latest types of the weapons of slaughter which man-kind has chosen to utilize, the percentage loss from heart disease is higher than ever before in history. At the same time, however, as we acknowledge this statement, it is just noteworthy that we are able, in some measure, to qualify its significance. One consoling factor obtains, and it is that numerous are the cases sent down from their units labelled "D.A.H." whose condition, primarily, is certainly not a cardiac one; in other words, the diagnosis is faulty. The heart, as for example in patients suffering from shell-shock and allied conditions, is more often than not very far from being the chief offender. It can, however, and does, give expression to such conditions in a variety of different ways, and if we remember that the heart is enabled, unlike some other organs, to publish with ease its varying objective phenomena, one is not surprised that physical signs, be they primary cardiac, or reflex in origin, tend usually to be attributed to the heart. In other words, numbers of cases are seen and labelled "D.A.H." in whom the cardiac phenomena are quite secondary to some other underlying state, and which, if subjected to closer investigation, would more correctly have been labelled in accordance with the primary source of the mischief.

It would in fact be distinctly more rational to delete the term "D.A.H." from our present vocabulary and substitute an entirely different method of diagnosis for these cases. Conditions primarily cardiac should be labelled as such if no doubt exists as to the diagnosis and evacuated under some one of the ordinarily accepted terms, preceded, if need be, by the abbreviation "N.Y.D." Should, however, the cardiac condition be secondary, the primary factor should be noted as the diagnosis and followed, if thought advisable, by the term "N.Y.D. C."

As an example we may consider an ordinary case of shell concussion. The nervous system is disorganized in varying degree and the heart frequently suffers some functional derangement, more likely than not of a fleeting character. It seems obvious that our present method of labelling such cases is unfortunate in that we brand them from the start with what turns out to be, an extremely treacherous title, in itself prejudicial to progress and recovery.

For this reason it is suggested that the wisest course to adopt is to adhere strictly to the primary cause when entering a diagnosis, whether it be shell concussion, trench fever, rheumatism, gas poisoning, or any
other well-known causative factor. These, and other maladies of a similar character, are frequently complicated, and possibly it may seem that the heart is the chief organ affected. Should this be so, the letter “C” (cardiac) should be added after the name of the primary disease; or, if the heart is only under suspicion, the term “N.Y.D. C.” might be used with advantage.

Adopting this method of nomenclature we should substitute diagnoses, as for example the following: Anaemia, “N.Y.D. C.”; rheumatism, “C.”; trench fever, N.Y.D. C.”; shell gas poisoning, “N.Y.D. C.” for the unfortunate and inappropriate term “D.A.H.” at present in vogue, and incidentally obviate in great measure the introspective element which tends to develop so rapidly.

Leaving now the question of diagnosis, it will be well to consider as shortly as possible the etiological question, and outline, under their respective headings, the different types of the condition from the point of view of causation. With this object in view the accompanying table is inserted:

<table>
<thead>
<tr>
<th>TABLE OF CASES ANALYSED ACCORDING TO ETIOLOGY.</th>
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</thead>
<tbody>
<tr>
<td>All admitted with the Diagnosis “D.A.H.” or “V.D.H.”</td>
</tr>
<tr>
<td>1. Post pyrexial (trench fever, P.U.O. influenza, etc.)</td>
</tr>
<tr>
<td>2. Gas poisoning</td>
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<tr>
<td>3. Heart disease (valvular, myocardial, etc.)</td>
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<tr>
<td>4. Langur cordis</td>
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<tr>
<td>5. Shell concussion</td>
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<tr>
<td>6. Rheumatic carditis</td>
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<tr>
<td>7. Resulting from previous disease: bronchitis, pneumonia, typhoid fever, dysentery, etc.</td>
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It sets out in tabular form a simple analysis of the cases, and by this method of grouping it becomes easier, not only to weigh up the significance of symptoms, but also to deal more satisfactorily with the question of prognosis.

Group I is entirely devoted to the cases in whom the affection arises as a direct result of trench fever, a disease unfortunately very prevalent, and one whose complications are extremely numerous. In spite, however, of the vast number of cases which daily present themselves, and of the researches which have been, and still continue to be, undertaken, the fact remains that the pathology of the disease continues uncertain. The organism is, as yet, not satisfactorily isolated, and the present state of our knowledge can shortly be summed up in that we strongly suspect the disease to be one of an infectious nature, and that the germ is conveyed and spread from man to man by the agency of the body louse. That such is the case can only be surmised for the present, but in the
meantime it is possible to state that, in common with other diseases of an infectious nature, trench fever can, and does, produce cardiac disturbances analogous with those resulting from the circulation in the cardiac muscle tissue of some specific organism or the toxin of such.

Happily, however, all cases of trench fever do not develop cardiac symptoms. It is but a small percentage, and one, moreover, capable of further reduction if adequate attention be paid to the early stages of the condition and the period of convalescence. This latter cannot be too strongly advised. Undue hurry is fraught with disaster later, and cases returned too soon to duty exhibit a very noteworthy proneness to cardiac debility in some shape or form, necessitating invaliding for a second and possibly very much protracted period.

Early symptoms indicating mischief in the heart muscle, though vague in their initial phases, begin, with very few exceptions, to make their appearance before the primary disease has been satisfactorily eradicated. The patient will complain of discomfort with slight exertions, the cardiac reserve power is evidently below the normal, and it is not long before definite symptoms make their appearance. Shortness of breath, undue exhaustion with exercise, palpitation, more especially at nights, and faintness easily produced are among the earliest of the complaints noted. But before long further disabilities arise. Excessive perspiration with even the smallest effort, postural giddiness and certain phenomena which herald the primary stages of dilatation, viz., precordial pains, troublesome and persistent palpitation, an inability to sleep on the left side, and smothering sensation at nights.

Among these early and initial symptoms it is on pain that the priority of stress is laid with remarkably few exceptions, both in the case of the young adolescents in whom dilatation so readily occurs, and in the older patients where this latter phenomenon cannot so easily come about. Sensations of pain and discomfort, though aggravated by exercise and exertion, persist even in the resting intervals and vary in degree more often than not, according to the severity of the primary condition. In this respect they conform to the comparable states which obtain in any of the recognized types of toxic angina.

From the point of view of actual causation one may conveniently divide pain into two main groups:—

(1) Intracardial: the heart muscle itself or the different nerve-endings being poisoned by toxins or possibly even micro-organisms circulating in the blood-stream; and

(2) The extracardial for which dilatation is mainly responsible, in that it causes pressure not only upon the superficial and the deep cardiac plexus, but also upon the intercostal nerves and other structures and nerves in the vicinity.

In type also the pain may be discussed from two standpoints:—
(1) The local, as, for instance, when an intercostal nerve suffers direct irritation; and
(2) The referred.

The latter type may be, without demur, accepted as the more important of the two varieties; in fact, the theory of referred pain has no more efficient an exponent than the heart proves to be.

Developmentally the heart is connected with the first eight thoracic segments, and the aorta (ascending and transverse arch) with those of the third and fourth cervical. Assuming, therefore, an irritation of certain of these segments by morbid processes located in the heart's muscle or fibrous tissues, and the projection of such impulses from the segments so involved to their peripheral distribution, we are not surprised to find definitely circumscribed patches of hyperalgesia, together with hyperesthetic zones of skin appearing on the thoracic wall and the inner surface of the arm, and their significance from the point of view of diagnosis is of great value.

The chief points noticed in the examination of patients suffering from the heart complications of trench fever are the following:

(1) An outward displacement of the apex beat, possibly reaching even the mid-clavicular line, and tender to even the lightest pressure and percussion.
(2) An increase in the area of cardiac dullness (light percussion only is advised, and proves to be the most accurate method); the dilatation, when present, is general, and the dullness is increased in all directions, both upwards, outwards, and inwards.
(3) An increased rapidity of heart rate, as a rule only very slightly marked in the resting state, but instantly assumed with the adoption of the erect position, aggravated even further by exercise, and returning to the resting rate only after an abnormally long interval.
(4) A rhythm unduly influenced by the respiratory phases, and punctuated frequently by the occurrence of premature contractions.
(5) An accentuation of the first sound at the apex, the valvular element of the sound predominating, and imparting a distinctly metallic clang to the tone of the sound. More often than not it is found that the extreme loudness of the sound obscures the presence of murmurs, and these latter appear if the patient rests in the recumbent position for a few minutes. In conjunction with an outward extension of the cardiac dullness to the left, a systolic murmur heard at the apical region, and external to it, undoubtedly indicates dilatation of the ventricle, including the valve, and probable regurgitation to the atrium.
(6) A systolic bruit with an accentuated second sound and a diastolic shock at the pulmonary area; these, with an impaired note in the third space, or even at the costal cartilage of the third rib, indicate upward dilatation of the right ventricle, the pulmonary orifice being in consequence displaced in an upward direction, and as a result the walls of the pulmonary
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artery develop an unnatural laxity; hence the production of a fluid vein and an audible bruit.

These, then, are the more striking of the physical signs which one notes on examining a patient whose heart affection follows trench fever, and experience permits one to attach more importance to certain of these than to others. From the point of view of prognosis, one looks with doubt upon the following:

(a) Excessive pain, apical tenderness, and patches of hyperaesthesia; 
(b) continual tachycardia, resting rates of 100 and above; 
(c) persistent dilatation; 
(d) multiple premature beats; 
(e) obvious distress with test exercises, giddiness, dyspnoea, etc.; 
(f) flinching when the precordium is being percussed; 
(g) a diffuse and wavy apex throb spreading inwards to a retraction with systole of the area covering the right ventricle.

Group II includes the patients whose cardiac mechanism has been rendered inefficient as a direct result of the inhalation of poison gas, quite apart from the other lesions, those of exposed mucous membranes, viscera, etc.; it is very evident that the lungs and the heart are the organs which merit the strictest attention, for it is upon them that the strain and the brunt of the initial damage undoubtedly falls.

In conformity with other rapidly acting poisons one views the primary stages of the condition with the greatest degree of uncertainty. Active treatment of a very specialized kind, which need not be discussed here, is instituted, and decided improvement at the end of forty-eight hours is looked upon as favourable. Progress towards recovery is slow, and it may be ten to fourteen days before convalescence can be confidently stated to have commenced. This latter is slow in all cases, and final recovery is by no means certain. Improvement is the rule, but unfortunately numbers of patients do not get beyond this stage. Complete cure appears impossible and this can generally be explained by the fact that there has been some previous mischief, possibly of the nature of bronchitis, pneumonia, or other malady. Or, on the other hand, the age of the patient may be the deciding factor, the prognosis being strikingly more favourable in the younger men than in those approaching middle life.

From an analysis of the notes dealing with patients in this group, the following list of the more frequent symptoms has been prepared:—

(1) General symptoms: Exhaustion, lack of energy, dizziness and headaches.

(2) Pulmonary symptoms: Cough, loss of voice, soreness, and weight on the chest, shortness of breath, tenacious expectoration which is worse (a) upon hot days; (b) when the weather is very damp; (c) when the patient gets warm in bed at night.

(3) Gastro-intestinal symptoms: Unpleasant taste in mouth, nausea, dyspepsia, enteritis, haemorrhage, and excessive flatulence.

(4) Symptoms the result of lesions of the various mucous membranes: Discharge from the eyes, adhesions of the lids, varying degrees of impair-
ment of vision all aggravated by strong sunlight, and possibly sufficiently severe to cause temporary blindness; obstinate catarrh of the nasal passages and the naso-pharynx.

(5) Burns of varying depth which involve not only exposed surfaces but also the areas of skin where perspiration is active.

Physical examination discloses signs characteristic of the above-mentioned symptoms. It is, however, towards those more especially connected with the heart and lungs that we are at present directing our attention, and these organs require a very careful scrutiny during the entire convalescence.

One notices, on observation, that the respiratory rate is excessive, and that its rhythm is abnormal; the average excursion is shallow, and the depth of individual phases varies, a moderately deep inspiration being followed by several, possibly three or four, short and jerky respiratory movements. The rate per minute, which has been recorded during the resting intervals, ranges between thirty and seventy, and it is significant that even the highest rates do not as a rule cause any marked degree of distress or anxiety to the patient while he refrains from exertion. High rates of breathing, therefore, characterize the patients who have been subjected to gas poisoning, and, contrasted with the normal rate, fourteen to eighteen per minute, they indicate gross damage to the respiratory mechanism.

We know that at all ordinary times the phases of respiration are under dual control, the vagal and that of the respiratory centre, and further that these latter are both connected and complementary the one to the other. In the vagus nerve there are found to be two sets of different fibres, stimulation of one set causing increased activity of the inspiratory part of the centre, and stimulation of the other set causing increased activity of the expiratory part of the centre; and these two sets of fibres are alternately stimulated by the alternate distension and contraction of the pulmonary air vesicles, where the vagal terminals ramify.

In addition, however, to this, so to speak, peripheral arrangement, it is found that the respiratory centre is possessed of further functions enabling it to control and manage the varying rates and magnitudes of excursion which may become warranted both in the conditions of health and disease. These it governs by reason of a property with which it is endowed, viz., an elasticity of action depending upon the relative acidity of the blood. In other words, the activity of the centre is regulated by the reaction of the blood and the rate of respiration varies in direct proportion to the amount of acid concentration which may obtain. This latter is found to be a variable quantity. In health we are aware that a continual stream of carbonic acid is thrust into the blood-stream as a result of ordinary tissue metabolism. This, however, does not materially influence the reaction of

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1 Paragraphs (4) and (5) refer to the so-called "mustard gas" only.
the blood, for it does not remain entirely free. There are in the blood certain salts, sodium bicarbonate and sodium phosphate, also protein bodies, which possess a definite affinity for carbonic acid. These so-called "buffer salts," enter into a loose chemical combination with the carbonic acid in the blood and by so doing, prevent the development of an undue acidity, and promote the necessary adjustment between the reaction of the blood and the activity of the respiratory centre which must obtain if the normal rate of breathing is to continue.

This adjustment suffers dislocation both in health and disease. We know that increased respiration both as regards rate and amplitude is the normal sequence to exercise. The explanation is obvious, for in addition to the spread of impulses which, during exertion, pass from the motor cortex to the respiratory centre, there is a definite increase in the relative acidity of the blood. Owing to the more rapid metabolic changes which necessarily accompany exertion, the blood becomes temporarily overcharged with carbonic acid, more even than can be dealt with by the "buffer salts," also lactic acid; and the centre is stimulated to increased efforts until the excess of these acid products is satisfactorily excreted. Dyspnoea in diseased states is capable of interpretation upon entirely similar lines, for, apart from those patients in whom the breathlessness is a direct result of deficient aeration of the blood, there are quite a number of diseases in which acid intoxication, following perverted metabolism, furnishes the underlying stimulus to extra effort on the part of the respiratory centre.

If for a moment we now consider the position of the patient who has been subjected to the influence of poison gas, it is quite evident that the most important of the resulting disabilities is the deficient blood aeration. This latter allows of explanation pathologically. The pulmonary air sacs and bronchial tubes are flooded by exuded fluid and serous effusion, and in consequence the respiratory exchange is seriously interfered with in both directions. Oxygen starvation follows, and the CO₂ not being satisfactorily eliminated, cyanosis and asphyxia follow. This explanation of affairs applies more especially to the early stages of the condition, and it is necessary to examine more closely for the reason of the dyspnoea continuing during convalescence and after all the bronchitic signs have cleared up. The explanation is not far to seek, for changes of a permanent character are induced in the lung tissue by the irritant vapours and the intense respiratory efforts which these latter give rise to. These changes include damage to the specialized pulmonary epithelium and a varying degree of actual emphysema; morbid processes which seriously hamper the even and orderly gaseous interchange in the lung tissues; both the intake of oxygen and the exit of CO₂ are impeded, but in view of the fact that cyanosis is not, as a rule, present to any noticeable extent, it seems evident that oxygen want is the prevailing factor and the more important agency provoking extra effort on the part of the respiratory centre; the pulmonary ventilation rate is accelerated in order to compensate for this oxygen
deficiency, and the likelihood is that this depends upon the production of a shift of the reaction of the blood in the acid direction, producing a condition comparable to that which is brought about in the normal subject when, at an altitude, he develops a compensatory acidosis to counteract the oxygen want resulting from the lowered alveolar tension of this gas.

The cardiac derangements are entirely secondary to those in the lungs. Owing to the emphysema we frequently find a diminished area of cardiac dullness. The rate of beat is rapid and shows an excessive rise with effort. Some degree of dilatation is the rule and the characteristic murmurs are observed. Premature beats are often noted in those cases which present evidence and history of profound initial toxemia.

Group III of the series comprises all the cases of genuine heart disease irrespective of those following the rheumatic affections which will be discussed under a separate heading.

These patients invariably fix the onset of their symptoms as having occurred at some date during civil life, and owing to their disability they have been advised to choose an occupation of a sedentary character as a conservative measure. Hence we find on glancing at the previous occupation in the notes upon the cases in this group that their business was invariably one requiring a minimum of active muscular exertion, and the quieter walks of life, for instance, that of the schoolmaster, the clerk, the painter, the sign-writer, the weaver, etc., have been for this reason followed.

One is not surprised to find that military training suddenly imposed upon inactive subjects with latent disease is a slow and, in the long run, ultimately an unsuccessful process. They develop symptoms of distress and exhibit rapid and premature exhaustion with their exertions. The effects of the latter evince cumulative characteristics, and failure surely appears; itself very frequently precipitated by some intercurrent affection, such, for instance, as an attack of tonsillitis, P.U.O. influenza, or other debility of like nature.

Needless to say this type of patient is certainly not going to be cured, or even efficiently enough improved for the full duty of a soldier, by any amount of hospital or convalescent treatment. He may, very possibly, make progress sufficient for the duties which a low category of service demands, but even this result is by no means certain, a fact which becomes perfectly patent if we, for a minute, inquire into the case analysis and incidence of the conditions embraced by the group under consideration.

These are as follows:

(a) Mitral incompetence
(b) " stenosis " with obstruction
(c) " stenosis 
(d) Chronic myocarditis with dilatation
(e) Aortic disease
(f) Auricular fibrillation
(g) Dextrocardia

69 cases
16 
11 
31 
3 
1 case
Beyond the fact that pains are considerably more obstinate and that premature beats, when present, are more apt to proclaim their existence by some such method as a fullness in the region of the heart, a suffocating feeling in the throat, or a sensation as though the heart had stopped beating, there are but differences in degree between the symptoms which characterize this and the other groups of cases. In both we recognize deficiency of reserve heart energy, but this, as one would naturally expect, is certain to be more noticeable when it results from disease of a permanent type than it is in those cases where the heart is suffering but a temporary and functional derangement. Further, we notice that the classical group of symptoms which indicate failure is usually complete in the organic, while in the functional cases it is customary for some one or two of the symptoms to be mentioned without reference to others. For instance, a patient with tachycardia following shell-shock may complain of shortness of breath and giddiness without any mention of palpitation.

Physical signs are undoubtedly more abundant in this group than in any of the others. Careful examination of the pulse furnishes its ever important share of illumination in the question of diagnosis. The rate and rhythm are noted; its quality and volume are examined. By these methods we gather valuable confirmatory evidence which materially aids us in arriving at a correct diagnosis, not only of the disease which may be present, but also the stage it has reached. We recognize, for example, and appreciate, the relatively small pulse of mitral disease and aortic obstruction, and the collapsing nature of the pulse which accompanies aortic incompetence and pure dilatation without hypertrophy.

A few moments in actual inspection of the chest and precordial area is always time well spent. One notices, possibly, some amount of deformity, or bulging of the chest wall, the position and character of the apex beat or impulse, the wavy systolic retraction which speaks for a dilated or hypertrophied right ventricle, abnormal impulses at the area covering the auricles and the origins of the great vessels, and possibly even certain obvious phenomena which indicate pericardial adhesions, viz., a systolic retraction in the region immediately external to the apex beat, and an absence of movement with respiration of the triangular space at the base of the sternum.

The heart’s size is defined by percussion, and certain points in the technique of the latter require attention. Undoubtedly it is better to percuss in the upright position and to confirm if necessary later with the patient lying down. In the latter position it is sometimes an advantage to wear a stethoscope whose chest piece hangs near the area which is being percussed. By this means changes of note are readily appreciated. Should the pectoral muscles be unduly prominent, it is an advantage to percuss with the arms loosely extended over the patient’s head. The actual percussion needs great care. Undoubtedly the more accurate results are obtained by light as opposed to heavy percussion. As an index to quality
the following plan is considered to be the most efficient; first to locate the apex beat and then to find the degree of percussion which most clearly demarcates the transition from resonance to dullness in this particular area. By this method we become possessed of a guide to the particular intensity which the percussion must assume in order that the limits of cardiac dullness may be satisfactorily mapped out and defined.

Certain of the signs which are revealed by auscultation merit a very careful study. Particular attention should be paid to the quality of the respective heart sounds and the time intervals between them; that is to say, the systolic period and the diastolic interval, the latter of these two being especially worthy of note. As regards the first heart sound, we know that it is of triple origin, the contracting ventricle and the closing valve combining with the pressure of the blood column to produce a complex sound; hence, we are able to appreciate the fact that the first sound varies within certain limits depending for its variations upon the values of its several components. We hear, for instance, a dull and muffled sound in cases of ventricular hypertrophy, the muscular element predominating, a high-pitched and shortened sound of valvular origin in cases of dilatation with enfeebled musculature, and a general diminution of the entire sound if the blood-pressure be below normal.

Venous murmurs are frequent, and easily recognized, not only the bruit-de-diable resulting from the loss of tone in the walls of the cervical veins, but also the vena cava murmur which, following the course of the vessel, can best be heard in the first and second spaces immediately to the right of the sternum.

The diastolic murmur, which indicates regurgitation at the pulmonary valve in cases of early mitral stenosis, is seldom noted. This may be accounted for by the fact that the pulmonary venous channels are capable of accommodating more than their normal amount of blood, should the necessity arise.

The so-called triple or canter rhythm is relatively common and its correct interpretation is by no means a simple matter. The third, or extra, sound which makes its appearance and so changes the normal sequence of events may depend upon one of several factors. The following are the more common:

1. Reduplication of the normal first sound. This may occur in cases of mitral stenosis and aortic incompetence as the result of a double closure of the mitral valve, or it may be due to an asynchronism in the systole of the right and left ventricles.

2. Reduplication of the second heart sound. The abnormal rhythm is, in this case, heard better at the base than at the apex, and depends for its presence upon the disturbed relationship arising between the pressures in the pulmonary and systemic circulations.

3. Audible contractions of the atrium; such may be the state of affairs both in certain phases of heart-block and in extreme tachycardia.
It is interesting also, to note the frequency with which it happens that a loud and accentuated reduplication of the first sound at the apex in the standing position is replaced, if the patient lies down, by the typical bruit which indicates mitral incompetence. For this, and other reasons, far too numerous to mention, it is highly important and necessary that all cases of heart disorder be examined both in the lying and standing positions. Too much stress need not be laid upon the appearance of a systolic bruit at the apex which is quite localized at this spot, heard only in the recumbent position and unaccompanied by other physical signs. But one should not forget to listen in such a case for the first sound. This may be inaudible at the apex, replaced here by a murmur, but appear quite normally immediately external to the apical region, and certainly indicates no gross or permanent disability. The case is different, however, if the following combination be present; a systolic murmur at the apex, not conducted outwards, and with it an entire absence of the first sound both at the apex and external to it; this invariably indicates permanent incompetence at the mitral valve.

Group IV consists of 240 cases, exhibiting features of cardiac debility in varying degree without any appearance of gross lesions or even a history of any of the diseases which one associates with heart maladies from the etiological point of view.

From the table one sees that the percentage of cases actually cured by treatment and convalescence, is extremely small, and far outnumbered by those in whom improvement fails to occur or is so incomplete that reclassification becomes inevitably the only solution. The latter, numbering 158, includes ninety-seven cases whose disability dates back to early youth, or, at any rate, to civil life, and sixty-one cases in whom the initial symptoms appeared during military service. Similarly, one may divide the cured cases. Of these, nineteen gave a history of similar symptoms in civilian life, while sixty-three did not experience appreciable disturbance until their military duties began. Quite apart, however, from the actual date of the onset of the first symptoms, we notice that all the patients in this group are drawn from sedentary occupations, clerks, students, printers, weavers, fitters, commercial travellers, to mention only the chief types of employment which, prior to the war, had been adopted. It is, moreover, customary to find on inquiry that these patients were advised to take up work needing a minimum of exertion because, for various reasons, the more strenuous occupations were contra-indicated. All the more violent of athletics and outdoor exercise have been sedulously avoided. One can be hardly surprised to find what appears to be the typical sequence of events. A delicate and poorly developed man is suddenly transferred from a sedentary mode of existence to one which involves not only hardships and endurance but a plenteous supply of grit and stamina; he undergoes his training with possibly nothing more than a suspicion of general unfitness, as evidenced by rapid exhaustion following exercise, or some degree
of discomfort after marches; but on the other hand cases do frequently present themselves who definitely and emphatically connect their conditions with some phase or other of their training. The significance of these early symptoms may not be grasped, but the stress and strain of active service will sooner or later expose the true state of affairs. The final and determining agent may be one of several, e.g.:

(a) Climatic changes; (b) exposure, damp and cold; (c) heavy marching with pack and equipment; (d) a wound; (e) the lifting and carrying of excessive weights, ammunition, rails, etc. Each or any of the above operating alone or collectively is fully capable of exciting mischief in those whose powers of resistance are abnormally low. The poor quality of the heart muscle is swiftly betrayed by the customary symptoms of incompetence; the circulation and in fact the entire organism suffers in consequence of the feeble vitality of the cardiac musculature; the subjective phenomena and the objective signs together indicate decided mechanical weakness, and express the results which strain produces on an organ whose vital powers are primarily below par.

Such a condition with intrinsic disease unrecognizable, but eloquent of an impoverished muscle power, seems to be suitably named " languor cardis," and it is suggested that such is the most satisfactory title under which to describe the cases dealt with in this group.

The symptoms of this condition are in no way peculiar, but conform to those which one accepts normally as indicating incompetence and inefficiency of heart power and reserve. More often than not the complaint is of weakness and premature exhaustion, with pain in the side and periodic spells of faintness and giddiness. Palpitation also is noted in the majority of cases. This depends largely upon a hyperirritability of the sympathetic nervous system which presides over the heart's enervation, and indirectly also upon the co-existing states of anaemia and lowered blood-pressure.

This latter presents several points of interest. The systolic pressure is below normal; so also, and more in proportion, is the diastolic; pulse pressure tends in consequence to be high; the depression in the diastolic reading is taken to indicate a generalized vasomotor inactivity.

Most illuminating, however, are the comparative results obtained by examinations of patients suffering from languor cardis before and after exercise. These, combined with similar details from a series of control cases, furnish a valuable basis on which not only the present state but also the prognosis can be founded.

The resting rate of the heart is rapid, and in this respect languor cardis differs from the other main varieties of heart disorder which soldiers are prone to develop. The average rate at rest\(^1\) of forty consecutive cases was ninety-six.

\(^1\) The resting rate here referred to is the heart's rate taken after thirty minutes' rest in the recumbent position.
This resting rate is subject to abnormal acceleration when the erect position is assumed. The average increase in the same series of cases was nineteen beats per minute, and from controls we know that this figure is approximately double what it should be in the healthy state.

A series of carefully chosen test exercises, which will be more fully explained at a later stage of the paper, are employed to determine the patient’s reaction to exercise and work of a physical character. It is, however, not considered sufficient to rely solely upon the results obtained from these tests; though very frequently it is possible to form an opinion of an adverse character by reason of the excessive tachycardia which the exercise produces, the abnormally lengthened period before the pulse-rate declines, the exaggerated and prolonged rise of the systolic blood-pressure and the more general signs of distress, such for instance as dyspnoea, perspiration, giddiness, etc., it is found practically that to rely solely upon the results of test exercises, when endeavouring to establish the fitness or otherwise of a man for military duties, is fallacious. The heart’s immediate response to muscular exertion is important, but of equal moment is its power of endurance. This latter can be determined by careful examination following rather more protracted and lengthened physical exercise than can be performed in the medical inspection room. One must start with a clear understanding of the man’s so-called resting state, and then proceed to investigate, by observation and examination, his condition on the parade ground, after physical drill, route marches, games, etc. By such methods we can reasonably form a satisfactory estimate of the heart’s capabilities, and, relying mainly upon physical signs, rather than upon symptoms, one can without difficulty arrive at conclusions sufficiently definite to allow of an exact prognosis and classification from the military point of view.

Group V.—Comments regarding the series of cases here for consideration need only be brief.

Firstly, it is important to thoroughly appreciate that the group itself offers important and tangible evidence against the careless and wanton usage of the unfortunate title “D.A.H.” Genuine shell concussion has, as we know, a widespread and complex variety of results. Symptoms abound and express the universal character of the system derangement. There is, however, appreciable reason for this extensive symptom complex, in that the central nervous system which governs and presides over the phases and functions of the various viscera, controls the size of the vessels, enervates the muscles, skin, and all the organs of special sense, is itself undergoing a functional disturbance.

Primarily, therefore, every genuine case of shell concussion is indicative of nervous system mischief, and all the phenomena which ensue are but secondary results of the same. Of these latter complications, the cardiac are without doubt prominent both objectively and subjectively. They appear, moreover, both in the severe and in the mild types of case and quite
irrespective of the actual causative factor, whether it be one severe shock or the summation of several. It is, however, highly important to remember that heart symptoms are capable of exaggeration, and evince extreme obstinacy, especially if, for instance, the general, moral and physical tone be below par. One cannot fail to notice, in fact, that the patients which compose this group, those men whose debility arises as a direct sequence of shell concussion, divide themselves from the commencement of their treatment into two well and clearly defined classes: (1) Those who intend and endeavour to improve, and (2) those who do not expect to recover.

Unfortunately the latter class of case is relatively common. One has but to see the types of patients who crowd the hospitals and bases suffering from the effects of shell concussion. The diagnosis varies, shell-shock, concussion (buried), neurasthenia, D.A.H., nervous debility, etc., apparently depending upon the most prominent symptoms. But it is important to notice that these diagnoses describe identical conditions. The patient is the same in all cases. Progress towards recovery is rapid and uneventful in those whose ultimate cure is effected; but the large majority of these patients are sources of dissatisfaction; the symptoms maintain an extreme degree of obstinacy; more especially, in fact, does this apply to those whose condition is aggravated by cardiac complications, for there is no doubt that the latter, once produced, are, for a variety of reasons, remarkably resistant to all forms of treatment.

The following notes of two illustrative cases offer what may be looked upon as characteristic details:—

Case 1.—Pte. C. J. R., aged 24; buried and concussed by the explosion of a shell on February 18, 1917. Not unconscious; treated in hospital for six weeks, then transferred to convalescent depot. On arrival at the latter it was noted that the man, who in civil life had been a bank clerk, was anaemic, pale, and of poor physique. The symptoms complained of were pain in the left side of the chest, daily headaches, palpitation, and insomnia. The physical signs included tachycardia (the heart's rate resting was 116); an extensive and forcible apex beat, a loud first sound, a diminution of the diastolic period, a pulse regular in rhythm, but low in tension and poor in volume, and a general hyperirritability of the nervous system shown by the presence of tremors and the exaggerated reflex response; the systolic blood-pressure was 100 mm. Hg; the pulse pressure 25 mm. Hg; response to test exercises was poor; the pulse rate was accelerated abnormally, and both it and the raised pressure returned to their respective figures only after an unduly lengthy interval. The patient was put under treatment; observed at exercise, and examined every third day. No progress was noted until fifteen days had elapsed; the patient then volunteered the statement that his palpitation was less and that he was not sleeping so badly as he had been; but he still complained of pains in the chest and severe headaches. His apex beat remained forcible in character, but the resting rate was at a lower level and the response to
exercise was more satisfactory. The limit of his progress seemed to have been reached, however, for during the following fortnight all the original symptoms returned, others were added. Response to effort, though improved, did not reach the normal limits, and the patient was discharged, to his base for reclassification.

Case 2.—Pte. P. J., aged 29, in civil life a milkman by trade, who had at no time indulged in athletic amusements of any kind. Was evacuated from his unit to hospital in April, 1917, suffering from the effects of shell concussion.

Having undergone treatment, patient was returned to his unit in July, but remained only one month. The symptoms returned and he had again to be admitted to hospital. Examined on September 2, patient was complaining of shortness of breath, nocturnal palpitation, dizziness and a gripping pain in the chest. The general development was under the average, and it was noted at the time of the examination that perspiration was excessive, while the general attitude was one of restlessness and nervous irritability. Physical signs included a rapid pulse of low tension (110 mm. Hg), a forcible and diffuse apex beat with its maximum impulse in the fifth intercostal space immediately below the nipple, a diastolic shock over the pulmonary area, an undue loudness of the first sound at the apical region, and well-marked respiratory irregularity of the heart's rhythms. There was no hyperesthesia of the chest wall; the lungs presented no abnormal physical signs; the reflexes were abnormally brisk; response to effort was poor; progress was unsatisfactory; the neurasthenic condition persisted, symptoms of exhaustion, both cardiac and general, were observed to arise prematurely during the routine convalescent treatment which was adopted, and it became evident that patient was unlikely to recover sufficiently for full duty with his unit. He was therefore evacuated to his base for reclassification.

These two cases are but types representative of the class of man who most readily falls victim to the effects of prolonged shell fire, concussion, etc. Without attempting to infer lack of stamina in every case, and admitting that the etiological factors do frequently assume an extreme limit of severity, one rapidly realizes the type of individual who succumbs mentally and physically by reason of the effects, both immediate and remote, which associate themselves with the varying degrees of shell concussion. The mental attitude is distorted, the moral tone is lowered, and the patients appear to develop an introspective state of mind, worrying as to the significance of small and trifling symptoms, thinking and brooding for hours over their recent experiences, disturbed with regard to the future and what may be their fate if they recover. Quite apart from treatment, one is perfectly convinced that the less these particular patients know about their condition, chances of recovery, etc., the better will be the result; and there can be no doubt that it is utter folly to label such cases symptomatically. This latter applies more especially in those patients
who develop some one or other cardiac complication. In fact no variety of case exists which illustrates to greater advantage the abuse of a faulty terminology. To diagnose them D.A.H. is in most cases quite erroneous and always unfortunate, for by so doing we directly prompt and encourage the patients to focus mentally upon the heart and its actions. This naturally is the very last and quite the worst of all possible events; as in other instances of functional disease, it is, invariably a mistaken policy to acquaint these patients with anything more than very superficial details. To inform them that they are suffering from D.A.H. is simply courting trouble and disaster, frequently aggravates the general state and always delays both progress and ultimate cure.

Group VI.—This, the rheumatic group, includes all the cases whose condition can be definitely connected with previous rheumatic fever.

Broadly analysed, one cannot fail to be struck by the very low percentage of cures in this group, and it can be accepted as a very fair working axiom that any man who has previously suffered from rheumatic fever and develops cardiac symptoms on active service, is unlikely to become fit enough to return to full duty.

Often enough some degree of distress is complained of during the early stages of training, but whether this be so or not one cannot fail to be struck by the short length of time which these patients have spent with their units before the onset of symptoms necessitating evacuation. It frequently happens that men drafted overseas do not get beyond their base, and those who do reach their units remain for a very short period, often a matter of weeks or, at the outside, months. The worst of these cases pass from hospital back overseas: It is not of these that one is here treating. The present group is composed of men whom convalescence will benefit in varying degree, possibly sufficiently so for them to be able to carry on useful work in a suitable and lower category. It is these men whose period of active service can be reckoned in months. The average period served by forty consecutive cases in this group was six and a half months before symptoms became sufficiently severe to warrant evacuation. So that one can soon realize, remembering the more serious hospital cases, that the average military value of a man who has had rheumatic fever is very short and inefficient from the active service point of view.

The symptoms do not differ from those which characterize the other groups to which reference has already been made, hence do not necessitate further discussion beyond an observation upon the striking frequency with which hyperalgesia and thoracic pains are noted upon the history sheets.

Physical signs of dilatation, and murmurs resulting from this condition, are common, and in numerous cases valvular incompetence, indicative of organic disease, is manifest; premature beats are the rule. The response to exercise is poor and effort is badly borne. Tests from the point of view of the heart's response to exertion and endurance tend but to confirm the opinion which is formulated by experience, viz., that the reserve power of
the heart after rheumatic fever is unlikely to be high enough in actual value to withstand satisfactorily the strain of full duty on active service.

Group VII.—This, the last group of the series, includes ninety-five cases in which the diagnosis "D.A.H." is, if possible, more unfortunate and less correct than in any of the above-mentioned types.

With few exceptions, an acceleration of rhythm, or an occasional premature beat, constitute the sole cardiac physical signs, and it is both wrong and wantonly fallacious to apply to these patients any diagnosis which may indicate heart mischief, when, as we shall see later, the primary disturbance is manifestly not cardiac but dependent upon some one of several morbid conditions which not only induce but also maintain in varying degree their own characteristic signs and symptoms, and further involve the entire system in a state of general debility which the heart rapidly reflects and brings into relief both subjectively and objectively.

It is certainly not the writer's intention to deny that there is an alteration in rhythm or cardiac response in certain of the cases which compose this group, but rather to lay stress upon the fact that no pains should be spared which may aid the elucidation of the primary disorder, so as to obviate as far as possible anything in the shape of a symptomatic diagnosis. The following sub-groups indicate the headings into which Group VII automatically divides:

(a) Dyspepsia (nine cases). Generally heralded by pains in the lower præcordium, described by the patients as being "round the heart." Worse at nights and also after food; associated with flatulence, frequent pain, fullness in the chest, a heavily coated tongue and shortness of breath; always improved, if not cured, by dietary regulations and stomachics. The teeth and gums are examined as a routine, and treated as may be necessary.

(b) Bronchitis (thirty-two cases). Signs and symptoms expressive of the gravity of the primary lesion and demonstrating in able fashion the closely related spheres of activity which obtain between the thoracic viscera. The possible presence of tubercular mischief should always be considered, and great care must be exercised that the patient is not sent from hospital before convalescence has definitely commenced.

(c) Pneumonia (fifteen cases). The cause and incapacitating effects were in these cases always apparent. Discomfort and inability for lengthy exertion were accounted for in three instances by imperfect resolution, in others by a deficiency of air entry at the seat of the primary lesion and a reduction in oxygenating areas. Quite frequently the pneumonia had occurred several years previously, but recovery had not been satisfactory. The patients stated that they were never the same after their attack. In some instances change of occupation became necessary owing not only to the bronchitic tendency but also to the lowered power of resistance. Of this sub-group those patients who did recover were strong well-built men who, previous to the war, had been employed at work of a laborious type, miners, general labourers, blacksmiths, etc.
(d) Malaria (eight cases). These patients were all perfectly frank cases of malaria. They had the numerous symptoms but none of the physical signs of heart disease.

(e) Pleurisy (six cases). Under this heading are grouped all those patients in whom physical signs of past pleurisy were clearly defined. These latter include among their number certain phenomena which indicate that the heart has not entirely escaped participation in the early stages of the pleural inflammation; the pericardial membranes, being prone to share any morbid state which the adjoining pleura may exhibit, tend later to form adhesions in various directions. We therefore recognize the presence of an adherent pericardium. We notice that the apex beat is immobile with change of position, that the area of cardiac dullness is unchanged during the alternate phases of respiration, and that, in certain areas, there is well-marked retraction with the heart's systole. These and other physical signs which need not here be noted, point to the presence of a permanent, and, in the truest sense of the word, functional handicap to the mechanism of the heart. Quite apart from the possibility of dormant tubercle, it is perfectly reasonable to understand that definite pleural adhesions, involving the mediastinum and the pericardium, are not compatible with ability for well sustained effort. Every case must be judged upon its own merits, and the heart's reserve of power will need a very careful estimation.

(f) Tobacco poisoning (one case). Fortunately the cases in this subgroup are few, and with ordinary treatment they all recovered satisfactorily. The symptoms complained of were: Palpitation, shortness of breath, fainting attacks, dizziness, excessive perspiration, nervousness, tremors, headaches, and indigestion. Tachycardia was always noted, and the blood-pressure was subnormal in every case. Abstention from tobacco was, as far as possible, rigidly enforced during the treatment.

(g) Enteric fever (seventeen cases). The patients under this heading divide simply; those who recovered complained of a variety of symptoms indicating general debility. This they ascribed to some previous attack of typhoid fever. The heart presented no sign of disease; its action was that of any ordinary convalescing patient. Those who did not recover sufficiently for full duty presented some form of cardiac failure, either a valvular incompetence, some degree of dilatation, or an impoverished response to exercise.

(h) Dysentery (seven cases). In all these cases the exciting cause had obviously been the bowel infection, for the previous health had been perfectly good. The cases on the whole did badly (three became fit). The majority did not improve; dilatation and myocardial enfeeblement were obvious, the response to effort was abnormally poor and the blood-pressure readings were eloquent of the low quality of the heart muscle and its ill-sustained efforts to maintain a satisfactory head of pressure.

Prognosis.—Judging by the figures which appear in the main table at
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the early part of this paper, one cannot fail to be struck by the low percentage of cases in whom complete recovery ensues. Furthermore, one is forced to assert and accept the following fact, that war diseases are complicated by a variety of heart disturbances which do not readily yield to treatment, and that latent disease of the heart itself which existed, but was suitably combated in civil life, assumes, with active service conditions, all the usual features which one associates with incapacity of cardiac origin.

Dismissing, for the time being, the cases of actual disease, and considering only those cases of functional disturbance which arise to complicate recovery from some one of the conditions previously mentioned, it is perhaps advisable here to add a note which will make clear the reason for the apparently small number of cures obtained.

Experience proves that the most efficient plan to adopt in dealing with the heart disorders of soldiers is to commence a carefully organized convalescence at as early a date as possible. But one word of warning is here necessary. This course of treatment, which will be more fully discussed at a later stage, must not be indefinite in time. An average period of two months is found to be a satisfactory working maximum. Cases not fit for full duty at the end of this time are, as a rule, perfectly capable of performing the employment specified in some one of the lower classifications at present obtaining; and it is very advisable that those patients whose cure is delayed for some reason be transferred to a suitable category, for, by so doing, we avoid the stagnating influence of an indefinite convalescence, and, moreover, we hasten the ultimate recovery and strengthen both the moral tone and the physical condition. Convalescence, therefore, in large numbers of cases, may be looked upon as the preliminary step, and suitably chosen work as the intermediate stage leading to final cure and a return to full duty.

In regard more especially to the question of prognosis, of which we are at the moment dealing, it is essential carefully to weigh up and consider a chain of evidence somewhat complicated in that so many are the details requiring attention.

It is imperative, obviously, that full and careful notes be taken of every case. The following details should appear:

The number, name, and unit of the patient; his age, length of service, and occupation in civil life; his previous history in regard to illness, and his habits; a minute history of the present illness, its onset, symptoms and progress (leading questions should not be asked).

The physical examination should be general and complete, not entirely devoted to the vascular system, though one as a rule finds it necessary to pay special attention to this in order that we may provide ourselves with concise notes on which to rely for the basis of an opinion later in regard to the progress made and the correct disposal of the cases.

The cardiac dullness should be mapped out with light percussion and
the apex beat located; the extent of the latter must be noted, also the
real tenderness in this region which is proved by the involuntary
flinching the patient exhibits on palpitation and percussion.

It is well always to note the length of the diastolic interval, the pulse
respiration-ratio, the occasional presence of an enlarged thyroid gland,
and excessive perspiration if this be present.

The heart sounds must be examined with all possible precision, both
in the erect and recumbent postures.

The heart's rate (resting) is taken before proceeding to the second part
of the examination which involves an investigation of the effects of exercise
on the cardiac mechanism.

This is without doubt the most essential and important phase of the
examination, for the following reason: every case of soldier's heart is
characterized broadly speaking by the discrepancy between the numbers of
the physical signs which obtain in relation to the abundance of the
symptoms, and in forming a prognosis one finds it essential to weigh up
these signs and symptoms and endeavour to balance them accurately with
the tangible evidence which is afforded us by the usage of simple effort
tests.

These latter may take a variety of different forms; in fact, it is
immaterial what we adopt as a test; all one requires is some definite
muscular exercise and a knowledge of the effects which it produces in the
normal healthy man. The actual details which one depends upon and
utilizes, when seeking information from effort tests, are furnished by the
several records which together comprise a table comparative of: (1) The
heart rate; (2) the respiratory rate, and (3) the blood-pressure, before
and at a certain definite interval after the exercise is finished.

Very valuable evidence is thus forthcoming of the behaviour of the
myocardium in its relation to activity, and it is obvious that the question
of prognosis is simplified, especially if we combine results such as these
with careful and minute examinations following definitely prescribed
periods of physical exercise, drill, marching, etc. These results should
be most carefully taken and recorded so that one may be in a position to
estimate the value of treatment, not only from the actual state of the
patient, but also from the tabulated series of effort test results.

The particular exercise which the writer has used and found not only
quite simple but perfectly efficient, consists of two parts; first, an arm
exercise is performed, and secondly the patient ascends a staircase carrying
in his hand a known weight. A series of fit men were examined with this
test in order to establish the necessary control values; the preliminary
details were noted; the exercise was then performed. Two minutes later
the heart-rate and that of the respiration were recorded, and after a further
interval of three minutes the blood-pressure was again estimated. From
these control experiments one can formulate, with perfect accuracy, a
series of facts whose value from the point of view of the heart’s response
to effort is of supreme importance.
Thus we find all the details which together are considered sufficient to indicate the reaction of the normal heart to exertion.

The immediate effects of the exercise include an acceleration of the rates of both respiration and heart-beat combined with an increase in blood pressure. These alterations are, however, of a temporary nature only. After resting for two minutes, the normal individual is breathing at the same rate as he was previous to the execution of the test; the heart-rate is found to be less constant; with this particular test an acceleration of rhythm is frequently noted when the rate is recorded two minutes after the cessation of the exercise. More often than not this acceleration is one of a few beats only, possibly seven or eight; in other instances the original rate is found to have returned, but in certain individuals, more especially those whose normal rate of beat is comparatively slow, the acceleration may reach one of even sixteen beats in excess of the resting rate. For practical purposes one must therefore allow a certain range of acceleration as being an event of normal occurrence. The whole position may be briefly summarized. The control performs the test, the heart-beat two minutes later has returned, or is within twelve to fourteen beats of the original rate, and in any case is normal after a further two minutes.

The question of the reaction of blood-pressure as affecting the normal healthy individual is next for discussion. It is found that, following the test, the pressure rises immediately some 5 to 10 mm. Hg, and returns to its original figure at the end of five minutes. The pulse pressure shows an equally marked variation. We have, therefore, in the matter of the blood-pressure, and equally also from the point of view of respiration rate and heart-beat, a series of facts upon which it is possible to establish a reliable standard between the conditions of health and disease.

Patients suffering from functional disorder of the heart manifest in varying degree an exaggerated response to effort. The respiration rate is increased and remains so abnormally long, even in spite of the fact that it is so frequently unduly rapid even in the resting condition. The heart-rate, as a rule rapid before the exercise and during resting intervals, exhibits an increase in rate, not only excessive in amount, but one, moreover, whose return to the normal is unduly delayed.

The accompanying table is prepared from the notes of 100 consecutive cases of the series, and illustrates typically the effects of the preliminary test performed on admission:

<table>
<thead>
<tr>
<th></th>
<th>Heart Rate</th>
<th>Respiration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before test</td>
<td>Two minutes</td>
</tr>
<tr>
<td>Average rate</td>
<td>98</td>
<td>19</td>
</tr>
<tr>
<td>increase</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum rate</td>
<td>162</td>
<td>36</td>
</tr>
<tr>
<td>increase observed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum rate</td>
<td>60</td>
<td>4</td>
</tr>
<tr>
<td>increase observed</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The blood-pressure observed in patients prior to the test exercise is, as a rule, perfectly normal. The subsequent reaction, however, reveals numerous interesting details. In the large majority of patients, those especially whose condition is purely functional in character, the rise in pressure which follows the exercise is exaggerated, and, moreover, abnormally persistent in that the decline to the original figure is delayed. It does, however, happen that certain patients manifest an entire absence of rise in blood-pressure reactionary to exercise. This may be taken to indicate some form of myocardial insufficiency and is invariably confirmed by the co-existing signs and symptoms.

The exaggeration of the rise in blood-pressure, and the delay in its return to the original level following the exercise test, can best be illustrated by the average figures noted in a series of typical cases. For this purpose the notes of 100 cases have been analysed, and it is found that the average rise, immediately after the test, was 18 mm. Hg, and that the average of the prolonged rise, that is to say, the rise still observed after five minutes' interval, was 8 4 mm. Hg. Hence we have a very definite degree of difference in the manometric readings of patients and controls. It was noted that in the case of the latter the pressure was invariably normal five minutes after the conclusion of the test. This is not so in patients with functional heart disturbance. The blood-pressure returns in tardy fashion; the maximum increase noted in the series was one of 25 mm. Hg; the minimum 2 mm. Hg; and the average as mentioned above was 8 4 mm. Hg.

Details then of great value therefore can be acquired by the usage of test exercises, and it is impossible to form any satisfactory opinion without them. But it is to be clearly understood that they do not constitute our sole source of information. They, so to speak, take their part in the investigation and frequently assist us very materially both from the points of view of diagnosis and prognosis. But it is very essential that before arriving at any conclusion we collect and consider each and every factor which may help us to form a satisfactory opinion; the age of the patient, his previous occupation, his length of service and past history will all possess an important bearing upon the matter of prognosis. Equally also must one consider the unit to which he belongs in order to exercise a cautious discrimination between the values of fitness which the various ranks and units relatively demand. For example, a man perfectly fit for full duty with a Labour Company need not reach the standard of fitness required by the infantryman. As mentioned above, an effort test should be carried out and the physical condition resulting must be observed, and signs of distress; if any be evoked, should be noted. In addition, one must frequently examine the state of affairs which is brought about by exercises of a more protracted nature, such, for instance, as physical drill, in some of its many forms, marching, games, etc. These examinations should be performed frequently, and it is advisable that they assume the type of a
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general inspection rather than that of a special inquiry into the heart's condition. One finds, moreover, in treating functional disorders of the heart, that the general physical condition needs to be watched very closely, for one realizes how intimate is its association not only with the activities of the heart but also with the entire mental attitude and outlook.

In conclusion, a list is appended of the more important signs which, when persisting, indicate lack of recovery:—

(a) Persistent tachycardia, rates of 120 and over at rest.
(b) Breathlessness on exertion tested objectively.
(c) Persistent pain, especially if its existence be proved satisfactorily by the presence of definite areas of hyperalgesia or true and involuntary flinching when the apical region is palpated or percussed.
(d) A poor response by the heart to change of position, giddiness and tachycardia following the adoption of the erect position from the recumbent.
(e) Premature beats in certain cases, especially if they only appear after exercise and are entirely absent in the resting state.
(f) A diminution in the diastolic interval, especially if this be continuously observed during the resting phases.
(g) Excessive perspiration in the absence of exertion.
(h) Continual dislocation of the pulse-respiration ratio.
(i) Obvious distress brought on by exercise, testified to not only by the symptoms above mentioned but also by fainting attacks, cyanosis, pallor and abnormal activity of the aæ nasi.

These signs and symptoms are, so to speak, of ill-omen, and if persisting, they certainly debar the patient from full duty, and the question arises as to which category he shall be put into. In this matter every case must be judged upon its own merits, as must also those cases in whom definite heart disease occurs. These latter, especially the rheumatic class, those with valvular disease, myocarditis, paroxysmal tachycardia, etc., can never recover sufficiently to undertake anything more arduous than work of a sedentary or the lightest possible character.

Those patients in whom symptoms and physical signs persist after two months' treatment, as, for instance, cases following trench fever, gassing, shell concussion, etc., become perfectly fit and usually tend to recover completely after, they have been suitably employed at light duty for a further period of two to three months.

The whole matter of prognosis is undoubtedly one of extreme difficulty. One has so many details to take into consideration, but briefly it can be summed up as follows:—

One should treat the heart as an ordinary muscle, and, starting with a definite knowledge not only of the capabilities of the normal heart, but also of the type of physical work which a soldier on active service in modern warfare has to perform, endeavour to elucidate by every method in our power the response on the part of the patient who suffers from some one
of the various forms of heart disturbance which one knows nowadays by the unfortunate term "D.A.H."

**Treatment.**—Convalescent treatment of patients suffering from functional disorders of the heart can only achieve success if we adhere rigidly to rational methods. One must primarily realize that, more often than not, the problem with which we are faced is one of a general rather than a localized and special derangement. The heart, unfortunately, is an organ which is capable of expressing in a subjective manner an untold multitude of widely differing states and conditions, and treatment, to be successful, should be on general rather than special lines. One is, moreover, convinced that these heart patients should not be separated, either from the point of view of institution or treatment, from other convalescents. In other words, "herding" is to be deprecated, and collective treatment enjoined, so that the tendency, to become introspective and even morbidly apprehensive, which results from a close inter-relationship between subjects whose chief malady is neurotic by nature, may be met by the valuable counteracting effect of the presence and society of others whose mental attitude and general outlook may be more hopeful in character.

During the preliminary days of convalescence it is our principal endeavour, partly by examination and partly by the due appreciation of the results brought about by treatment, to decide definitely and quickly which patients will recover and become fit for full duty with their units, so that those in whom the prognosis is unfavourable may be drafted without delay for such suitable employment as their condition may allow. Indirectly, in other words, we arrange that, during the convalescent treatment, an automatic sorting process shall take place, actual disease being eliminated at once, and, similarly, all types proving obstinate and resistant to treatment, as soon as one is satisfied that complete recovery will not ensue within a reasonable period.

During the initial stages one must pay special attention not only to every complaint which the patient may offer, but further, one must make an exhaustive search for the possible presence of any factor which may retard recovery. Errors of digestion should be corrected, the teeth inspected with care, and every effort must be made to promote the highest standard of personal hygiene that is reasonably possible.

In regard more especially to the essentials of treatment, one learns by experience that two qualities must always apply, viz., employment and properly regulated activity of both brain and muscular system, together with the patient's whole-hearted efforts if these latter can be satisfactorily enlisted.

From the outset it should be the chief object of the medical officer to gain the entire confidence of the patient, and in so doing he will of necessity be called upon to display both tact and sympathy in reasonable amount. The cases vary to such an enormous extent that each requires most careful investigation and advice.
Physical exercise, graduated in character, is regarded as the backbone of the actual treatment. This must be performed under the guidance of skilled and expert instructors, and supervised by a medical officer who, himself, should have a thorough and complete knowledge of the detail and technique of the drill from the practical point of view, so that he may fully appreciate not only the effects of the individual exercises, but also the difficulties, apparent or real, of which the patient may complain.

The practice adopted by the writer consists of a course of exercises so graduated that, by convenient stages, the patient eventually reaches and performs the drill laid down in the trained soldier's table. The drill takes place daily (Sundays excepted), and is performed, if the weather permits, in the open air; at other times in the gymnasium. The squads formed are as small as possible, so that the maximum of individual care and attention may be devoted to each patient, and include patients convalescing from all types of maladies; the heart cases must not be kept apart—the so-called "heart squad" is an unsatisfactory institution and to be deprecated.

The exercises are prescribed upon a carefully arranged plan and in a definitely graduated series, which latter is divided into three groups.

Group A, the elementary class, in which patients as a rule remain only three to four days. This series of exercises include a large number very specially directed towards the respiratory movements, and one moment's consideration clearly explains how beneficial these exercises must be in cases of disturbed heart action of the functional variety. We know that with the chest at rest in the expiratory position, the intra-thoracic pressure stands at, roughly, — 5 mm. Hg, and that a full inspiration lowers the pressure in the thorax to — 30 mm. Hg. Hence we see at once how very materially the venous flow may be aided, and the tendency to venous stagnation counteracted. Further, we know that, unlike the venous channels, the arteries are but little affected by pressure changes, and in consequence we can readily appreciate the reason for the increase of blood-pressure and arterial output during the inspiratory phase.

Group B, the intermediate class, and Group C, the final class, each differ from Class A and from one another in that, as can be seen from the detailed list given below, the exercises of which they are composed follow a scale of increasing severity, so arranged that at the termination of the treatment the patient is performing exercises similar to those prescribed for normal healthy soldiers who have not recently undergone a course of physical training.

Class "A" (thirty minutes).

Heels raising: Foot placing outwards.
Heels raising and knees bending. Feet close and full open.
Head backward bend. Breathing exercise.
Breathing exercise. Arms raising sideways and upwards.
Head turning (slowly).
Marching (to a given step).
Breathing exercise.
Foot placing sideways.

Arms lowering sideways and downwards.
Feet close. Heels raise.
Breathing exercise.

Class "B" (thirty minutes).

Hips firm, heels raise, knees bend.
Hips firm, heels raise, knees bend (quickly).
Head turning (slowly).
Breathing exercise.
Arms forward, sideways, and upward stretch.
Breathing exercise.
Foot placing sideways (continuous).
Breathing exercise.
Head backward bend.
Feet astride, arms upward stretch.
Hips firm, leg raising, forward, sideways, and backwards.
Feet closed, hips firm, trunk bending sideways.

Breathing exercise.
Hips firm, left foot sideways place, trunk backward bend.
Breathing exercise.
Hips firm, left foot sideways place, trunk forward bend.
Breathing exercise.
Marching on the toes, marking time with knees raising.
Slow march.
Feet closed, feet open, heels raise.
Head backward bend.
Heels raising and lowering quickly.
Breathing exercise.

Class "C" (thirty minutes).

Arms bend, heels raise, knees bend, arms stretching sideways (four times).
Head backward bend (three times).
Arms bend, arms stretching sideways, upwards and forwards (three times, varying sequence of direction).
Arms bend, foot sideways place, trunk turning (three times in each direction).

Hips firm, foot placing sideways with heels raising (six times each foot).
Feet astride, arms sideways stretch, trunk backward bend (four times).
Feet astride, hips firm, trunk bending forward and full downward (twice).
Hips firm, leg raising sideways (three times each leg).
Leg raising forward, sideways, and backwards (once each leg).
Arms bend, foot sideways place, trunk bending sideways quickly (four times each side).

On the hands down, arms bend, on to one hand turn (twice on each); or (ground permitting) lying on back, leg raising.
Arms bend, foot sideways place, trunk forward bend, arms stretching sideways (three times).
Quick march, double march.
Marching on toes.
Marching with knees raising.
Hopping on alternate feet.
Sideways marching.
Heels raising and knees bending (four times).
Arms raising forward and upward, lowering sideways and downwards (four times).

Combined with the exercises, and incidentally to avoid monotony, certain games are introduced into the daily physical training table. These must be conducted with every energy and the strict observance of all prescribed details. These games include:

1. Jumping the bag.
2. Simple relay race.
3. Three deep.
5. "Whip to the gap."

The maximum time devoted to games should not exceed ten minutes; their value depends not so much upon the physical effort as upon the fact that, smartly executed, they inculcate discipline and develop quickness and rapidity between the co-ordination of brain and movement.

The physical training laid down in the above tables is supplemented by route marches, and all forms of outdoor games are strongly encouraged. Under all the various conditions of physical exercise the patients should be watched very closely, especially during the early period of their treatment; but intricate examinations are not to be advised as a regular event. In fact the less obvious attention one pays to the circulatory system, after first ascertaining the existing state of affairs, the better undoubtedly is the outlook. One can, by the use of ordinary caution and tact, easily elicit the symptoms existing and examine the physical signs which may be present without the use of leading questions, and without alarming the patient or making him unduly suspicious.

It must be patent to all concerned in the treatment of heart disorders which arise in soldiers, that the main part of the therapy, which is found by experience to be attended by the best results, is properly organized and graduated training, but, as one would expect, this does not comprise our sole remedial agency.

Certain of the symptoms can be relieved by the judicious use of drugs. Mild tonics containing iron and arsenic are usually appropriate, as in other instances of convalescing patients, and, quite apart from their recuperative qualities, it may be stated as a general rule that the so-called "placebo" mixture is of extreme value in the majority of the "D.A.H." types.

Should the symptoms be of very recent onset, exaggerated in degree, or suddenly aggravated, a short rest from the exercises is indicated, but except in very special circumstances, it is not considered wise to keep the patient in bed.

Tachycardia is frequent and extremely obstinate, in fact the most troublesome of all the physical signs, and the palpitation which more often than not coexists is, to the patient, a continual source of worry and alarm.
It is advisable to supplement the general treatment in such circumstances and endeavor by all the means in our power to control the excessive rapidity of the cardiac action. Digitalis and strychnine are obviously useless and should not be prescribed. One achieves the desired end very frequently by the exhibition of bromides combined with either quinine or mix vomica. Such a formula as the following has proved itself very valuable:

<table>
<thead>
<tr>
<th>Pot. brain.</th>
<th>Tr. nucis vom.</th>
<th>Aq. dest.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tr. zingib.</td>
<td>Liq. arsiz.</td>
<td></td>
</tr>
<tr>
<td>Tr. nit.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

It is good practice to see the effect of the application of blisters to the vagi, both nerves being treated, thus with a succession of small blisters in their cervical course.

Nocturnal palpitation calls for the use of some sedative at bedtime, and it is well to combine this with a sound tonic during the day. Chlorella hydrate with bromides, or paraldehyde, is useful in small doses, seem to be the most satisfactory of the sedative drugs. The tenderness which develops in the apical region after prolonged tachycardia responds to the effects of mustard. It is a good practice to see the effect of the application of blisters to the nerves, both being treated, thus with a succession of small blisters.