OBSERVATIONS UPON DISORDERED ACTION OF THE
HEART, SO-CALLED "SOLDIER'S HEART."

BY M. S. PEMBREY, M.D.

The question of the "soldier's heart" is of so much importance and interest that a free discussion cannot fail to be of value. The whole subject requires to be reopened in the light of recent work upon the physiology and pathology of the heart. The range of the discussion must be a wide one, for "disordered action of the heart" is not a simple condition due to any one cause. The discussion must be free, for it is only by considering different views and testing them by further observations and experiments that advance will be made.

The clinical aspect of the disorder, the frequency of its occurrence, and its distribution among recruits and trained men, have been discussed by Lieutenant-Colonel Simpson; my part in the discussion is to bring before the Society the physiological aspect of the question.

There is no doubt that a condition of disordered action of the heart occurs among men who have never served in the Army, but it does not follow therefrom that the prevalence of the condition among soldiers is due to failure to detect it among the numerous candidates who present themselves to the recruiting officer. The recruits are selected men; it may be that they include many who have been unemployed, and few of the best physical types of the labourer, but, still, they are men selected as likely to bear the training of a soldier. The Navy takes a large number of boys as recruits, and therefore the condition is not comparable to that of the Army; but nevertheless it is important to recall the fact that there is no cardiac disorder known as the "sailor's heart." The distribution of the cases of "soldier's heart" over the first three years of service also supports the view that there are conditions in the life of the soldier which favour disordered action of the heart. The investigation of these conditions is a physiological problem.

The rhythm of the heart-beat and the conditions which affect it may now be considered. The heart is a muscle, and, as in the case of other forms of muscular tissue, is influenced by its nerves. It is unnecessary, therefore, to discuss here the myogenic and neurogenic theories of the heart-beat. The discovery of the auriculo-ventricular bundle by Stanley Kent and His has given additional significance to the work of Gaskell, and throws much
light upon pathological conditions of the heart, as is so well shown in the investigations of James Mackenzie.

The rate of the heart-beat varies greatly in different subjects, even when they are healthy and as far as possible under similar conditions. There is no rate which can be given truly as the normal. Many physicians forget that they do not see the cases which are necessary for the determination of the range of the pulse in health; they forget that “only the sick need the physician.” We must look to the medical officers of the Services for the determination of this range, for at their command they have unlimited material. Lieutenant-Colonel Deane has made numerous observations of much value in this connection. Other fields of investigation are the medical schools, and these have received attention, but not to the extent that is necessary.

The range of the pulse-rate in different healthy young men at rest is from 45 to 90, and there is no evidence that even this extensive range is a rigid one. Dr. Michell has examined a large number of undergraduates at Cambridge, including 1,200 rowing men, 410 football players, and a few running men; he found for the average rates of the pulse the following values: In first year of residence, 69; second year, 64-5; and third year, 56-8. The rate in some men was as low as 46. At Oxford Miss Buchanan found the rate of pulse to vary between 44 and 80 per minute in about forty-five undergraduates, chiefly athletic men. In 174 observations, made by Captain L. E. L. Parker, R.A.M.C., and myself, the range of the pulse in soldiers at rest was 52 to 110; the determinations relate to fifteen men only, but were made upon thirty-six different days. The slow pulse is generally found in the men who are physically the fittest subjects, and under the influence of progressive training the frequency of the pulse at rest is reduced.

Of the conditions which quicken the rate of the pulse the most important is muscular exercise. The pulse of healthy men may be as rapid as 185 per minute immediately after strenuous exercise, and there is little doubt that physicians have often taken too low a figure, owing to the fact that in the trained man the acceleration of the pulse begins to decline directly the work ceases. A march of seven miles in drill order on a hot day will double the rate of the pulse of a healthy but imperfectly trained man.

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1 See Guy, article “Pulse,” in Todd’s “Cyclopaedia of Anatomy and Physiology,” vol. iv., p. 184.
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Temperature is another cause of acceleration of the pulse, and becomes a very important one in view of the clothing of the soldier. It is necessary to consider not only the internal temperature taken in the rectum, but also the surface temperature of the skin and the temperature and moisture of the air, as indicated by a wet-bulb thermometer. The following data are taken from the Second Report of the Committee on Physiological Effects of Food, Training and Clothing on the Soldier; they show the influence of marching on a hot and a cold day:—

<table>
<thead>
<tr>
<th>Number of observations</th>
<th>Increase in pulse</th>
<th>Rise in rectal temperature, degrees F.</th>
<th>Loss of moisture in grammes</th>
<th>Increase in weight of clothes in grammes</th>
<th>External temperature, dry bulb wet bulb</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>84 52 62 2.3</td>
<td>6 0.6 1.4</td>
<td>2,390 1,140 1,816</td>
<td>640 60 320</td>
<td>79 67.5</td>
</tr>
<tr>
<td>4</td>
<td>24 8 14 1.6</td>
<td>0.6 0.8</td>
<td>555 300 419</td>
<td>40 0 27</td>
<td>45 38</td>
</tr>
</tbody>
</table>

The march of seven miles was over the same road, and the four men, who carried a load of 6 kilogrammes each, were the same in each experiment. The differences in the acceleration of the pulse and the sweating on the hot and cold days are very striking.

The heart is influenced by the reflex tone of the muscular system, both the skeletal and the circulatory. The blood-vessels of the skin are dilated when more blood is sent to the skin to be cooled, and at the same time during work more blood is needed by the muscles. The dilatation of the blood-vessels will lower the blood-pressure and therefore for the maintenance of an efficient circulation the heart must contract more frequently or more forcibly. It follows, therefore, that clothing which unduly prevents the evaporation of sweat and the cooling of the skin will throw an extra stress upon the heart. On the other hand, exposure of the skin during muscular work will contract the cutaneous vessels by the cooling effect of the evaporation of the sweat and thus raise the pressure of the blood. Moreover, a general effect will be produced upon the nervous system by the impulses arising from the skin, which is the largest sensory area of the body.

Athletes are lightly clad during exercise, for they have learnt from experience that they are far more efficient and suffer less discomfort under such conditions. The farm labourer or navvy, when he works hard on a warm day, takes off his coat and waistcoat and turns up his shirt-sleeves, and any employer would hold suspect the man who did not. In respect of clothing the soldier differs from all civilian labourers; he works at a disadvantage and throws a greater tax upon his heart. It is true that with the new
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equipment the soldier can now open his coat and shirt and make the conditions more favourable for efficiency, but his belief in the importance of conventional ideas of smartness is against him. This influence of clothing upon the heart, circulation, and loss of moisture has not only been proved by experiments upon soldiers, but is one of common experience.

The soldier is under another disadvantage as compared with the civilian: he must carry the load of his equipment in such a manner that his hands are left free for fighting. The straps of his equipment may impede considerably the freedom of his respiratory muscles and thus deprive his heart of some of the aid of the respiratory pump, which assists the passage of the blood from the right to the left side of the heart. The equipment, moreover, often hinders the free circulation of air through the clothing, and thus the evaporation of sweat and the cooling of the skin are diminished. With the new equipment the conditions are much more favourable than they were with the old.

The assistance naturally afforded by the respiratory movements to the circulation of the blood is diminished in the soldier by the constrained position assumed when he is trained in the gymnasium and on the barrack square. The distended chest was long ago rightly condemned by the medical officers of the Army, but, as in the case of other injurious fashions, it is difficult to effect reform. It is fortunate that among sailors this artificial bearing with a distended and rigid chest has never been approved; the freedom of their gait has become as marked a characteristic as their loose clothing.

Another factor of importance is the demand in the gymnasium and on the barrack square for uniformity. There is no finality in style; it is impossible to stereotype any muscular action, for in each man there are peculiarities, in each a personal equation. Over and over again athletic contests have shown victory gained by men whose style was condemned by all the critics. Too rigid an insistence upon uniformity in the performance of gymnastic exercises, especially in the early stages of training, imposes a greater tax upon the recruit, and observations have shown that flurrying and hustling will disturb the control of the heart's action and of the voluntary muscles in healthy men.

Alcohol, smoking, and vice have been looked upon as important factors in the production of disordered action of the heart. There is very little doubt that such habits do contribute, but undue stress must not be laid upon them, for there is no evidence at the present
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time that they are more prevalent among soldiers than among civilians and sailors. Excessive smoking is a well-known cause of disordered action of the heart, and it is surprising that smoking on the march has been allowed. The athlete does not expect this indulgence during training, nor does the labourer during his ordinary work.

A comparison of the conditions under which a soldier works shows that they are more unfavourable than those of the outdoor labourer or sailor. The soldier does not enter the gymnasium as a boy, at a stage when he would be in a plastic condition and able to accommodate himself to unnatural and constrained postures. The soldier marches under unfavourable conditions as regards clothing, equipment, and load. All of these drawbacks throw an extra tax upon the heart, and it is not surprising that some men fail to meet it, especially if the training is not progressive. The law of excitation shows that the greatest effect or disturbance is produced by a sudden change; by slowly progressive training a man can, even under unfavourable conditions, perform with little risk work which would be impossible without such training. There is very little doubt that Clifford Allbutt is correct in his view that a properly trained person, man or boy, need never fear cardiac strain.

In conclusion, I wish to say one or two words upon the question of treatment and prevention of disordered action of the heart. My experience of the “soldier’s heart” is naturally limited, but, from the cases I have seen with Lieutenant-Colonel Simpson, I am convinced that hospital life is not suitable for such cases. The heart is a muscle. If it is strained, rest may enable it to recover; but if it is only weak and disordered in action, rest will make it weaker still. Inaction and the knowledge that his heart is not right have a bad effect upon any man. The heart is improved by progressive exercise, and it is known that many men discharged for disordered action of the heart have become efficient workers in civil life. It is possible to pay too much attention to a rapid and irregular pulse after exercise, and it is probable that men with “soldier’s heart” would be better treated if they were classed, not as cases of heart disease, but as men of inferior or defective physique who require a special training and discipline.

Colonel Wardrop and Colonel Cottell maintain that many of the men discharged for disordered action of the heart might be retained and become useful soldiers. The saving of men and money would be a great gain to the State; the advantage to these
men would be as important, for they would not leave with the
impression that they were unfit for work and the victims of heart
disease and military service. The Army would also gain, for the
criticism sometimes made that men are first broken down and then
discharged would fall to the ground.

The prevention of disordered action of the heart could no doubt
be extended by more attention to progressive training in the
gymnasium and in route marching. The soldier would profit by
more constant and harder work, as against work suddenly under­
taken without adequate training.

DISCUSSION.

Dr. JAMES MACKENZIE asked whether men were admitted to hospital
or rejected for service because they had a murmur, or because they broke
down; many healthy hearts did show a murmur, and he thought the
rejection of recruits for a murmur alone was a mistake.

Surgeon-General BRANFOOT attributed disordered action of the heart to
cigarette smoking.

Dr. Moir asked whether anyone had noted a connection between tall
men and disordered action of the heart; he thought small men were likely
to make better soldiers as far as the heart was concerned. An abnormally
slow pulse was bad: such cases were liable to syncope.

Lieutenant-Colonel DEANE said he no longer believed that the position
of attention had anything to do with soldier's heart, nor overtraining, since
the men affected were soft, flabby men. Swedish exercises were no better
than any other. He thought that clothing might have something to do
with the causation.

Lieutenant-Colonel MELVILLE suggested that the apparent increase
in heart diseases in the third year of service might be attributed to the
rejection of men coming up for foreign service. He attributed soldier's
heart to the over-exercise of recruits before they were properly fed; and
suggested that recruits should be fed up for a month before any serious
work was given to them. It was necessary to reject men with heart
murmurs, since one could not separate injurious from harmless murmurs
in a recruiting station.

Major W. S. HARRISON referred to the work of Davy in 1876. Davy
attributed soldier's heart to the compulsory position of attention, which,
as he pointed out, was accompanied by an habitual semi-expansion of the
chest and loss of action of the respiratory pump. He also referred to a
personal experiment where he found that his pulse-rate was increased by
fifteen beats when he put on a tight jacket.

Lieutenant HAYES had made some experiments for Major Harrison,
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counting the pulses of men “standing easy” (in which position it was impossible to expand the chest in the soldier’s habitual manner) and after five minutes’ standing at attention; in twenty-nine observations there was an average increase of 7.5 beats in the pulse-rate after standing at attention, the maximum increase being twenty beats, while in only three instances of the twenty-nine was there no increase in the pulse-rate.

Fleet-Surgeon Hume thought that Marines suffered more from heart trouble than bluejackets, and attributed the difference to the better feeding of the latter.

Colonel Sir David Bruce said that the distinction between valvular and functional disease of the heart was often a matter of idiosyncrasy in diagnosis. He related a personal observation when shooting. Whilst he was wearing his coat he was much oppressed and almost fainted, but when he removed his coat he was able to shoot for the rest of the day in comfort. He suggested that the proper way to solve the etiological problem was by means of a series of well-conducted experiments.