THE TREATMENT OF HEART FAILURE * GENERAL CONSIDERATIONS

BY

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The term "circulatory failure" implies that the heart is unable to maintain an output of blood adequate to meet the requirements of the body. The heart is a pump, and the ability of a pump to maintain its output depends not only upon its mechanical efficiency but also upon the adequacy of the reservoir from which it is supplied. When the cardiac pump breaks down we speak of the condition as "heart failure," but when the well runs dry we speak of it as "peripheral failure." In opening this discussion I shall confine my attention to heart failure, and will leave the problem of peripheral failure to be dealt with by later speakers.

The Cardiac Reserve

Heart failure is a relative term: it signifies that the supply is unequal to the demand. The latter varies greatly according to the habits and mode of life of the

FIG. 1.

patient. The reserve of the healthy heart is amply sufficient to meet all contingencies. In the trained athlete during severe physical exertion the heart is able to increase its output sixteenfold (Hill, 1927): in patients with advanced heart failure it is unable to satisfy the requirements of the body even at rest. Between these two extremes all intermediate degrees of cardiac efficiency and insufficiency may be observed in health and disease.

Let me illustrate these facts by a diagram. In Fig. 1 (i) the column AC represents the capacity of the heart for work in a normal healthy subject, AB being the resting or basal requirement, and BC the additional amount of work which can be undertaken without distress—that is,

the cardiac reserve. As the result of athletic training (ii) the "condition" of a normal person improves and he is able to undertake greater exertion without discomfort. The part CD represents the additional reserve of the trained athlete. The reserve of the man who leads a sedentary life (iii) and does not take sufficient exercise to keep himself "fit" falls below normal, just as that of the athlete rises above it. These three columns represent the variations which one finds in health, what we might speak of as the athletic (Ath.), average (Av.), and sedentary (Sed.) types.

The second diagram (Fig. 2) represents the variations in the cardiac reserve in a patient with advanced heart disease. Here, likewise, the reserve can be increased by treatment (ii); but if the patient neglects his treatment (iii) his reserve may fall to zero, or may even become a negative quantity—that is, the output of the heart may be less than the basal requirement of the body, which is higher in the cardiac than in the normal subject. Then, even at rest, he will manifest symptoms of cardiac insufficiency.

Disease of the heart muscle, the heart valves, or coronary arteries entails a reduction of the cardiac reserve proportional to the severity of the structural lesion. The resulting disability is of a permanent nature. Lack of exercise and toxic causes, such as focal sepsis and recent

FIG. 2.

infection, add to the disability by producing a biochemical change in the buffering mechanism in the muscles. This reduces their mechanical efficiency; they work less economically, and for the same output of energy require a greater supply of oxygen than "trained" muscles, thereby increasing the demand upon the heart. The myocardium itself suffers in a similar way. The result is twofold—an increased demand upon the circulatory mechanism and a diminished capacity of the heart to meet this demand.

Whereas the structural lesions determine the basal disability, the additional impairment of function due to lack of exercise or to other causes may be partly eliminated by appropriate treatment. Lastly, it is important to remember that in all cases of heart disease the nervous factor plays a part. To this aspect of treatment I shall refer presently.

* Read in opening a discussion on circulatory failure in the Section of Pharmacology and Therapeutics, including Anaesthetics, at the Annual Meeting of the British Medical Association, Belfast, 1937.

Types of Heart Failure

In patients with heart disease the tolerance for exercise may be limited by dyspnoea or by pain. In the past it has been customary to restrict the term "heart failure" to congestive heart failure, a condition in which the venous pressure is raised and dyspnoea is the presenting symptom. I would strongly advocate that the term "heart failure" should include angina, in which the tolerance for exercise is limited not by dyspnoea but by pain. My reasons for making this suggestion are two. In the first place the term "heart failure" signifies inability of the heart to maintain a circulation adequate to meet the requirements of the body, and it is immaterial whether this inadequacy manifests itself by dyspnoea or by pain. The mechanism of production of these two symptoms is essentially the same. When the output of the heart is insufficient to meet the requirements of the active muscles lactic acid accumulates in the body and the hydrogen-ion concentration of the blood rises. This stimulates the respiratory centre, and dyspnoea is produced. When, on the other hand, the coronary arteries are diseased the effects of anoxaemia are first felt by the myocardium, and the patient's activities are limited by pain. My second reason is that the general indications for treatment in congestive heart failure and in angina of effort are identical—namely, to adapt the life of the patient to the limitations imposed by his damaged heart; in other words, to enable the heart to balance its budget. It is now generally agreed that angina is attributable to ischaemia of the heart muscle, and I would suggest that the term "ischaemic heart failure" be applied to this type of case.

Right and Left Ventricular Failure

When one considers the causes of heart failure it is obvious that in different types of heart disease the burden falls unequally on the two ventricles. In hyperpiesia, for example, the left ventricle has to bear the strain; and not until it has given way does the right ventricle become embarrassed. Conversely, in patients with mitral stenosis or emphysema the burden falls on the right ventricle.

Failure of the right ventricle leads to venous engorgement in the systemic circuit. The veins of the neck stand out like knotted cords, the liver enlarges, and oedema makes its appearance in the dependent parts. Failure of the left ventricle, on the other hand, leads to venous engorgement in the pulmonary circuit. This is well shown in a radiograph.

In most cases of heart failure both ventricles are involved to a greater or lesser extent; but, when the left ventricle alone is at fault, there may be intense congestion in the pulmonary circuit without any oedema or engorgement of the systemic veins. Left ventricular failure manifests itself clinically by certain signs, which merit special consideration. They are paroxysmal dyspnoea, presystolic gallop rhythm, and pulsus alternans.

Paroxysmal dyspnoea or, as it is sometimes called, "cardiac asthma" differs from the more common dyspnoea of effort in that it is not brought on by exertion but occurs at rest. It often wakes the patient from sleep in the early hours of the morning. The attack itself may closely simulate bronchial asthma. A slight attack may pass off in a few minutes, but a severe one will last half an hour or more and may develop into acute pulmonary oedema. In this condition adrenaline and other asthmatic remedies fail to give relief, but morphine acts as a specific. Twenty or thirty minims of nupenthe at bedtime will often ward off attacks.

Gallop rhythm has been called "the cry of the heart for help." It is distinguished from other forms of triple rhythm by the equal spacing of the sounds, and by the fact that it is palpable as well as audible (Bramwell, 1936).

Let us now consider those therapeutic measures which are applicable both to the congestive and to the ischaemic type of heart failure.

Rest and Exercise

Since physical exertion makes the greatest demand upon the heart, the most important consideration in the treatment of heart failure is rest.

During the past eight years I have had occasion to make a special study of patients in whom heart disease was complicated by pregnancy. As pregnancy advances it imposes an increasing burden upon the heart; consequently the great danger to which these patients are exposed is the development of heart failure. Over and over again in the course of this investigation I have been impressed by the fact that, when heart failure is recognized in its early stages, the response to treatment is extremely satisfactory; whereas in patients who are admitted to hospital as "urgencies" with fully developed heart failure the mortality is very high. The secret of success in treatment is early diagnosis.

In incipient heart failure slight curtailment of the normal activities may suffice, but in advanced cases, where the patient is oedematous or is subject to anginal attacks on slight exertion, complete rest for a period of several weeks may be necessary to enable the exhausted heart to build up a reserve. Under these circumstances, the patient must be confined to bed and attended by competent nurses, who will feed him, wash him, and lift him when he wishes to change his position or to use the bed-pan. He must not be allowed to make any physical effort himself, or even to attempt to assist his nurses.

Dyspnoeic patients are more comfortable sitting up than lying flat. Some, especially the obese, find it easier to sleep in a chair, leaning forward with the forearms supported by a table and the head resting on the wrists. Whatever position the patient finds most comfortable should be adopted; and, if in bed, a bed-rest or an adjustable bed is essential in order that the whole spine, from the pelvis upwards, may receive adequate support. The feet and knees also should be supported to prevent him from slipping down. In patients with left ventricular failure this is especially important, since assumption of the horizontal position appears to be a determining factor in precipitating an attack of nocturnal dyspnoea. Skilled nursing is the most important consideration in the treatment of heart failure, for it is the only means we have of ensuring complete bodily rest.

During convalescence massage to the limbs and back is helpful in promoting the venous return to the heart and in restoring tone to muscles which have become flabby through disuse. This should be followed by resistance exercises and finally by graduated exercise.

Prophylaxis

When convalescence is complete the future still remains to be considered, and precautions to prevent a recurrence must be observed. The patient should be warned against over-exertion on the one hand and insufficient exercise on the other. Whereas the former may precipitate a further breakdown, the latter, as I have already pointed out, imposes an additional burden on the damaged heart. The advice which I give to patients with chronic heart disease may be summarized by saying that they must

lead a life of moderation in all things, taking regular exercise within the limits of their tolerance, but never making any sudden effort which entails exerting their full strength, or which gives rise to dyspnoea or precordial discomfort. For example, they must never run for a train, struggle against the wind, or attempt to start their motor car by hand. They must stop eating before they are satisfied, and sit quietly in a chair for half an hour after meals.

When walking or participating in any form of physical exertion the patient must set the pace. He must never attempt to keep up with others fitter than himself. The problem of suitable employment often presents insuperable difficulty. As in the case of physical exertion, the patient should, if possible, be his own master, and able to go to work or stay away at will.

Stair-climbing should be eliminated. A bungalow is the ideal residence for these patients. Failing that the bedroom should be on the ground floor. One whole day in bed each week is often helpful. It enables the heart to build up sufficient reserve to ward off a further breakdown.

A special danger when the cardiac reserve is limited is the added strain upon the heart of intercurrent infection. An attack of bronchitis, influenza, or even a common cold necessitates immediate confinement to bed.

Obesity imposes an additional burden on the damaged heart. Moreover, it establishes a vicious circle. By diminishing the cardiac reserve it limits exercise, and lack of exercise tends to increase obesity. To break this circle a diet low in fats and carbohydrates should be prescribed, together with massage and carefully graduated exercise.

Let me give you two examples of the dangers to which patients with chronic heart disease are especially liable. In many towns the approach to the railway station is an uphill slope. In order to ensure that passengers will arrive in time, the clock outside the station is kept five minutes fast. Having allowed himself ample time to catch his train our patient arrives at the station approach. Glancing at the clock he is horrified to find that he is late. He dashes up the slope and collapses at the top.

My second example is one which constantly recurs in the course of my practice. A business man tells me that the only time he experiences discomfort is when walking to the station after breakfast. Throughout the rest of the day he is unaware of any disability. The reason is obvious. He likes to lie in bed until the last possible moment; he bolts his breakfast and dashes off to catch his train. It is a sound rule for the patient with incipient heart failure, either of the congestive or of the ischaemic type, to sit quietly in a chair for at least twenty minutes after meals.

I should like to have devoted more time to the problem of rest and exercise; for it is, to my mind, the fundamental consideration in the treatment of heart failure. There are, however, other important aspects of the subject to which I must briefly refer. The questions of diet and of drug therapy will be dealt with by other speakers who are to follow me in this discussion. I therefore do not propose to refer to these points except incidentally, and will now pass on to consider another general problem of great importance—namely, treatment of the associated nervous phenomena.

The Nervous Factor

In the treatment of all cases of heart failure, but especially in those of the ischaemic type, the nervous aspect calls for most careful consideration. The typical anginal

subject is by no means a neurotic; but some patients are more highly strung than others, and the nervous pattern of the individual is largely instrumental in determining the clinical picture, which it may modify in various ways. In the first place the threshold of sensitivity for pain varies in different people. Other things being equal the limitations imposed on the patient's activities are much greater in the hypersensitive than in the hyposensitive subject. Secondly, in the irritable "nervy" type of individual an anginal attack may be precipitated by a relatively trivial emotional stimulus, since the detonating mechanism which fires off an attack lies dangerously near the surface. Minor annoyances will, in him, suffice to produce an emotional storm adequate to provoke an attack; whereas in the calm placid person a much more massive stimulus is required to do so. Thirdly, there is the element of anxiety, for angina is proverbially associated with sudden death.

We can do much to combat the nervous factor and thereby to reduce to a minimum the aggravation of the symptoms for which it is responsible. Bromides, luminal, and other cerebral depressants make the patient less liable to attacks and render the attacks less distressing when they do occur. Evans and Hoyle (1933) have shown that the cerebral depressants are the only group of drugs which, when given in a routine manner, reduce the frequency of attacks.

In a nervous subject stage-fright induced by having to make an after-dinner speech, or, in an irritable business man, shortness of temper provoked by a heated discussion at a board meeting, may be warded off by a prophylactic dose of bromide. In passing I have referred to the use of opiates in the treatment of paroxysmal dyspnoea. Similarly in acute congestive heart failure morphine is a most valuable drug. By allaying both physical discomfort and mental anxiety it helps to achieve that peace of body and mind which is so essential to effective treatment. When, in acute heart failure secondary to auricular fibrillation, urgency demands the administration of digitalis by the massive-dose method I generally give a hypodermic injection of 1/4 grain of morphine before the first dose of digitalis. Many practitioners fail to realize that the danger of giving an opiate to cardiac patients may be far less than the danger of withholding it.

Anxiety figures prominently in the picture of heart disease. To disregard this "complication" and to make no attempt to alleviate the mental suffering is to neglect an important aspect of treatment. To achieve success in this sphere the physician must possess both sympathy and understanding. He must be able to put himself in the patient's shoes and to regard the case from the patient's point of view. When illness is prolonged the possible physical damage that may result from allowing a man to return to his work too soon must be carefully weighed against the mental trauma when he sees his business going to pieces and the future of his dependants at stake.

Surgical Measures

I hope that later speakers will refer to the surgical measures which have been employed in the treatment of heart failure. These merit consideration, though, in my opinion, they must still be regarded as being in the experimental stage. Complete thyroidectomy by lowering the basal metabolism reduces the heart's liabilities, and might therefore be indicated on theoretical grounds. In congestive heart failure the results of this operation have not come up to expectation, but in angina they have proved more promising.

Operations such as sympathectomy serve to relieve pain, but I cannot help doubting whether these procedures are justified, except in cases where all other methods of treatment have failed; for in angina pain is a danger signal which warns the patient that he is overtaxing his heart, and if we relieve the pain without eradicating the cause of the disease we may be depriving him of his only safeguard.

Minor surgical procedures such as paracentesis of the chest or abdomen may be necessary when the heart is embarrassed by large effusions.

Venesection

It is no exaggeration to say that the therapeutic procedure which earned for our predecessors the nickname of "leech" is an emergency measure of the greatest value. It is equally applicable to right and to left ventricular failure. The indications which should lead one to employ it are venous engorgement with cyanosis in the former and acute pulmonary oedema in the latter.

With regard to the technique of this small operation it is desirable in nervous subjects to anaesthetize the part with novocain. For constricting the arm the sphygmomanometer bandage is much more convenient than a rubber tourniquet. With it one need not employ a pressure of more than 50 mm., and this can be easily regulated. The patient should be made to clench and unclench his fist a few times, so that the veins stand out, and for the actual puncture I find the tapered needle designed by French a great improvement on the common type cut from a tube of uniform bore. To prevent clotting the needle may be sterilized by heat and carried in a tube of sterile liquid paraffin. It should be inserted bevel side downwards. The vein should be steadied between the forefinger and thumb of the left hand, and in fat persons in whom it is deeply buried it must be located by touch. The blood may be allowed to flow under its own pressure or aspirated off by connecting the needle to a receiver in which a slight negative pressure is maintained by means of a pump.

Conclusion

In Fig. 3 I have attempted to summarize diagrammatically the therapeutic possibilities in the treatment of heart failure of the ischaemic type. A similar diagram could be devised for the congestive type.

FIG. 3.—In this diagram the black area represents the cardiac reserve in I, the normal subject; II, the patient with angina before treatment; and III, the same patient after treatment.

In columns II and III the various factors which limit the cardiac reserve in the anginal patient are indicated. This limitation is due in part (DE) to an increased basal requirement and an increased cardiac load, and in part (AC) to impaired myocardial efficiency.

In the normal healthy subject (F) the cardiac reserve (AE) far exceeds the basal resting requirements of the body (EF). In the patient suffering from angina (II), on the other hand, the cardiac reserve (CD) is greatly

reduced. The reduction is in part attributable to impaired efficiency of the heart itself (AC). This depends on various factors, of which the most important is insufficiency of the coronary circulation (AB). Structural changes in the coronary arteries and in the myocardium are of a permanent nature, and therefore beyond the scope of therapeutic measures. As I have already pointed out, however, the nervous factor is of great importance in determining not only the sensitivity to pain but also the liability to attacks. This can, in part at least, be controlled by cerebral depressants. Similarly we may be able to eliminate toxic factors—such, for example, as tobacco and focal sepsis. By these means the efficiency of the damaged heart can be increased from DC to DC'. We may likewise hope, by suitable treatment, to lighten to some extent the load imposed upon the heart by such factors as obesity and high blood pressure, thereby increasing the cardiac reserve from CD to CD'. That marks the limit of possible therapeutic achievement. When it has been attained the patient must be content to limit his activities to meet his reduced exercise tolerance CD'.

Briefly our aim in treatment is to enable the heart to balance its budget by increasing its intrinsic assets and by reducing its extraneous liabilities.

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THE ASSESSMENT OF "STATE OF NUTRITION" AND THE DETECTION OF MALNUTRITION*

BY

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In many parts of India the poorer classes—that is, the vast majority of the population—live on a diet largely composed of rice or millet, which contains in addition a little pulse and very small quantities of vegetables, but no milk, eggs, or meat. Such a diet is thoroughly deficient, in terms of "generally accepted" Western standards, and, apart from qualitative defects, the diet of the poorer classes is often insufficient in quantity. *A priori*, we should expect to find plenty of "malnutrition" resulting from diet deficiency among Indian children on a rice staple. I propose to give an outline of certain investigations of the "state of nutrition" of Indian children indicating the direction in which we are moving. Our work is still in the preliminary stage.

We started the inquiry with no idea of what we should find, since practically no previous work on the subject had been carried out in India. This is a very agreeable situation for the research worker, nowadays a somewhat rare one. A little scepticism about "generally accepted" dietary standards is pardonable; conceivably investigation would reveal bouncing, thriving children living on a diet which outrages all the principles of modern dietetics, to the consternation of the nutrition commissions of the League of Nations. I may say at once that on the whole our observations confirm modern ideas about diet. Indeed,

* Read in the Section of Nutrition at the Annual Meeting of the British Medical Association, Belfast, 1937.