THE TREATMENT OF CONGESTIVE HEART FAILURE

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FOR purposes of practical therapeutics, congestive heart failure can be divided into two types. In the more common of these, decompensation is the result of intrinsic myocardial disease. For all cases of this kind treatment is the same regardless of underlying etiology. In the less common form, failure is due, not to primary myocardial damage, but to some systemic disease or local pathologic disorder which either increases the demands on the heart for work or interferes with the ability of the myocardium to maintain adequate circulation. Examples of this form of decompensation are cases due to thyrotoxicosis, myxedema, beriberi, severe anemia, arteriovenous aneurysm, patent ductus arteriosus, coarctation of the aorta and chronic constrictive pericarditis. In this group treatment by the measures employed in the common form of failure is of no lasting value. A satisfactory result depends on the medical or surgical correction of the causative condition, and a number of notable advances have been made along this line within the past several years. Parallel with this progress, intensive research on the pathologic physiology of the common type of decompensation has resulted in important changes in therapy. Today, as a result, most persons suffering from an initial attack of the common form of failure can be restored to a comfortable and useful state of health and often can be maintained in this condition for many years by careful supervision of activities, diet, medication and living habits. Treatment of the more common type of congestive failure will be the subject of the remainder of this discussion.

Rest. A period of strict rest is an essential part of the management of every case of myocardial failure, and with few exceptions the first part of this period should be spent in bed. Levine[1] has pointed out that the sudden enforcement of the conventional type of bed rest may have harmful effects. These are to be regarded as complications against which suitable precautions must be taken, and the possibility of their occurrence does not detract from the importance of rest itself. In patients with congestive failure, the recumbent position, through the effect of gravity, brings about a shift of edema fluid from the lower to the upper portions of the body. This often results in prompt diminution in the edema of the lower extremities, but, unless proper treatment has been instituted, edema may simultaneously appear or increase over the back and the evidence of pulmonary congestion may become more apparent. Hydrothorax may develop for the first time. The recumbent position also facilitates the return flow of blood to the heart and, by favoring absorption of edema fluid from the legs into the blood stream, results in an increase in circulating blood volume.[2] The load upon the heart is therefore augmented, and unless corrective steps are taken a decided increase in the degree of failure

may result. These undesirable effects can be avoided by prompt and vigorous treatment with digitalis and diuretic drugs, and, in patients with severe decompensation and considerable edema, by the use of shock blocks or kitchen chairs under the head of the bed. The latter measures were proposed by Levine, and their use readily convinces one of their value.

Except for the use of a commode at the bedside, rest in bed is continued until the patient has become comfortable and has lost most of his edema. He is then allowed up in a chair for as long each day as he desires but is assisted in and out of bed. In cases of more than mild degree, no additional privileges are granted for from four to six weeks. Gradually increasing activity is then permitted, but precautions must be taken to avoid dyspnea and fatigue, and there must be careful observation for gain in weight and any return of edema.

Digitalis. Digitalis remains the most valuable drug in the treatment of congestive heart failure. Every patient suffering from failure should be completely digitalized, and with few exceptions the digitalized state should then be maintained permanently. Digitalis leaf may be administered in pills, tablets or capsules whose potency has been adjusted to conform to the international standard, or one may employ one of the purified glycosides, such as digitoxin. The dosage schedule ordered in any instance is determined entirely by the urgency with which the effect of digitalis is needed. The purified glycosides have no special advantage over whole digitalis leaf, either in the way of clinical effectiveness or in simplicity of dosage. The aim in administering any preparation of digitalis is to secure the maximum therapeutic effect of the drug without producing toxic symptoms. The established average amounts necessary to attain this goal are of value only as a general guide, and the amount actually administered in any case must be individualized for the particular patient being treated. Maintenance of a satisfactory state of digitalization often is more difficult with purified glycosides than with the whole leaf. The reason for this is that certain of the purified preparations are excreted more rapidly than are the products of the whole leaf, and others are eliminated much more slowly with a consequent tendency to cumulate in the body.

When auricular fibrillation is present, the ventricular rate furnishes the most helpful guide as to whether or not the maximum therapeutic effect of digitalis has been obtained. The drug is given in amounts sufficient to reduce the rate, in the absence of fever, severe anemia and hyperthyroidism, to approximately 70 beats per minute. When normal rhythm is present, the heart rate is of no aid in estimating the degree of digitalization, and one must then prescribe the amount of the drug required by the average patient and be guided by the general clinical response. Once the patient has been satisfactorily digitalized, this state usually can be maintained by the administration of 0.1 Gm. of the whole leaf on five to seven days of each week.

There are no contraindications for the administration of digitalis to patients who have congestive heart failure. In the presence of frequent ventricular premature beats or auriculoventricular block of either first or second degree, however, digitalization should be accomplished gradually and with electrocardiographic control. It has long been considered dangerous to employ

digitalis in patients suffering from ventricular paroxysmal tachycardia, the fear being that the drug, by increasing the irritability of the myocardium, might convert the arrhythmia to ventricular fibrillation. This apprehension now appears to have been needless. The treatment of choice for ventricular tachycardia consists of efforts to abolish the disturbance by the oral or intravenous administration of quinidine or Pronestyl®. If in spite of these drugs the arrhythmia persists and signs of decompensation appear, digitalis should be given in an effort to support the failing myocardium.

The oral route of administration is the one of choice for digitalis and can be employed in all but an occasional patient. At times, a condition is present which causes vomiting or prevents the taking of drugs by mouth, and intramuscular injection must then be resorted to. Several preparations are available for use in this manner. For those which contain one cat unit of digitalis in 2 cc. of solution, an initial dose of 10 cc. can be followed in four to six hours by a second injection of the same amount. The process of digitalization is then completed by administering 2 cc. two or three times a day until the full effect of the drug is obtained.

The absorption of digitalis from muscular tissue is no more rapid than is absorption from the gastrointestinal tract. In true cardiac emergencies, therefore, where a delay of even a few hours in securing the effect of the drug might mean the difference between a successful and a fatal outcome, intravenous administration of a digitalis preparation is indicated. Instances of this kind are uncommon. The preparations mentioned for intramuscular use may be given also by intravenous injection, and the dosage is the same by either route. If one prefers, ouabain, digitoxin, or Cedilanid® can be employed. When ouabain is used, the initial dose is usually 0.5 mg., and this is followed by additional injections of 0.1 mg. to 0.25 mg. every four to six hours until a total of not more than 1.0 mg. has been given. For digitoxin, intravenous dosage is the same as for oral administration, namely 0.8 mg. (4 cc.) followed in four to six hours by 0.4 mg. If Cedilanid® is employed, 0.8 mg. (4 cc.) usually is given initially, followed in four to six hours by a second injection of 0.4 mg. to 0.8 mg. After one of these schedules has been finished, the process of digitalization is completed by oral administration of digitalis or, if this is not possible, by intramuscular injection of a suitable preparation in the manner already outlined. It is, of course, essential to be certain that patients to whom ouabain or digitalis preparations are to be given intravenously have not received digitalis during the preceding two weeks.

Diet. The most significant change in the treatment of congestive heart failure in recent years has been the adoption of diets of restricted sodium content. Formerly it was customery to limit the fluid intake of patients suffering from cardiac decompensation and pay little attention to the amount of salt in the food. This has been changed entirely as a result of repeated demonstration that sodium retention on a renal basis is a cardinal feature of congestive failure and the most important factor responsible for water retention and the development of edema. There is uniform agreement today that the diet of patients with myocardial failure should contain not more than 500 mg. of

sodium per 24 hours. Restriction of fluids is unnecessary and may even be harmful. The most satisfactory results are obtained when the patient takes between 2 and 3 L. of water daily, and whenever an individual is unable to drink this much, it appears advisable to administer sufficient 5 per cent glucose solution in distilled water by intravenous drip to bring the total fluid intake up to the desired level.

The preparation of a low sodium diet can be accomplished in the home without great difficulty if specific instructions are given. No salt is used in cooking, all salted foods are eliminated, and only salt-free bread and unsalted or washed butter are allowed. Canned foods to which salt has been added during processing, and all foods prepared with baking soda or baking powder are prohibited. Medicines and proprietary preparations which contain sodium must not be used. A sodium free salt substitute may be taken if desired.

In patients who respond well to treatment and maintain a satisfactory state as they increase their activities, the limitation of sodium intake often can be lightened. Only occasionally, however, can the daily allowance be increased beyond 1500 mg.

Diuretics. Although many individuals who have congestive failure will recover satisfactorily when treated by means of rest, digitalis, and a low sodium diet without other measures, the additional use of diuretic drugs hastens improvement and more promptly restores the patient to a state of comfort. Their administration, therefore, is indicated in every case. The most effective preparations for routine use are the organic mercurial compounds, and of the members of this group Mercuhydrin® is the one most extensively employed at present. This preparation can be given by intravenous or intramuscular injection, but the intramuscular route is preferred because of its greater safety.

In the early stages of treatment, mercurial diuretics are given daily, the initial dose of 0.5 cc. being increased to 1.0 cc. and then to 2.0 cc. whenever the patient fails to lose three pounds in 24 hours. Gold and his associates[3] have demonstrated that daily injections can be given safely to all persons in whom the output of urine is within normal limits. Excessive diuresis should be guarded against, especially in elderly individuals, because of its prostrating effect, the danger of inducing the "low salt syndrome" and azotemia, and because rapid dehydration may favor the development of phlebothrombosis and subsequent pulmonary embolism. After all edema has disappeared and the daily injection fails to cause further diuresis and loss in weight, the interval between doses is lengthened gradually, and in favorable cases the drug is eventually discontinued.

Although reactions to Mercuhydrin® are not common, there is one type which seems to have increased in incidence since it has become such standard practice to administer the drug at frequent intervals. Reactions of this kind appear to be due to the development of hypersensitivity to the mercurial component of the drug. Whitman and Proudfit[4] observed that they occur only after a series of 6 to 11 daily intramuscular injections. In the fully developed form, the reactions are characterized by fever, often preceded by a chill and usually accompanied by muscular aching and general malaise. In some patients

there also is nausea, vomiting, pain in the abdomen or anterior chest, or transient erythema of the face, neck and upper trunk. The symptoms usually last for 12 hours or less but recur with increasing severity after each subsequent administration of the drug. Because the first evidence of developing hypersensitivity of this kind usually consists of mild fever of short duration, close attention should be paid to the temperature chart whenever mercurial diuretics are being given at daily intervals. Changing to a different mercurial preparation avoids further trouble.

It is seldom necessary or advantageous to administer ammonium chloride simultaneously with a mercurial diuretic. Ammonium chloride is helpful at times, however, in doses of 4 to 8 Gm. daily, in preventing a return of edema after the patient has become ambulatory. Its effectiveness may possibly be increased by giving it for four consecutive days followed by a rest period of three or four days.

Cation Exchange Resins. A recent addition to the treatment of congestive heart failure and one of considerable interest has been the use of cation exchange resins. These substances have the capacity to take up sodium in limited amounts in the intestinal tract, and in certain patients their administration permits liberalization of the sodium content of the diet. It must be emphasized, however, that resin is not a complete substitute for salt restriction for, in spite of its use, sodium intakes of more than 1500 mg. daily usually result in reappearance of edema.

Klingensmith and Elkinton[5] have pointed out situations in which cation exchange resins are often helpful. In patients in whom congestive heart failure resists the usual measures of treatment, the addition of resin may result in diminution of edema. In others, who respond satisfactorily to treatment but require periodic injections of a mercurial diuretic to remain free from edema, the administration of resin may substitute partially or completely for the diuretic drug. Finally, persons who are hypersensitive to mercurial diuretics may experience diuresis and diminution in edema from the use of exchange resin. Unfortunately, about one-half of the patients to whom resin is administered experience anorexia, nausea, vomiting, abdominal cramps, diarrhea or constipation; and in many these symptoms are of sufficient severity to force discontinuing the preparation.

Resin should not be given to patients who have renal failure. If this precaution is taken and if a combination of ammonium and potassium cycle resins is employed, important alterations in the potassium content of the blood serum need not be anticipated. Adequate calcium and a mixed vitamin preparation should be given during the period of resin therapy in order to guard against calcium and vitamin depletion.

Anticoagulant Drugs. Embolic occlusion of an artery in the pulmonary or systemic circulation is a common complication of congestive heart failure. Emboli to systemic arteries arise from thrombi in the left atrium or its appendage in patients who have auricular fibrillation or mitral valve disease, or from mural thrombi in the left ventricle when congestive failure occurs as a complication of acute myocardial infarction. Pulmonary emboli, on the other hand, originate

much more frequently from areas of phlebothrombosis in the lower extremities than from the right auricle or ventricle.

There is evidence[6] that the incidence of thrombo-embolic accidents in cardiac decompensation can be reduced significantly by the administration of anticoagulant drugs. It is our opinion, therefore, that Dicumarol® should be employed in all cases of severe failure, in all elderly persons, and in those who have decompensation with auricular fibrillation, auricular flutter, mitral valve disease or recent myocardial infarction. The drug should not be used, however, unless facilities are available for accurate measurement of the prothrombin time of the blood, and should not be given to patients who have hepatic insufficiency or a blood dyscrasia with hemorrhagic tendencies.

Morphine and Sedatives. Persons suffering from congestive failure of moderate or severe degree frequently have had no restful sleep for many nights, and this contributes importantly to their exhaustion and apprehension. In all such cases, morphine should be administered either when the patient is first seen or in the evening of that day. In severe failure, the use of morphine may be necessary on the following two or three nights, but after this, milder preparations such as one of the barbiturates, usually suffice. Mental as well as physical rest is important, and in restless, worried, or emotionally tense individuals, a relaxing sedative, such as a small dose of phenobarbital, is advisable two or three times a day during the early part of treatment.

Oxygen Therapy. The use of oxygen is unnecessary in the great majority of patients who have congestive heart failure. When moderate or severe cyanosis is present, however, or when dyspnea persists with the patient well elevated in bed, oxygen often has a decidedly beneficial effect. Oxygen therapy also is of value in combating the dyspnea and anoxia of certain complications of myocardial failure, such as pulmonary embolism, acute pulmonary edema, and pneumonia.

Venesection, Thoracentesis and Abdominal Paracentesis. In myocardial failure of the combined right and left ventricular type, the peripheral venous pressure is increased approximately in proportion to the degree of decompensation. When failure is severe, the jugular veins often are engorged to the angle of the jaw with the patient sitting upright. Venesection should be performed in such instances with the removal of 250 cc. to 500 cc. of blood, and the same procedure should be carried out in less advanced cases whenever digitalis therapy and the other measures mentioned previously fail to produce a satisfactory response. Venesection directly reduces venous congestion and diminishes the degree of dilatation of the heart. In favorable cases, the venous pressure remains low after having been reduced by the removal of blood, but in unfavorable situations peripheral venous congestion promptly returns.

Severe congestive failure often is attended by the accumulation of large amounts of fluid in one or both sides of the thorax. The resultant compression of the lungs further reduces the already diminished vital capacity and by so doing increases the degree of dyspnea. Whenever extensive pleural effusion is

present, therefore, the fluid should be removed as completely as possible by prompt thoracentesis.

Although ascites is a not infrequent complication of advanced decompensation, the amount of fluid seldom is sufficient to embarrass respiration seriously or add importantly to the patient's distress. Occasionally, however, and especially in rheumatic heart disease with mitral stenosis and tricuspid insufficiency, fluid accumulates to such a degree that the abdomen becomes greatly distended and the diaphragm markedly elevated. Removal of the fluid in such a circumstance often gives striking relief from dyspnea.

Estimation of Clinical Progress. There are a number of guides which can be used in estimating the response to treatment of congestive heart failure. Of these, the most important are relief from such symptoms as dyspnea, cough and malaise, the occurrence of diuresis, disappearance of clinical edema, clearing of the evidence of passive congestion in the lungs and liver, improvement in the vital capacity of the lungs, return of the peripheral venous pressure to normal, control of the ventricular rate when auricular fibrillation is present, and the course of the weight curve. It must be remembered that a considerably increased volume of extracellular fluid may still remain in the body after all apparent edema has disappeared. Convalescence cannot be considered satisfactory until this subclinical edema also has been eliminated. This is the reason why Gold[3] places such emphasis on the patient's weight curve and is the main consideration for recommending the use of mercurial diuretics at whatever intervals and for whatever length of time are necessary to maintain the minimal weight and a relatively constant output of urine.

In conclusion, although the majority of persons who have had congestive heart failure eventually die of a recurrence of the condition or of some other complication of the underlying heart disease, the treatment of myocardial decompensation should not be a matter of pessimism. Management according to the principles which have been outlined will restore many patients to a useful and self-supporting state for long periods of time and will contribute greatly to the comfort of the less fortunate ones who cannot be helped beyond a life of semi-invalidism.

Summary

(1) The essential features of the management of congestive heart failure consist of a period of rest, restriction of the sodium content of the diet, and the administration of digitalis, mercurial diuretics, and sedatives. In selected cases, cation exchange resins, anticoagulant drugs, oxygen, venesection, and the mechanical removal of fluid from the thorax or abdomen are useful adjuncts to treatment.

(2) A period of rest is necessary in every case of myocardial failure. Precautions must be taken, however, to prevent possible harmful effects of the recumbent position.

(3) The diet should contain not more than 500 mg. of sodium per 24 hours. In favorable cases, the limitation on sodium intake often can be lightened sub-

sequently, but only occasionally can the daily allowance be increased beyond 1500 mg.

(4) Every patient suffering from cardiac decompensation should be completely digitalized, and with few exceptions the digitalized state should be maintained permanently. For oral use, the purified glycosides have no special advantage over whole digitalis leaf. Intravenous administration of digitalis preparations is necessary only in true cardiac emergencies.

(5) Mercurial diuretics by intramuscular injection are indicated in every case of congestive failure. They usually are given daily in the early part of treatment. Excessive diuresis should be avoided, and close attention should be paid to the temperature chart for the first evidence of developing hypersensitivity.

(6) Cation exchange resins are definitely not a complete substitute for sodium restriction in the diet, but they are of value in certain selected situations.

(7) The incidence of thrombo-embolic complications in myocardial failure can be reduced by the administration of Dicumarol.(TR) Anticoagulant therapy should be employed in all cases of severe failure, in all elderly patients, and in those who have decompensation with auricular fibrillation, auricular flutter, mitral valve disease or recent myocardial infarction.

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