

THE TREATMENT OF CONGESTIVE HEART FAILURE

A. CARLTON ERNSTENE, M.D.

Section on Cardiovascular Disease

CONGESTIVE myocardial failure is one of the most important problems in clinical medicine. It may result from any form of heart disease. Among the less common causes are cardiac conditions secondary to hyperthyroidism, myxedema, beriberi, severe anemia, and arteriovenous aneurysm. In this group the principal measures of treatment are directed toward correcting the underlying disorder. The majority of cases, however, are consequent to the more common types of heart disease. In these, treatment is not determined by the etiology of the condition but consists of well established procedures which are applicable in all instances. Intensive research on the pathologic physiology of congestive failure during the past few years has resulted in the adoption of important changes in therapy which in turn have considerably improved the outlook of the individual patient.

Rest. A period of rest in bed is an essential part of the management of every case of congestive heart failure. Levine¹ has pointed out that the sudden enforcement of the conventional type of bed rest may have certain 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 into the blood stream, results in an increase in the 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. Occasionally it may be advisable to allow the patient to spend the first few days in a comfortable chair with the feet dependent, but just as soon as improvement has been initiated, he should be transferred to bed.

It is our opinion that in every case of congestive heart failure of more than slight degree, bed rest should be continued for at least six weeks. If there is difficulty in the use of the bed pan and the patient is improving satisfactorily,

the program may be modified after ten days or so by allowing the use of a commode or a daily trip to the bathroom, but no other exceptions should be made. After completion of the period in bed, gradually increasing activity is permitted, but precautions must be taken to avoid dyspnea and fatigue, and there must be careful observation for a gain in weight and any return of edema.

Digitalis. Digitalis remains the most valuable drug in the treatment of congestive heart failure. Every patient in failure should be completely digitalized, and the state of digitalization 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. Digitoxin has the advantages of causing less gastric irritation than do preparations of digitalis leaf and of being susceptible to chemical assay. The former feature makes it possible to digitalize patients rapidly without causing nausea and vomiting. It has become our practice, in individuals who have not been taking digitalis previously, to begin treatment by the administration of 0.8 mg. of digitoxin, followed in six hours by a dose of 0.4 mg. This constitutes the average amount of the drug necessary to digitalize a patient.

When auricular fibrillation is present the ventricular rate furnishes the best guide as to the completeness of digitalization, provided the patient does not have hyperthyroidism. If, in the absence of thyrotoxicosis, the ventricular rate is still above 70 beats per minute on the day after beginning treatment, digitoxin is prescribed in doses of 0.2 mg. twice daily or digitalis in doses of 0.1 Gm. two or three times daily. This schedule is continued until the desired control of the ventricular rate has been accomplished or the first evidence of digitalis overdosage appears. The dose is then reduced to 0.2 mg. of digitoxin or 0.1 Gm. of digitalis on five to seven days of each week, and this maintenance amount is continued indefinitely.

When the heart rhythm is normal, the ventricular rate cannot be used as a guide to the degree of digitalization. Digitoxin, therefore, is given according to the initial schedule outlined above, and on the second day of treatment the patient is placed upon a maintenance dose of either digitoxin or digitalis. In large individuals a somewhat greater amount, such as digitoxin 0.2 mg. twice daily or digitalis 0.1 Gm. two or three times a day, may be continued for a day or two. Overdosage with digitoxin causes nausea, vomiting, and other manifestations of intoxication, just as do excessive amounts of digitalis. As in the case of digitalis, these symptoms probably are the result of a direct toxic effect of the drug on the heart.

It may be objected by some that rapid digitalization as accomplished by administering digitoxin according to the outline given is not necessary in the majority of cases of congestive failure. Most patients who have decompensation are seen before the condition has reached a far advanced stage, and in the past they have responded satisfactorily when the process of digitalization has been spread over a period of several days. However, if the maximum therapeutic effect of the drug is obtained more rapidly by the use of digitoxin, the patient begins to improve more promptly and becomes comfortable earlier.

Furthermore, in individuals who have extensive edema, rapid digitalization helps greatly in preventing the possible untoward effects of suddenly instituting a program of strict rest in bed.

Except for the uncommon arrhythmia ventricular paroxysmal tachycardia, there are no contraindications for the use of digitalis when congestive heart failure is present. In patients who have partial heart block of either first or second degree, however, and in those who have frequent ventricular premature beats, digitalization should be accomplished gradually and the electrocardiogram should be checked daily.

The oral route of administration is the one of choice for digitalis and digitoxin 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 administration must be resorted to. Several preparations are available for use in this manner. For those which contain 1 cat unit of digitalis in 2 cc. of solution, an initial dose of 10 cc. can be given and 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 therapeutic effect of the drug is obtained or evidence of overdosage appears. Whenever digitalis is given by any route, it is desirable, of course, to avoid the production of toxic symptoms.

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. Cases of this kind are uncommon. The preparations mentioned for intramuscular use may also be given by intravenous injection, and the dosage is the same by either route. If one prefers, ouabain, digitoxin, or cedilanid may 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 administered. 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, the usual schedule is 0.8 mg. (4 cc.) 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 digitoxin 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 introduction and general use of diets of restricted sodium content. Formerly it was customary 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, probably 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 quite uniform agreement today that the diet of patients with myocardial failure should contain less than 2 Gm. of sodium chloride per twenty-four hours. Restriction of the fluid intake is unnecessary and may even be harmful. The most satisfactory results are obtained when the patient takes between 2 and 3 liters 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.

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 mercurhydrin is the one most extensively employed at present. This preparation is equal to the other members in diuretic action and is less toxic. It can be given by intravenous or intramuscular injection, but the intramuscular route is preferred because of its greater safety. It was customary formerly to administer the drug at intervals of three to five days, but Gold and his associates³ are of the opinion that such intervals between injections serve no useful purpose. They recently recommended daily administration until no further diuresis results and the patient's weight remains stationary. No undesirable effects were observed from this procedure in a large series of cases, and they are convinced, therefore, that daily injections may be given safely to all patients in whom the output of urine is within normal limits. An initial dose of 0.5 cc. is advised, and this is increased to 1.0 cc. and then to 2.0 cc. whenever the individual fails to lose 3 pounds in twenty-four hours. 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.

When mercurial diuretics are employed, no advantage results from the simultaneous administration of ammonium chloride by mouth. The latter preparation 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. In other patients, synthetic theophylline in doses of 0.1 Gm. three times a day is effective when given for the same purpose.

Morphine and Sedatives. Persons suffering from congestive failure of moderate or severe degree frequently have gone for many nights with little restful sleep, and this contributes considerably 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. A night of comfortable sleep often produces a remarkable improvement in general condition and morale. 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 mild sedative, such as a small dose of phenobarbital, is advisable two or three times a day during the early part of treatment.

Venesection and Thoracentesis. In myocardial failure involving the right as well as the left ventricle, 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 even with the patient sitting upright. Venesection should be performed in such instances with the removal of 500 cc. or 600 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.

Advanced 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 pleural effusion of moderate or greater degree is present, therefore, the fluid should be removed as completely as possible by prompt thoracentesis.

Estimation of Clinical Progress. There are a number of guides which can be used in estimating the patient's response to treatment. 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 and the patient has become comfortable. Convalescence cannot be considered satisfactory until this subclinical edema also has been eliminated. This is one of the reasons why Gold places great 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 patients 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 failure 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.

References

1. Levine, S. A.: Some harmful effects of recumbency in treatment of heart disease. *J.A.M.A.* **126**:80-84 (Sept. 9) 1944.
2. Perera, G. A., and Berliner, A. W.: Relation of postural hemodilution to paroxysmal dyspnea. *J. Clin. Investigation* **22**:25-28 (Jan.) 1943.
3. Gold, H., *et al.*: System for routine treatment of failing heart. *Am. J. Med.* **3**:665-692 (Dec.) 1947.