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ADMINISTRATION OF DIGITALIS*

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Digitalis has been known to medical science since it was brought to its attention in 1785 by William Withering. Although that is approximately a hundred and forty years ago, we have yet no drug which can replace it in the treatment of heart disturbances. The history of digitalis is a most interesting story. Perhaps its most interesting phase is the correctness of the first observation which, though discredited during much of the early work, has finally been proven to be correct.

For therapeutic application digitalis has been prepared in many different ways. The strength and assay of these preparations varied greatly, and as a result dosage was difficult. It was not until 1918 that standardization of digitalis became uniform. Since this time, however, the U. S. P. tinctures or the powdered leaf can be depended upon for assay. It is no longer necessary to use special preparations which are much more expensive to the cardiac patient.

The actions of digitalis upon the animal organism are many. These are all less or secondary to its effects upon the heart. This action, which is usually that of increasing the strength yet slowing the beat, is due to a combination of effects. Both vagal stimulation and direct action upon cardiac musculature play their roles in producing this heart

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effect. We have been taught that digitalis thus acts as a heart stimulant to whip up heart work. Why do we obtain good results in whipping up a tired and fatigued organ?

During the past year Starling and his coworkers have shown us that heart efficiency is inversely proportional to diastolic volume, that is, the amount of oxygen consumption needed to obtain the most efficient amount of work depends upon the diastolic volume. They also showed digitalis decreases this diastolic volume. This gives us our first satisfactory answer on the beneficial results of digitalis in heart failure. We can now think of digitalis, not as a cardiac stimulant but as a cardiac tonic which increases heart efficiency when properly used.

Withering told us to use digitalis until its action was noted on "the kidneys, the stomach, the pulse or the bowels; let it be stopped upon the first appearance of any one of these effects." This dictum clinically holds today, having been again reproven by Sir James Mackenzie.

Why do we obtain good results with digitalis in some failing hearts and poor results in others? It has been stated that we may have definite types of heart failure, some of which are not helped by digitalis. In the light of our present knowledge this has not been proven. It seems more reasonable to presume that when digitalis fails, it has done so because the dose may have been insufficient, the heart may lack recuperative power, the circulatory disorder may have been extracardiac in origin, or occasionally the preparation may be of low potency.

The clinical indications for digitalis are definite. It should be used in every failing heart, in auricular

fibrillation with tachycardia and usually in auricular flutter. In these conditions one need have no fear of using massive doses until the desired effect is obtained. The signs of toxicity are nausea, vomiting, bowel disturbance, such as diarrhea, pronounced slowing of the pulse, bigeminal pulse and heart-block. The therapeutic effect is usually obtained before any of the toxic manifestations present themselves and careful observation will indicate the time to withdraw the drug before toxicity is present. (However, if toxic manifestations do arise, immediate withdrawal of the drug leaves the patient no worse off). A second use of digitalis is in heart strain. Here the indications are perhaps more vague. Experience is needed to pick out those cases that will do best. However, the dosage in these cases is small and no harm could possibly come from such use.

The contraindications for digitalis have been overstressed in the author's opinion, providing one bears in mind the true concepts for its use. These contraindications have arisen because of misconception and have produced fears which on the whole have done more harm than good. The bogy of heart-block, as pointed out by Reid, does not exist. He says, "As far as I am aware there are no records of adequately studied patients who have died solely as a result of digitalis-induced heart-block." He further states, "Digitalis is often of benefit in complete heart-block with insufficiency of the heart. It is occasionally beneficial to convert partial into complete heart-block."

The fear of using digitalis in arterial hypertension has been shown to be wrong. Luten has shown that blood pressure, whether high or low in decom-

pensation, apparently tends to approach the normal when the cardiac efficiency is improved with digitalis. The pronounced nausea and vomiting often blamed upon digitalis are many times due to the passive congestion and relieved with digitalis. Aortic regurgitation and pulsus alterans have been advanced as contraindications for the use of digitalis. In patients having these conditions in which the heart is failing, digitalis usually gives definite improvement. Caution should be used in administering digitalis to patients who have had it prescribed within the past two weeks, who have heart-block, in cerebral hemorrhage and with intravenous preparations in acute conditions. Pronounced nausea and vomiting may prevent its use orally but unless one is sure the emetic effect is the result of digitalis, it should be administered by other routes.

With the above conception of using digitalis, one immediately withdraws many conditions from the list in which it has been advocated. The author believes that digitalis should not be used as a routine measure in preoperative preparations, in infectious fevers, in toxemias, in tachycardias, in irritable heart conditions, in patients in whom a murmur has been found and no symptoms have been produced, nor in pneumonia. Its use has been shown to have but little effect in the presence of acute carditis. For this reason its use in children is limited.

Ten years ago it was considered good therapy to digitalize a patient with pneumonia. This view is no longer held because animal experimentation has shown that the heart muscle in pneumonia is usually normal and that an impaired myocardium is an unusual cause of death in this disease. As is pointed out by Treiman, why add the toxicity of digitalis to the already present toxemia of pneumonia? Of course, in any of these conditions which have been mentioned, digitalis should be used if heart failure presents itself. In the goiter heart the effect of digitalis is disappointing and the question of its use is debatable. It has been our practice to use it with caution when fibrillation existed or heart failure was present.

The question of dosage and route of administration has been carefully studied by Pardee, Gold and DeGraff, Bromer and Blumgart, Eggleston, White and many others. Oral administration in the ordinary patient is the choice because of the ease with which it can be carried out and the rapidity of effect. If nausea and vomiting prevent the oral administration, it may be used rectally, the dose being practically the same. The dose to be given depends upon the method chosen. This may be either by the small or the massive dose method. The small dose method is probably the more satisfactory for ambulatory patients and the massive the more satisfactory for those patients showing more advanced failure.

The small dose method which is the older has been carefully studied by Gold and DeGraff. We usually use 25 or 30 mm. three times a day for forty-eight to seventy-five hours. If neither toxic nor beneficial results are noted, the dose may be increased for the next twenty-four hours. If the effect has been obtained, we usually give 20 to 25 mm. three times a day for three days and skip the fourth day because of the cumulative effect. However, one may use daily repetitions of small doses

which would be about the equivalent to the amount which is excreted daily. This varies between 20 to 25 mm. It should be pointed out that minims are not drops and the quantity of digitalis used should be measured and not dropped from a dropper.

The massive dose method, first pointed out by Eggleston, uses .15 grams of the powdered leaves or weight and gives one-third to one-half of the total 1.5 c.c. of the tincture per ten pounds of body dose at once and the remainder in decreasing doses at intervals of six hours. White has modified this to give .10 of a gram or 1 c.c. per ten pounds of body weight and administers one-sixth of the total dose three times daily for two days.

In an emergency the hypodermic method may be chosen and this should always be the intravenous route. Pardee has shown that the dose recommended by the manufacturer in most instances is much below the amount needed and suggests that 1 minim per pound of body weight of digalen or digifolin solution or 1/100 grain per eighteen pounds of body weight of digitalin tablets should be used if the patient has not had digitalis for two weeks. If the effect is not noted within two hours, a second dose of one-fourth that size may be given but only four of these subsequent doses should be used. If digitalis has been used within two weeks, the one-fourth minim per pound dose should be started with and repeated every thirty to forty minutes until therapeutic or toxic effects are noted. Digitalis is not a panacea and should be used only when indicated, combined with rest, diet, exercise, diuretics and psychotherapy.

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