

In conditions of fever, digitalis does not seem readily to slow the heart though the temperature may at times be a little lowered. For some reason, the action of digitalis on the vagus or the inhibitory center does not work, hence if digitalis is given in feverish conditions, it should not be pushed, as any improvement of the vascular tone, or of the dyspnea, and an increase of the amount of urine and a diminution of the edema are signs of sufficient action, and it should not be attempted to push it to slowing of the heart. In fact, in conditions of prolonged fever, when the heart muscle has been weakened, digitalis should be given only in small doses. In mammals, digitalis probably never has any effect on the nerves or sensory organs except, as above stated, on the eyes.

The only effect of this drug on the muscular system is that of an increased and better blood-flow to the muscles. It has not been proved that smooth muscle-tissue other than those of the blood-vessel walls are much stimulated by digitalis, only such improvements as would occur from a bettered circulation.

The glands of the body are not affected except as improved circulation and nutrition increase their functional activity.

The kidney secretion or excretion is the only one affected, and here there is an increased flow of urine almost entirely due to an increase of the watery part.

Increase in the amount of urea in the urine under the action of digitalis varies with the condition of the patient. If the metabolism has been sluggish from poor circulation, the output of excretory products would be increased. If the circulation has been pretty normal the character of the urine is probably not much changed.

Whereas there may be slight stimulation of the kidney cells, the increased flow of urine seems to be almost entirely due to the increased blood-pressure and improved circulation. The increased circulation causes more lymph to be poured into the blood-vessels, this diluting the blood is one more reason for the increased action of the kidney.

Valuable as digitalis is in increasing the output of urine, in cardiac weakness, edema, effusions, etc., it is not good treatment to push digitalis to any extent, if used at all, when the kidneys are diseased.

This drug is largely but slowly excreted by the urine, one dose lasting for from twelve to twenty-four hours, or even longer, and we are probably almost never justified in giving a dose of digitalis oftener than twice in twenty-four hours. The heart and pulse may show the effect of the drug several days after it has been given continuously for a time. The active principles are mostly oxidized or broken up, and therefore cannot be found in any considerable amount in the urine.

*Action of a Therapeutic Dose or the Primary Physiologic Action.*—The action desired of digitalis used therapeutically is: to slow the heart; to increase arterial tension; to increase the output of urine; to improve all the results of circulatory weakness such as dyspnea, edema, and trophic disturbances due to poor circulation.

The heart should rarely be slowed by digitalis below sixty, or at most fifty beats a minute. If it is slowed beyond this point, or if there is a feeling of constriction in the head, or there are cold and numb sensations in one or more extremities, or there is a distinct reduction in the amount of urine passed in twenty-four hours, or the pulse becomes irregular, or there is nausea

or vomiting, *too much digitalis* is being given and it should be stopped. Any or all of these symptoms can develop during the administration of therapeutic doses, due to the so-called *cumulative action* of digitalis. This may be caused by some chemical condition in the gastro-intestinal canal causing more rapid absorption than usual of several doses, or the rate of excretion can be diminished by the kidneys not acting well, and the above symptoms of overaction can develop. Delirium and hallucinations occur as a symptom of cumulative or over-action of digitalis.

When giving digitalis in large doses it should be remembered that the full effects of a single dose may not appear for from twenty-four to even sixty hours. Consequently, when a result desired is not immediately obtained, large doses should not be repeated, and smaller doses should not be given too frequently.

Idiosyncrasy against this drug probably does not occur, but tolerance probably depends on the condition of the kidneys; the more perfect the kidney, the greater the tolerance. The parts of the drug longest tolerated without cumulative effects are probably digitoxin and digitalinum, while the whole drug, representing all the various active glucosids, in large doses too frequently repeated, owing to slow excretion, can readily cause the above undesired symptoms of cumulative action. When an unusual tolerance to the drug is shown, it is probable that the preparation is inactive, and the various records presented of the harmlessness of repeated large doses of digitalis are explainable by the inactivity of the drug or preparation used. When large doses are being administered to a patient, or he is thoroughly under the influence of digitalis, he should be frequently seen by the physician. Any sudden exertion by a patient when under the full influence of digitalis must be positively prohibited.

The *toxic symptoms* of digitalis are a rapid, irregular heart, the auricles not beating synchronously with the ventricles, cold hands and feet, nausea, vomiting, dizziness, disturbed respiration, lowered temperature, muscular weakness, and final collapse with delirium cordis or cardiac paralysis. The face may be pale, the sclerotics may be bluish, there may be diarrhea, there may be suppression of urine, and there may be delirium and convulsions.

Digitoxin is the most active poison of the digitalis active principles, although it is the most rapidly eliminated.

*Treatment of Digitalis Poisoning.*—There is no good physiologic antidote and no good chemical antidote, if the poison is in the stomach, except the physical treatment of removing it by emetics or by stomach washing. Tannic acid and tincture of the chlorid of iron are feeble chemical antidotes. The patient should be kept absolutely at rest. The body temperature should be kept up with dry heat applications. Artificial respiration may be advisable and necessary. Moist, hot applications to the lumbar region may be of advantage in aiding a relaxation of the kidney vessels, which will allow the drug which has been absorbed to be excreted gradually. Brandy and whisky and nitroglycerin to dilate the arterial system and cause more blood to reach the surface of the body and relieve the strain on the heart, are along the line of physiologic antidotes. After the stomach has been emptied, magnesium sulphate, or some other quickly acting saline cathartic, should be given in order to prevent absorption of any of the drug that may be in the intestines.

{To be continued}