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The effect of therapeutic doses of digitalis on the contraction of heart muscle.

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That digitalis causes alterations in the heart resulting in changes in the form of the electrocardiogram is now well known. Robinson and Wilson have estimated in experiments on cats that the quantity of digitalis which can induce a change is about 30 per cent. of the calculated lethal dose. So far, however, no evidence has been presented to show that this amount of digitalis is beneficial—except in cases of fibrillation of the auricles in which block of auricular impulses, mainly through stimulation of the vagus nerves, takes place.

A beneficial action must be based on the ability of the drug to increase the volume output of the heart, and it must be able to do this in therapeutic doses, that is to say, in doses which influence the T wave of the electrocardiogram or reduce the rate in auricular fibrillation. We have accordingly injected this amount into the veins of dogs, 11 of which received the tincture of digitalis and 19 of which received *g*-strophanthin; and into cats, 5 of which received *g*-strophanthin, and 9, the tincture of digitalis.

Alterations in volume output were studied in curves obtained by the use of the Roy and Adami myocardiograph. The curves represent longitudinal linear alterations in the form of ventricles and may, under the conditions of cardiac contraction, represent changes in volume of the cavities and consequently of volume output. The results are reported as changes in the degree of contraction. The animals were anesthetized with ether only. The chest was opened in the median line. Other details of the technical procedure, which are important, will be given in the full report of these experiments.

The significant results concern the effect of these two drugs on the T wave and on the degree of contraction (Table I). In

TABLE I.

No.	Drug.	Rate.	P-R Time.	T-Wave.	Contraction.	B-P.	Result.
Dogs, 19..	g-Strophanthin...	9	0	0	1	1	Decrease.
		8	4	11	14	4	Increase or change.
		2	15	8	4	0	No change.
11..	Tr. Digitalis.....	4	2	0	0	0	Decrease.
		5	1	6	10	2	Increase or change.
		2	8	5	1	0	No change.
Cats, 5..	g-Strophanthin...	3	1	0	1	1	Decrease.
		2	0	4	2	3	Increase or change.
		0	4	1	2	0	No change.
9..	Tr. Digitalis.....	7	0	0	5	3	Decrease.
		0	2	7	2	6	Increase or change.
		2	7	2	2	0	No change.

30 dogs, the T wave changed 17 times, and remained uninfluenced 13 times; the degree of contraction increased 24 times; decreased in 1; and remained unchanged 5 times. The degree of contraction changed, then, in the greater number of animals; the T wave, in more than half. In 14 cats, the T wave changed 11 times and remained uninfluenced in 3; the degree of contraction increased 4 times, decreased 6 times, and remained unaltered 4 times. That is to say, the T wave usually changed; the degree of contraction decreased in more than half. The effect on contraction differed, therefore, in cats and dogs.

In 7 dogs and 13 cats the record of the blood pressure in the femoral artery was added to the other records. Except in one dog and 4 cats, the blood pressure usually rose. With the tincture of digitalis a significant fall of pressure often preceded a rise.

Anesthesia and operative procedures, it was thought, might disturb the electrocardiogram. Experiments were therefore done on dogs in which electrocardiograms and blood pressure records were taken without anaesthetic and without operation. The electrocardiograms were taken in the usual way. The blood pressure curves were obtained in dogs previously prepared by a method described by van Leersum. By this method a long stretch of one carotid artery was enclosed in a stretch of skin included between two parallel incisions. The tube containing the artery lay free of the neck, and surrounded by a small rubber cuff. Water transmission to a mercury manometer permitted the taking of records. Minimum and maximum oscillations after the manner of Erlanger indicated systolic and diastolic pressures. It has

been found in the few experiments which have so far been done that T wave changes occurred uniformly and that the blood pressure usually rose, the increase varying from 20 to 66 mm. Hg.

Data on the effect of the drugs on rate and on conduction are reserved for later publication and likewise detailed descriptions of differences between the two drugs.

CONCLUSIONS.

With doses of therapeutic range equal to 30 per cent. of the calculated lethal dose, digitalis and strophanthin (1) increased the contractile power of the cardiac muscle, and by so doing increased the volume output. This effect supplies a firm basis for the statement that these drugs may exercise a beneficial action. (2) At the same time, the T wave is usually altered, and (3) there is a transient elevation of blood pressure.

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A method for the estimation of lactic acid in blood.

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The procedure is based upon the observation of Denigès[1] that lactic acid, in the presence of concentrated sulphuric acid, is converted into acetaldehyde, and can then be detected by certain reagents, particularly phenols and morphine alkaloids.

5 c.c. of untreated whole blood or serum is delivered directly into 15 c.c. of acidified copper sulphate solution, the flask being in the meanwhile gently shaken. It is heated 4–5 minutes on the water bath, cooled, and an excess of powdered calcium hydrate is added. It is then allowed to stand for 30 minutes and filtered. A water-clear solution is obtained which is free from sugar and other aldehyde forming substances, and which does not char appreciably during the subsequent treatment with sulphuric acid. One part of filtrate is added cautiously to 4 parts of pure concentrated sulphuric acid, the mixture being meantime shaken and

[1] G. Denigès, *Ann. de Chem. et de Phys.* (8), *18*, 149.