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An experimental study of the resistance to compression of the arterial wall.

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The object of this study was to determine whether the resistance to compression of the arterial wall introduces an error of any importance in the clinical measurement of systolic blood pressure by methods employing circular compression of the arm.

No previous studies are free from serious criticism on the ground of inaccuracy of the methods employed. Some direct on post-mortem vessels (v. Basch, Martin, Herringham and Womack), and some indirect (Oliver, Hill, Williamson, Russell). In consequence of the discordant results, opinion has been divided. Some hold the resistance to compression of the arterial wall to be negligible; others that it might be extreme. The present study has been carried on by a method giving graphic records of the pressure within the artery, the pressure in the external compressing medium, and of the changes in the outflow from the artery by a Hürthle membrane manometer. Ringer's solution was used in all the experiments. The point of first collapse of the artery, of complete obliteration of its lumen, and of resumption of the flow on lowering the external pressure after obliteration were recorded in each experiment. The latter proved by far the most constant index and most analogous to the ordinary criterion of the return of the pulse in clinical work.

The post-mortem vessels examined gave the following results:

Ten carotids from infants.

Readings at 30, 100, and 150 millimeters internal pressure.
Difference of pressure at which flow ceased:

Maximum = 8 mm. Hg.
Average = 3.9 mm. Hg.
Minimum = 1 mm. Hg.

Twenty carotids from adults.

Number examined.	Condition.	Internal pressure = 100 mm. Hg.	Difference of pressure at which flow: Ceased.	Returned.
16	Slight atheroma.	Maximum	30	19
		Average	15	9
		Minimum	3	0
3	Moderate atheroma.	Maximum	13	9
		Average	10	5
		Minimum	6	2
1	Calcified.		28	14

These observations show clearly that, other things being equal, small arteries with thin walls are more readily compressed than large arteries with thick walls, but in no case was a higher pressure than 19 millimeters required.

Some experiments were made on the passage of a wave, showing that at the point of return of the flow a small pulse wave was transmitted through the artery.

Arteries from amputated limbs were examined in the hope that they might be obtained in a surviving state and that the effects of tonus upon the compressibility might be studied. Though examined within two hours after removal we were unable to demonstrate clearly their surviving character, so that our results with them must be considered merely corroborative of those with dead vessels.

Artery.	Length.	Difference of pressure at which flow: Ceased.	Returned.
Normal femoral.....	7.5 cm.	4	3
Normal femoral.....	7 "	11	2
Calcified post tibial.....	11 "	24	11
Extremely calcified femoral.....	8 "	28	16

These results, with the single calcified post-mortem vessel, show that the effect of even extreme calcification of the vessel is not very great, 11 to 16 millimeters being the over pressure found requisite for these vessels, which is less than the resistance found in some practically normal vessels. The evidence is, therefore, clear that other factors are of preponderating importance.

Since the study of O. B. Meyer demonstrated the extreme degree of contraction into which ox carotids pass when placed in ice cold Ringer's solution, and that such arteries, warmed and stretched to overcome this contraction, react to vaso-constrictor

substances for as long as six days, surviving ox arteries were chosen as the best material for the study of this other factor in the arterial wall, namely, tonus. These vessels were examined first cold and contractured, then warmed to body temperature, then stretched to relaxation by 100 millimeters internal pressure, then after the introduction of adrenalin, and finally of barium chloride, into the internal circulation. In each case a control tracing of the reaction of a strip of the vessel according to Meyer's method, carried under identical conditions and tested at the completion of each stage of the experiment, was made. The surviving character of the vessel was thus demonstrated.

Of 38 common carotids and 4 mesenterics from the ox, the following gave results free from obvious error:

Seven ox carotids.

	15° C.	37° C.	Stretched.	Adrenalin.	Barium chloride.
Maximum	68.5	22	9.5	10.5	28.5
Average	42.8	14.3	6.6	8.9	15.5
Minimum	25	8	4.5	7.5	9

Four ox mesenterics.

Maximum	52	9	5	8	55
Average	25.1	6.5	3.8	6.6	29.5
Minimum	10.5	4	2	6	18

These observations demonstrate very clearly the relation between tonus of the arterial wall and its resistance to compression. A definite opinion as to the possible maximum effect of tonus, and, therefore, the placing of a numerical value for this factor of error, is not possible as yet.

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A simple device for regulating the administration of ether or chloroform, with either artificial or voluntary respiration.

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In the course of a study by Dr. Meltzer and myself of the use of continuous insufflation in the treatment of various forms of fatal poisoning, the apparatus described below was devised to simplify the control of anesthetic and pressure of air entering the