M. BAILLIART'S METHOD OF MEASURING RETINAL BLOOD-PRESSURE; AN AMENDED DESCRIPTION

BY
PRIESTLEY SMITH,
BIRMINGHAM.

I REGRET to find that a description of M. Bailliar's method of measuring retinal blood-pressure, given by myself in the May number of this Journal (1918, p. 259), was incorrect. At the time of writing I had unfortunately seen only the earlier of his two articles on this subject, and was not aware that he had already published a second, modifying his original procedure in an essential point. He has kindly drawn my attention to the latter paper,* and I hasten to give an amended description of the procedure he employs. It is unquestionably a matter of great interest.

The object is to ascertain for any given eye the degrees of chamber-pressure which balance respectively the diastolic and systolic blood-pressure in the retinal artery, and thereby to determine these blood-pressure. Two separate steps are essential. The first step determines the amounts of external pressure on the eyeball which suffice to balance the blood-pressure in question; the second step determines the amounts of chamber-pressure which these external pressures respectively induce.

The instrument used in making the external pressure is a spring dynamometer. In the earlier of M. Bailliar's two articles it was referred to as a modification of the sphygmomanometer of Bloch-Verdin, and in the absence of further information, taking the word *pelote* to mean air-cushion, I incautiously assumed that it acted, like most of the sphygmometers now in use, by air-pressure. This was a mistake. It acts by means of a spiral spring, and is, in short, a delicate spring-balance, having somewhat the form of a pocket pencil. The end which presses against the eye is tipped with a slightly convex button, 7 mm. in diameter. It is applied in the region between the upper and the outer recti, either through the eyelid or directly to the globe itself, the lid being raised for the purpose. The latter method gives the more accurate results. The pressure is directed strictly towards the centre of the globe. The amount of force employed at any moment is indicated in grammes by a scale on the sliding shaft of the instrument. The dynamometer may be applied by an assistant, while the observer watches the retinal artery (carefully differentiated beforehand from the vein) by the indirect or direct method; but it is better, though at first a little difficult, for the observer to manipulate both instruments—dynamometer in one hand, electric ophthalmoscope in the other, using the direct method.

* *Annales d'Oculistique*, November, 1917.

First step.—Working as just stated, the observer makes pressure on the eye with slight and gradually increasing force, until he sees well-marked pulsation in the retinal artery; he thereupon withdraws his eye slightly, turns the light of the mirror on to the scale of the dynamometer, and reads the force which he is at that moment employing. He then gradually increases the pressure, until he sees that the arterial pulsation is on the point of being arrested; or, better, he goes beyond this point, and then, relaxing slightly, watches for the return pulsation. On seeing this *battement de retour*, he again reads the force he is employing. For the sake of accuracy he repeats the observation several times, at the rate of once or twice in a minute and averages the results; the third and fourth trials usually give the most trustworthy averages. He has now ascertained the amounts of force which he must exert through the dynamometer in order to balance the diastolic and systolic pressures in the artery. Let us say that they are respectively 25 and 75 grm.

Second step.—It remains to ascertain the heights to which the chamber-pressure rises, when the eye is subjected in this way to these external pressures. This is no longer done, as proposed in the earlier article, by adding the external to the initial internal pressure; it cannot be done in that way. It is done by means of the Schiötz tonometer as follows:

The patient being placed in a suitable position, the observer places the tonometer, loaded as a rule with the 10 gramme weight, on the cornea, and applies the dynamometer to the same part of the eye, and in the same relative direction as before. Now, making gradually increasing pressure as before, he notes the reading given by the tonometer when the dynamometer indicates 25 grm., and again when it indicates 75 grm. Let us say that these readings are respectively 7.5 and 3 (Schiötz), then a glance at the Schiötz chart will show that the corresponding pressures are about 26 and 50 mm. Hg. These then are the diastolic and systolic pressures in the retinal artery of that eye.

To simplify the procedure M. Bailliart gives a table of averages based on the examination of a large number of persons in the way above described. It shows the degrees of chamber-pressure induced by various amounts of external pressure on the globe, and differentiates between eyes having different initial chamber pressures. The observer may refer to this table instead of using the dynamometer in the second step of the proceeding. For example, if he finds that the initial chamber-pressure, according to the tonometer, is 15 mm. Hg., the table will show him that when the dynamometer is pressed on such an eye with a force of 75 grm. the chamber-pressure is likely to rise to about 50 mm. Hg.; if the initial chamber-pressure be 20 mm. Hg., it will rise under the same circumstances to about 58 mm. Hg., and so on.

The procedure may be simplified even further. If the eye has normal vision, the observer may omit the tonometer entirely, and may assume, with sufficient approach to accuracy, that the initial chamber-pressure is about 18 mm. Hg.; the corresponding line of figures in the table will show at once the height to which it is likely to rise under any given pressure by the dynamometer.

The principle of M. Bailliant's procedure appears to be entirely sound. The technique, he assures us, is not too difficult. With a little practice in the simultaneous manipulation of the dynamometer and the electric ophthalmoscope, the observer will find that when he tests a given eye a number of times in succession, he will get the same result time after time. In considering the results one must, of course, allow some margin for unavoidable error, arising, if from no other cause, from differences of build in the human eye, for these are not taken into account by the dynamometer or the tonometer. The author warns us expressly not to attach a precise value to his figures. Yet when taken with all due reserve they are striking and seem likely to modify our estimates of retinal blood-pressure. Thus they seem to show that in normal eyes the arterial blood-pressure usually exceeds the chamber-pressure by 5 to 10 mm. Hg. during the diastole, and by 30 to 35 mm. Hg. during the systole. Assuming the average normal chamber-pressure to be 18 mm. Hg., M. Bailliant puts the average diastolic and systolic pressure in the artery at 25 and 50 mm. Hg. If we put the average chamber pressure, as I think we safely may, rather higher than this, say at 24 mm. Hg., and adjust the other figures accordingly, they are still much lower than some current estimates.

Of clinical importance is the following general conclusion: In an eye of normal tension, if the dynamometer has to be used with a force exceeding 35 gm. in order to *induce* pulsation in the retinal artery, the *diastolic* pressure in the artery is excessive; if it has to be used with a force exceeding 80 gm. in order to *banish* the pulsation, the *systolic* pressure is excessive. The chamber pressures so induced are stated to be about 30 and 60 mm. Hg. For illustrative examples of variations of the retinal blood-pressure, above and below normal limits, and for various details necessarily omitted here, the original paper should be consulted. Perhaps it is not superfluous to add that any other observer employing M. Bailliant's method and desiring to compare his results with those here cited should use a dynamometer which is not only graded with accuracy, but which is identical with M. Bailliant's instrument as regards the diameter and curvature of the surface applied to the eye.