extreme aberrant form of hypothyroidism, and that all the other groups, such as circumscribed, diffuse, symmetrical, confluent, and multiple lipomas, were much more closely related together. The objection to this view was that one sometimes came across typical multiple fatty tumours which were very tender, and therefore suggested the transition to adiposis dolorosa.

Dr. Gossage, in reply, said he would only wish to remark on Dr. Rolleston's reference as to "adiposis dolorosa" being an example of myxœdema. The point was how one was to make a diagnosis. Some cases of adiposis dolorosa improved markedly under thyroid treatment, but several of the cases which had been described as adiposis dolorosa did not improve under thyroid treatment. Whether that meant that they were not, properly speaking, cases of adiposis dolorosa he did not know. The patient now shown had not improved under thyroid treatment, but she probably more properly belonged to the class of painful general obesity.

Two New Methods (Auditory and Visual) of Reading Arterial Blood-pressure.

By George Oliver, M.D.

Last June I made a preliminary communication to the Medical Section of this Society entitled "A Combination of the Auscultatory and Tactile Methods of Reading the Arterial Pressure (Systolic and Diastolic)."\(^1\) In that paper I endeavoured to show that the reading of the pressures afforded by the finger for the systolic, and by the eye for the diastolic, pressure (as indicated by optimum oscillation) is rendered more definite and more accurate by bringing the ear also into play, the brachial artery just below the armlet being auscultated as originally suggested by Korotkow in 1905. I also advocated the employment of a small, air-tight tambour, furnished with a binaural tube and mounted on a stout band with an automatic buckle, by which the sound collector can be adjusted, like the armlet, without pressure. This arrangement has certain advantages over the application of the stethoscope by hand. It enables you to auscultate under a uniform condition and to avoid variability of pressure and alteration of position of the end-piece of the stethoscope when held in situ—variables which may vitiate the record; it also liberates the finger for palpation of the pulse. Moreover, the air-tight tambour seems to me to be more sensitive than the stethoscope.

\(^1\) *Proceedings*, 1910, iii (Med. Sect.), p. 207.
Clinical Section

In applying the armlet I place the tambour band around it so that both are passed on to the arm together. I then adjust the armlet to the upper arm and the tambour to the front of the elbow, just inside the tendon of the biceps, avoiding pressure, but adapting closely. I do not apply the armlet to the forearm, because the smaller arteries in that area frequently fail to afford the full auditory response to the compression of the armlet. I now place the binaural stethoscope attached to the rubber tube of the tambour in situ and connect the manometer with the filler and the armlet.

On raising the air-pressure you hear a "throb" or "thud" when the mercurial column reaches a certain point on the scale, and on further raising the pressure you note that the throb grows in intensity and in clearness; then it gradually diminishes in loudness, and finally ceases as definitely as when it began. Some observers (such as Ettinger) attach clinical importance to certain alterations or phases of the arterial throb as observed by the stethoscope, but I cannot say that I have been able to follow these phases through the medium of the tambour. It seems to me that such variations differ with a rising or falling pressure; and moreover, I doubt if they are sufficiently constant in the same subject to warrant our drawing any assured clinical inference. For example, I have detected a murmur stage with the falling pressure which was not apparent with the rising pressure and could not be again heard during the rest of the séance.

From the blood-pressure point of view you should with care determine at what pressure the throb begins and ceases; in other words, you should define precisely the pressure limits of the throbbing area. You will find that these limits are, as a rule, lower on the scale when determined by the slowly increasing pressure than by the slowly decreasing or release pressure, after you have overstepped by 20 mm. the point at which the throb ceases. I have failed with the auditory method to obtain any lower systolic readings by the release pressure, as are apparent in digital estimation. The limits of the throbbing area should therefore be defined by the direct or increasing pressure as well as by the now generally adopted release pressure, for the difference in the systolic pressure readings thus afforded may prove of clinical import in discovering arterial wall changes.

I shall now touch briefly on the interpretation of the pressure limits of the throbbing area. The reappearance on release after the extinction of the throb with the upward pressure signifies the systolic arterial pressure, and the reading thus afforded is more delicate than that
furnished by the finger, being, in the average of cases I have examined, about 7 mm. or so higher than the direct extinction digital reading and at least 15 mm. higher (and often rather more than this) than the return digital reading. Moreover, it is more definite, the parting line between throb and silence being quite sharp; and I have observed that in the same case a series of observers will frequently read quite alike, as several of you have done this evening, whereas digital estimation is open to considerable individual variation in determining the pressure in the same subject.

Does this auscultatory method help us to a more easy, definite, and accurate reading of the diastolic pressure than is afforded by optimum oscillation? I think it does. There has always been a doubt as to what the optimum oscillation signifies—whether the minimum or the mean arterial pressure. It is, nevertheless, accepted generally to indicate the diastolic pressure; but whether it signifies the minimum or the mean diastolic pressure, or the mean arterial pressure, we do not at present actually know. But whatever it denotes, if you halve the throbbing area you obtain a figure which, as a rule, coincides with the optimum oscillation. For example, if under the release pressure the throb re-appears at 110 mm. and ceases at 60, the readings will be $\frac{85}{110}$—half the throbbing area being added to 60 or subtracted from 110, giving you 85 mm. as the diastolic reading as at present interpreted, this being 25 mm. lower than the systolic.

This mode of dealing with the figures furnishes data which are comparable with those of the manometric readings hitherto made, and they are more definitely reached than by the digital and visual method, for the upper and lower limits of the throbbing area are much more certain and decided. But those who have worked with the auscultatory method in reading blood-pressure are not in agreement as to the position of the diastole (or minimum arterial pressure) in the throbbing area. Ettinger, for example, believes it to be in the lower limit indicated by the cessation of throb on the release pressure, and Dr. Gittings, of Philadelphia, a recent worker, acquiesces in this interpretation.¹ I am disposed, also, to accept this location of the true diastole, and to regard the area of throb as furnishing three readings of the arterial pressure—namely, those of the minimum, the mean and the maximum arterial pressure.

I have lately found that the auditory apparatus is available for a visual reading of the systolic pressure. The two methods being equally sensitive, either method may be substituted for the other and may be employed for corroboration. The visual should also be a useful alternative method when the hearing is impaired or when noises disturb auscultation; it is also valuable for demonstration, as every one around can appreciate the reading, whereas the tactile and the auditory methods appeal only to the individual observer. The auditory method which I am suggesting may, however, be participated in by two observers at the same time, and each of them may listen either with one or both ears.

The apparatus of the visual method, as you see, consists of (1) the tambour, mounted on the strap and furnished with the auditory tube, but without the rubber ear-pieces; and (2) a coloured spirit indicator, fitted by the side of the manometer. At the end of the indicator tube, in which you see rings of coloured spirit, there is a bulb which serves two purposes—one being a reservoir of the spirit, and the other being an air-spring which amplifies the pulsation of the rings of spirit. The armlet may be adjusted above the elbow or to the forearm, just as the observer prefers; in both cases the tambour is buckled on to the front of the forearm in the mid-line, either just below the elbow, which is the best site when the armlet is placed on the upper part of the arm, or just below the armlet and above the wrist when this is adjusted to the forearm. The tambour should be strapped on with firm pressure, which develops the oscillation of the spirit in the indicator. Then, you see, I attach the rubber tube leading from the tambour to the connector of the spirit indicator, when the rings of spirit oscillate. Should you desire to have more motion you disconnect the rubber tube from the spirit indicator, and after further tightening of the tambour band you reconnect the tube. You see, on raising the air pressure in the armlet, that the oscillations of the spirit rings increase and become much sharper and more jerky in character; then you observe that the motion diminishes, until it finally ceases. You then raise the air pressure some 20 mm. higher, and as you very gradually release the pressure you note the first distinct throb. This indicates the systolic reading. In this manner we obtain the pulsation of the limb rather than that of an individual artery; therefore this method is more trustworthy and more easy of application as an indicator of the cessation of the
Oliver: *New Methods of Reading Arterial Blood-pressure*

circulation below the armlet than the appliances which are adjusted to an artery. You observe that in the cases in which we have applied this method to-night the reading of the systolic pressure is identical with that afforded by the auditory method; now and then, however, I have found that the visual is still more sensitive, affording a somewhat higher reading.

One very important condition is necessary to a reliable observation, and that is that the arm, throughout the observation, should be maintained in a flaccid condition and quite free from tremor or movement.