

A STUDY OF THE ANKLE JERK IN THYROID DISORDERS

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Although prolongation of the tendon reflexes in myxoedema was described by William Ord¹ 80 years ago, graphic recordings of the ankle jerks were not made until 40 years later, when Chaney² recorded the reflex on a rotating drum. In 1951 the technique was first incorporated into the routine investigation and follow-up of cases by Lambert *et al.*,³ who, using a resistance-wire pressure transducer, studied the duration of the ankle jerk in several types of thyroid disease. In 1958 Lawson⁴ described a method of recording the ankle jerk by using an electromagnetic device, and reported his findings throughout the spectrum of the thyroid function. Lawson and Weissbein⁵ in 1959 reported the effect on the Achilles reflex during treatment of hyperthyroidism. In the present study, a simple method for recording the ankle jerk was used and the results obtained were correlated with the level of protein-bound iodine (PBI), blood cholesterol, and 24-hour thyroidal ¹³¹I uptake.

Method

The apparatus (Fig. 1) consisted of a light source and a photoelectric cell connected to an electrocardiograph. When an ankle tap was followed by a movement of the foot shadow across the photoelectric cell, the changes in-

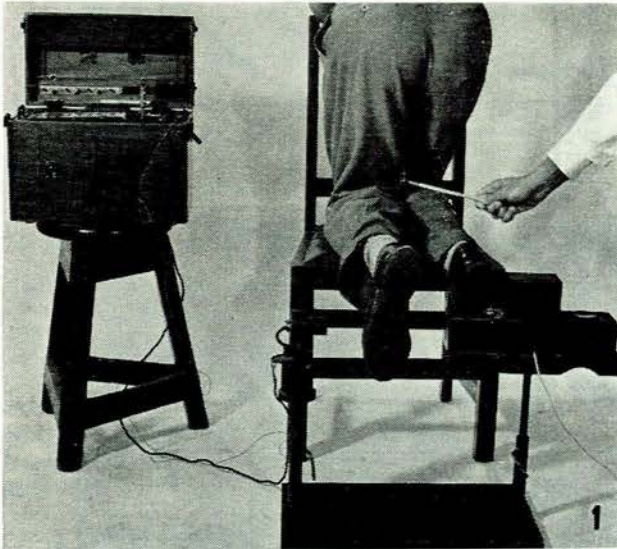


Fig. 1. The photoelectric cell in position for recording the ankle jerk.

duced by this movement were recorded by the electrocardiograph. A paper speed of 50 mm. per second was used.* The type of curve produced by this method is shown in Fig. 2. The initial deflection is due to the arti-

*A similar method of recording the ankle jerk was reported by Gilson⁶ (1959), and apparatus of this type is commercially available from the Burdick Corporation, Milton, Wisconsin, USA.

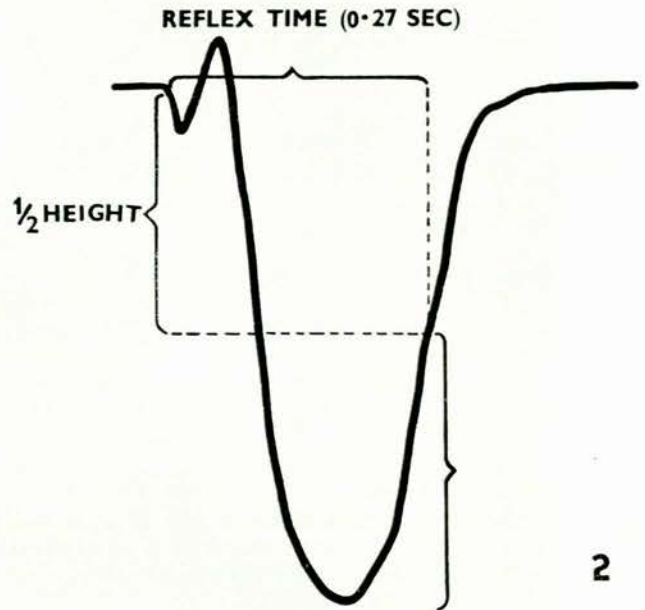


Fig. 2. The curve obtained as in Fig. 1, indicating the method of measurement of the reflex time.

fact of the tendon tap. This time interval from the onset of the initial deflection to halfway on the relaxation segment of the curve was considered to be the reflex duration time. This end-point was suggested by Lambert *et al.*³ because neither the peak nor the end of the curve constituted a fixed, easily definable point.

Altogether 165 tests were done. Of these, 50 were performed on normal students and euthyroid ward patients, 76 on 29 hyperthyroid patients before and after treatment with ¹³¹I, and 39 on 20 patients with myxoedema before and after treatment. Thyroid status was determined in all cases by clinical examination correlated with the results of estimations of the following: serum-PBI levels, 24-hour thyroidal ¹³¹I uptake, blood-cholesterol levels, 24-hour conversion and salivary-PB¹³¹I ratios, and the red cell uptake of ¹³¹I-labelled triiodothyronine. In cases presenting difficulty in diagnosis, reliance was placed on the effect of triiodothyronine suppression or thyrotrophic-hormone stimulation on the 24-hour thyroidal ¹³¹I uptake.

RESULTS

Duration of the Ankle Jerk

The duration of the ankle jerk in typical examples of thyrotoxic, euthyroid and myxoedematous individuals is shown in Fig. 3. The results for the whole series are tabulated in Table I and shown diagrammatically in Fig. 4. It will be seen that while the mean levels obtained in these three groups differ considerably, there is, nevertheless, a well-marked overlap in the range of values ob-

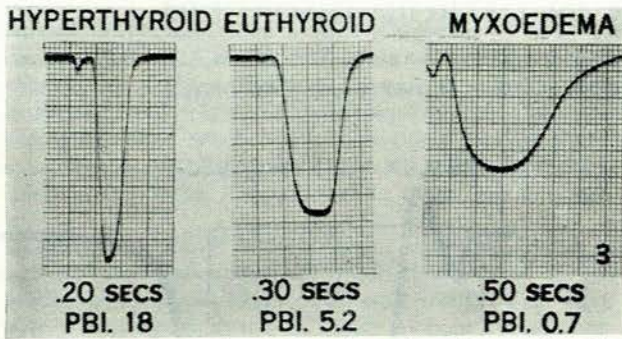


Fig. 3. Curves produced by a hyperthyroid, a euthyroid and a myxoedematous subject.

TABLE I. DURATION OF ANKLE JERKS IN VARIOUS THYROID STATES

	Normal		Hyperthyroid		Myxoedema	
	Mean	Range	Mean	Range	Mean	Range
Lambert <i>et al.</i> ⁹	0.34	0.22-0.45	0.26	0.18-0.35	0.53	0.34-0.80
This series	0.32	0.25-0.46 (50 cases)	0.26	0.16-0.33 (29 cases)	0.46	0.35-0.69 (20 cases)

tained. The results in this series are strikingly similar to those reported by Lambert *et al.* in 1951 (Table I), although they used an entirely different type of apparatus. It is noteworthy that very few normals have reflex times above 0.38 seconds, whereas the great majority of patients

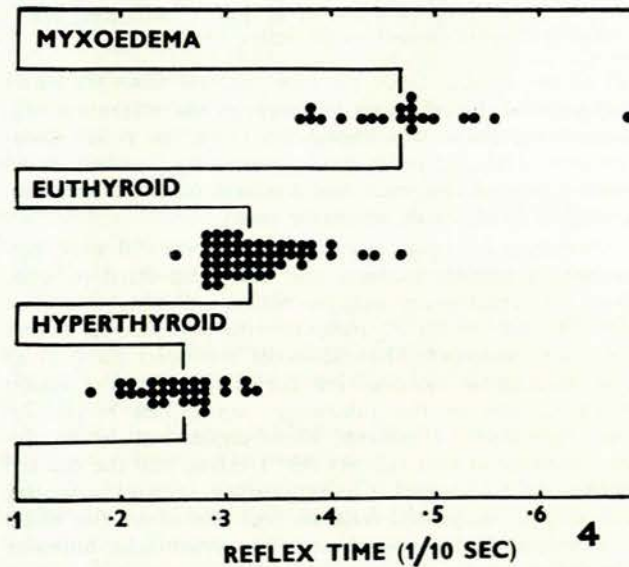


Fig. 4. Range of measurements of the duration of the ankle jerk in hyperthyroid, normal and hypothyroid persons.

with myxoedema have reflex duration times above this level. A number of hyperthyroid patients have reflex times that overlap those found in the euthyroid group.

Correlation of the Reflex Time with Other Tests

Comparisons with other tests of thyroid functions, namely the PBI, blood cholesterol, and thyroidal 24-hour ¹³¹I uptake, are shown diagrammatically in Figs. 5A, 5B

and 5C. A reflex duration time ranging from 0.28 to 0.40 seconds was taken as a practical range of the normal values. Although correlation was good in the whole series, when any one of the tests was taken, a few cases of hyperthyroidism or myxoedema fell within the normal range. This applied as much to the reflex time as to the other tests.

In 25 patients with hyperthyroidism both reflex time and PBI were measured. In one case both tests were within normal limits. In 3 cases the PBI was normal and the reflex time decreased. In 7 cases the reflex time was

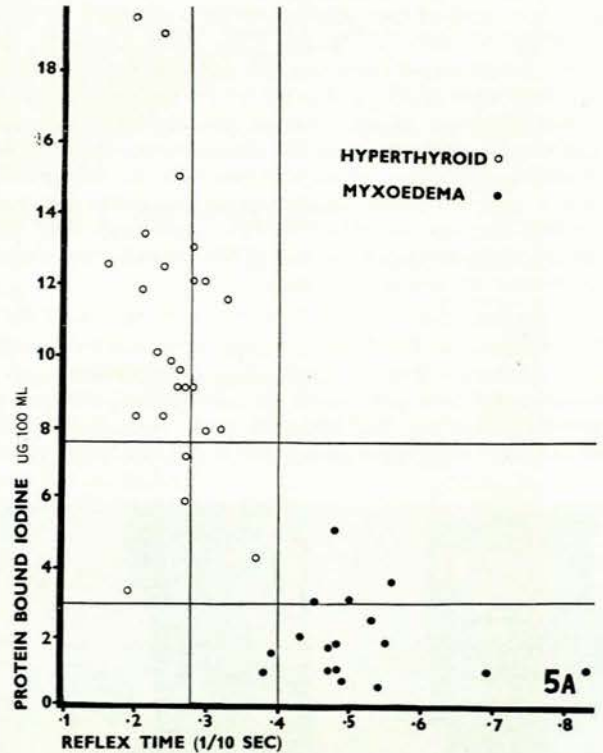


Fig. 5A. The correlation between the reflex time and the serum-PBI level in hyperthyroid and myxoedematous patients. The lines indicate the limits of normal for each test.

normal and the PBI increased. There were 17 myxoedematous patients who were similarly tested. In 4 of them the PBI was normal and the reflex duration increased, whereas 2 had normal reflex times and very low PBI levels.

In 21 hyperthyroid patients both a 24-hour thyroidal uptake of ¹³¹I and a reflex time were measured. Of these, 17 patients had normal reflex times with raised 24-hour uptakes, while in 3 patients the latter test was normal and reflex times decreased. There were 13 hypothyroid patients who had both these tests performed. Of these 3 had normal 24-hour thyroidal ¹³¹I uptakes, in 2 of whom the reflex time was increased.

In 21 hyperthyroid patients both blood-cholesterol levels and reflex times were measured. Of these, 7 had either raised or normal blood-cholesterol levels and 8

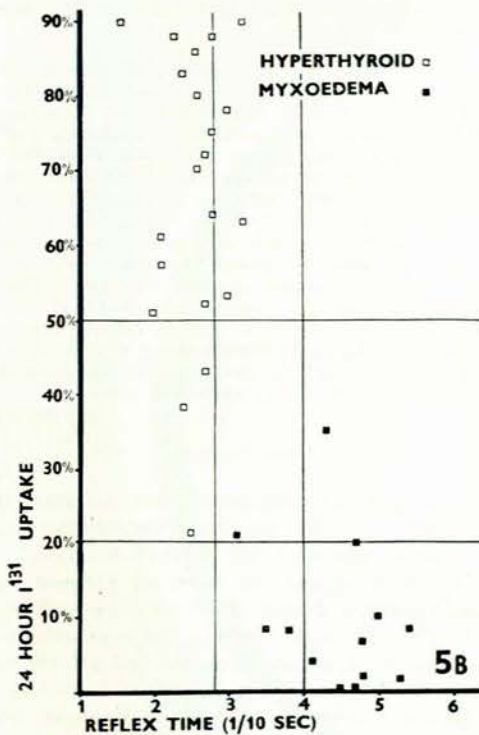


Fig. 5B. The correlation between the reflex time and the 24-hour thyroidal uptake of ¹³¹I in hyperthyroid and myxoedematous patients. The lines indicate the limits of normal for each test.

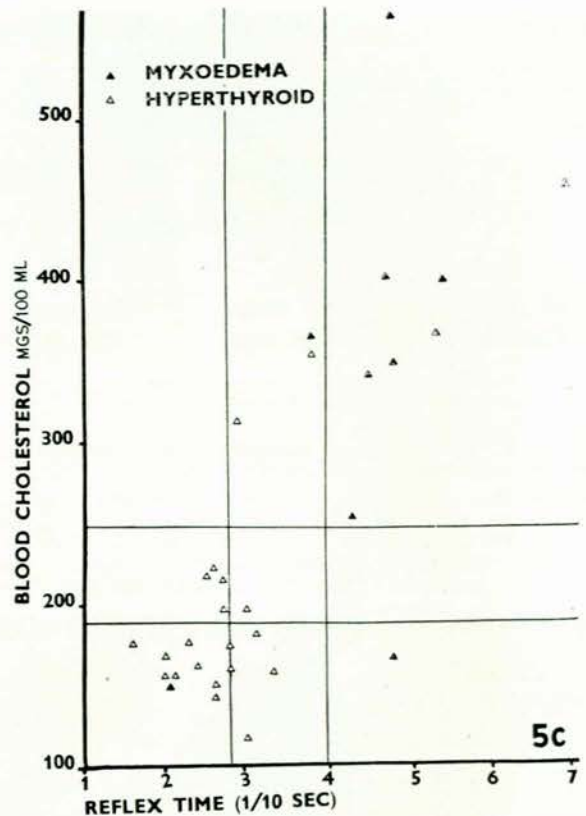


Fig. 5C. The correlation between the reflex time and the blood cholesterol in hyperthyroid and myxoedematous patients. The lines indicate the limits of normal for each test.

had normal reflex times. The tests indicated the correct diagnosis in 9 out of 10 cases of myxoedema.

Effect of Therapy on the Ankle Jerks

In 19 cases the patient was followed up for a period of 3-9 months after ¹³¹I therapy for hyperthyroidism. Of these, 5 patients became hypothyroid, viz. Mlr, J, Gr, W and Ro (Fig. 6). The reflex time closely paralleled the changing clinical picture and PBI levels. Similarly, 3 patients, viz. Cr, To and Da (Fig. 6) remained hyperthyroid and in 2 of them the reflex duration time remained low. In 10 cases hypothyroid patients were similarly followed up after treatment and in all of them there was a striking fall in the reflex time to normal levels. In both these groups of patients, cases failing to respond to therapy were easily identified by the reflex tests; so were those hyperthyroid patients who progressed to a hypothyroid state.

Case Illustrations

Patient A.M. (Fig. 7A). This man of 53 had already been treated with a single dose of ¹³¹I for hyperthyroidism with only a limited response. At the time of testing, his PBI was 15 µg. per 100 ml. and the tendo-Achillis reflex time was 0.26 seconds. He was given a second therapeutic dose of ¹³¹I and responded rapidly. He did not appear at the follow-up clinic until 4 months later, when his PBI was 3 µg., and although he felt well his reflex time was 0.44 seconds. He had gained 50 lb. in weight and his voice was a little gruff. One month later, slight periorbital puffiness was present and there was no clinical doubt that he was myxoedematous. His

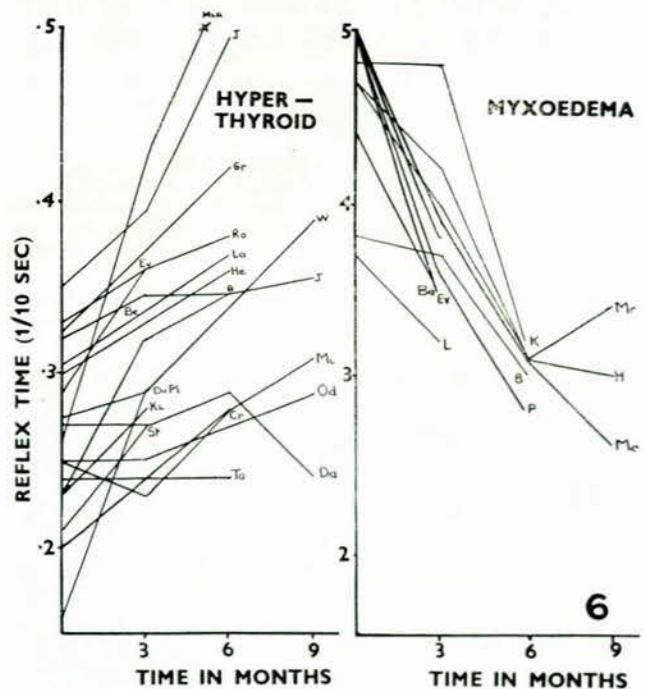


Fig. 6. The effect of therapy on the reflex time in hyperthyroid and myxoedematous patients.

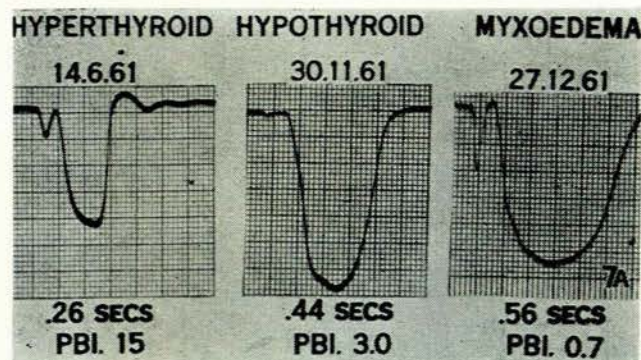


Fig. 7A. Patient A.M., showing the changes in reflex time as myxoedema develops after treatment of hyperthyroidism with ^{131}I .

PBI was 0.7 μg . and his reflex time was 0.56 seconds. Thus both tests confirmed the clinical diagnosis.

Patient Mrs. L. (Fig. 7B). This woman of 60 remained mildly hyperthyroid after an initial therapeutic dose of ^{131}I . Her PBI was 7.8 μg . and her 24-hour thyroidal ^{131}I uptake was 63%. This uptake was not suppressed by the administration of triiodothyronine in a dose of 80 μg . daily for 7 days. Her

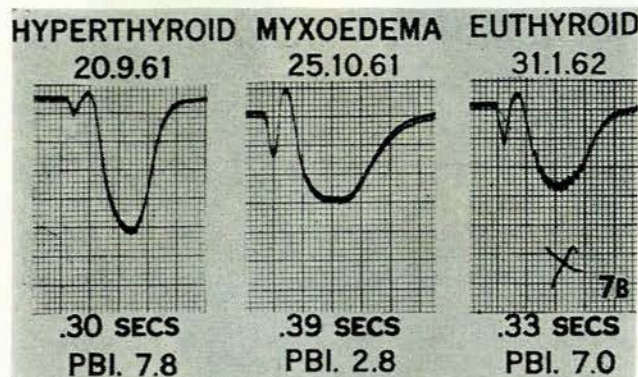


Fig. 7B. Patient Mrs. L., showing changes in reflex time following treatment for hyperthyroidism with resultant myxoedema and the return to the euthyroid state.

reflex time was 0.30 seconds, which was within normal range. After a second dose of ^{131}I she became hypothyroid, with a PBI level of 2.8 μg . and a reflex time of 0.39 seconds. After treatment with thyroxine for 3 months, her reflex time was 0.33 seconds and her PBI 7.0 μg ., both tests thus confirming her return to a euthyroid state.

Patient Mrs. K.M.M. (Fig. 7C). This myxoedematous woman of 50 was treated with triiodothyronine in a dose of 60 μg . daily. Well-marked clinical improvement resulted and,

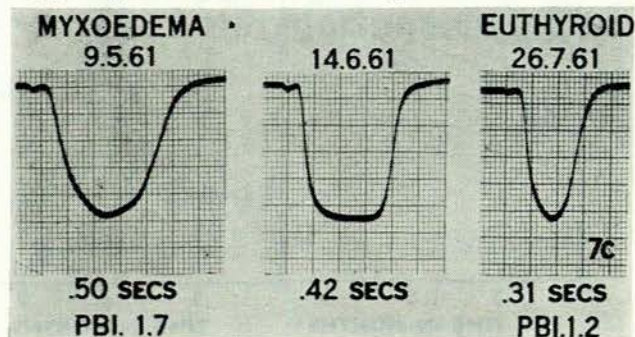


Fig. 7C. Patient Mrs. K.M.M., showing change in reflex time in a case of myxoedema responding to treatment with triiodothyronine.

as is usual with this method of treatment, her serum-PBI level remained low. Her reflex time, however, shortened from 0.50 seconds to 0.31 seconds.

Patient K1. In this case, the reflex time provided a better index of thyroid status than other standard tests. The patient was a woman of 55 who was treated for hyperthyroidism with ^{131}I . A year later she complained of irritating puffy eyes, mental sluggishness, and feeling cold. She presented a confusing, clinical picture in that she had well-marked periorbital swelling and a cool, dry skin, but a persistent tachycardia. Her PBI was 3.3 μg . and blood cholesterol 315 mg. Despite a reflex time of 0.29 seconds a diagnosis of mild hypothyroidism was made and the patient was treated with thyroxine. Three months later it became apparent that her condition had not improved. Re-testing showed a PBI of 13 μg ., a 24-hour thyroidal ^{131}I uptake of 55%, and a reflex time of 0.25 seconds. She was clinically hyperthyroid with a rapidly progressing malignant exophthalmos. Her blood cholesterol remained raised even in this hyperthyroid state.

DISCUSSION

This investigation has confirmed other workers' findings that measurement of the duration of the Achilles-tendon reflex is a useful index of the thyroid function.^{3,4,7} As a diagnostic test it appears to have its greatest value in hypothyroid patients. In this series very few euthyroid persons had reflex duration times in the myxoedema range. In most cases of hyperthyroidism the test affords valuable corroborative evidence of the diagnosis. In mildly hyperthyroid patients, however, the reflex duration time may fall at the lower limit of normal and it was found that no reliance could be placed on this test alone. The main value of the test would appear to be in the follow-up of treated cases, whether thyrotoxic or myxoedematous. A major asset is that the test is not affected by previous therapy, either with iodides, ^{131}I , thyroid extract, or drugs of the thiouricil type, which may artifactually interfere with either PBI estimations or ^{131}I -uptake studies. As performed by us, the test requires no expensive apparatus, and provides a rapid and reproducible result and a permanent objective record of the patient's state that can be compared with subsequent findings. Fogel *et al.*⁷ (1962) found that pregnancy, obesity, age and sex did not interfere with the validity of the test. Nor did such pathological states as fever, agitation, and certain neurological and muscular disorders.

The reflex test cannot replace other tests. Its value, from this investigation, would appear to be similar to a blood-cholesterol estimation in the assessment of thyroid function, and, provided its limitations are appreciated, it can serve as a valuable addition to the tests available for the study of thyroid disorders.

SUMMARY

The duration of the ankle jerk was measured by means of a photoelectric cell connected to an electrocardiograph. Such tests were carried out on 165 normal, hyperthyroid and myxoedematous persons. As a test of thyroid function, it appears that the reflex time was of particular value in the diagnosis of myxoedema and in the follow-up of treated patients, whether hyperthyroid or myxo-

dematous. It was of less value in the diagnosis of hyperthyroidism.

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