THE BLOOD GALACTOSE TOLERANCE TEST

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Human tolerance to galactose has been extensively investigated since its introduction as a diagnostic entity by Bauer in 1906.

In 1924, Allen Winter Rowe, in the first of a series of papers entitled "The Metabolism of Galactose," considered the "threshold of tolerance" as the dose of galactose the normal individual was able to metabolize without significant galactosuria. Over one thousand cases, representing various pathologic states, mainly endocrine in nature, were subjected to his investigations. He concluded that the states strongly depressing galactose tolerance were hyperpituitarism, hyperthyroidism, adrenal disease, ovarian and pancreatic failure, and liver dysfunction. Cases of pituitary failure and hypothyroidism exhibited increased galactose tolerance. Rowe, therefore, stressed the proposition that the findings in this test measured a single end-result common to a wide variety of causes. "Further, there may co-exist in the single organism two or more agencies, each capable of influencing sugar utilization, producing reenforcement or antagonism, and the tolerance as measured, is the algebraic sum of these several factors."

In 1928, Raymond and Blanco established the technical principles for the quantitative estimation of galactose in blood. Shay, Schloss, and Bell considered galactose excretion in the urine sufficient for the diagnostic investigation of liver intolerance in jaundice, even in the presence of severe renal damage. Mann, however, contended that galactose excretion depended too intimately upon the rate of urine flow to permit correct interpretation in all instances. The determination of galactose utilization by measuring blood levels, therefore, would appear to eliminate any real or theoretical objections appertaining to the measurement of such utilization by the degree of galactosuria.

In 1937, Althausen and Wever substituted a blood galactose tolerance test for the customary urine determination and confirmed, in 26 cases, Rowe's earlier observations concerning galactose intolerance in hyperthyroidism. Althausen and his associates later presented experimental work in substantiation of their previous contention that these disturbances of carbohydrate metabolism in hyperthyroidism could be satisfactorily explained by increased intestinal absorption of sugars.

In 1940 Althausen, Lockhart, and Soley enlarged upon their earlier series by reporting their clinical experiences with the blood galactose tolerance test in 130 patients with hyperthyroidism, 121 individuals without hyperactivity of the thyroid gland, and seven patients with myxedema. According to their results, after the administration of 40 grams of galactose orally, the blood level of normal individuals did not exceed 30 mgm./per cent in the examined thirty and sixty minute specimens. Galactose peaks between 30 and 40 mgm./per cent were considered in the doubtful range. Values exceeding 40 mgm./or failing to reach 10 mgm./per cent were regarded as definitely abnormal. Repetition of the test in the same individual gave fairly uniform results. The test revealed depressed tolerance in 124 of the 130 cases of hyperthyroidism, was doubtful in 5, and normal in one such patient. In 87 of 121 cases without hyperactivity of the thyroid gland, and representing varied clinical syndromes, normal galactose tolerance was found.

The test was offered as a means of differentiating hyperthyroidism from conditions clinically mimicking this state, such as, anxiety with hyperventilation, cardiac disease with hypermetabolism, and non-toxic thyroid enlargements. Parenchymatous liver disease and Paget's disease of the long bones represented the only two pathologic conditions, in the experience of the authors, that interfered with the test in the diagnosis of hyperthyroidism,—both of these conditions producing appreciable depressions in tolerance.
One month after the appearance of this paper, MacLagan, an English worker, presented an almost identical blood galactose tolerance test as a means of estimating liver dysfunction, and shortly thereafter utilized this test to judge hepatic function in thyrotoxic patients.

The basic differences in these two investigations were in the range of the normal values obtained, and in the proposed explanation of the mechanism of the test. MacLagan's normal values ranged from 63 to 81 mgm. per cent, with correspondingly greater depressions in galactose tolerance in hyperthyroidism. Variations in technic appear insufficient to account for the great differences in the normal values obtained by these two workers. Moreover, from a theoretical standpoint, MacLagan's experimental work on rabbits supported his contention that the blood galactose tolerance test primarily measured liver function. Five rabbits rendered hyperthyroid by daily subcutaneous injections of thyroxine gave high blood galactose values after intravenous administration of the sugar. This modification of administration, by short-circuiting the gastrointestinal tract, presumably segregated the liver as the principal tissue involved in the fate of galactose. At postmortem, the livers of the rabbits revealed marked degenerative changes. In contrast, Althausen's retested by the intravenous route hyperthyroid patients who had diminished tolerance to galactose administered orally, and found normal galactose tolerance. This was considered by him to be proof for the theory that the mechanism involved is essentially one of associated increased intestinal absorption in hyperthyroid states.

These differences, however, fail to alter the test's clinical value. Thus, in confirmation of Althausen's work, MacLagan noted impairment of tolerance in 30 of 41 cases of thyrotoxicosis, and high normal values in the remaining 11.

The purpose of this communication is, first, to present a third series of blood galactose tolerance studies, the findings of which corroborate in normal individuals, the galactose values obtained by the Althausen group as opposed to the findings of MacLagan and his co-workers; second, to discuss the value of the test in the diagnosis of hyperthyroidism; and, third, to reiterate and stress Rowe's original insight into the complexity of the factors involved, by presenting a series of non-thyroid patients with abnormal galactose tolerance.

**TECHNIC OF THE TEST**

This is essentially the same as that outlined by Althausen, Lockhart, and Soley:

Forty grams of galactose are dissolved in about 100 cc. of hot water, flavored with lemon juice to the patient's taste, and made up to a 400-500 cc. volume with ice water. A sample of oxalated venous blood is obtained and the drink is administered to the patient in the morning after an overnight fast. Oxalated venous blood samples are obtained 30 and 60 minutes after the administration of the galactose. Fresh commercial yeast is suspended in ten parts of distilled water and washed by successive centrifuging and decanting until the supernatant fluid is clear and colorless. A 20 per cent yeast suspension is then prepared and 14 cc. of this suspension is added to 2 cc. of each of the three samples of oxalated blood obtained. Fermentation of blood glucose is completed within 20 minutes. The blood protein is then precipitated by the addition of 4 cc. of a mixture of equal parts of 10 per cent sodium tungstate and 4 Normal sulfuric acid. After standing five minutes the mixture is filtered and a Folin-Wu sugar determination is done on the filtrate. By this technic 2 cc. of the filtrate and 2 cc. of an alkaline copper sulfate solution are mixed and boiled 8 minutes in a water bath, allowed to cool, and 2 cc. of phosphomolybdic acid added. A standard solution, consisting of 2 cc. of a glucose standard and 2 cc. of alkaline copper sulphate, is treated in like manner. The solutions are then diluted to 26 cc. with distilled water and the amount of reducing substance determined in each by comparing colorimetrically with the standard glucose solution. After complete fermentation of the "before" sample, the level
of reducing substance obtained in this sample represents the saccharoid or non-glucose reducing fraction of blood. Narayana Menon and Radhakrishna-Rao estimate 20 mgm. and Peters and Van Slyke 23–31 mgm. per 100 cc. of blood as the average level of non-glucose reducing substances in human blood. Our levels usually fell mainly in the 15–22 mgm. range with isolated readings of from 10 to 30 mgm. per 100 cc. Levels above 30 mgm. probably indicate incomplete yeast fermentation and the necessity for discarding the yeast suspension in use. Though this fraction is not constant in the same individual from day to day, we have determined that the saccharoid blood level varies less than 1 per cent in the same individual during the period of the test itself. Hence accurate galactose results may be obtained by subtracting the "before" saccharoid value from the 30 and 60 minute values. Since galactose possesses less reducing potency than glucose, the true values of galactose are obtained by multiplying by a factor (1.24). This calculation may be omitted if a galactose standard is used. We have customarily prepared a yeast control by centrifuging the

\[ \text{Blood Galactose Values} \]
\[ \text{Basal Metabolic Rate} \]

**Fig. 1. Blood Galactose Tolerance in 36 Hyperthyroid and 10 Normal Patients**

For the purpose of establishing a control series, the blood galactose tolerance test was performed upon 10 apparently normal individuals (fig. 1). As in Althausen's cases, only values up to 30 mgm. per cent were obtained in these normal individuals.

**RESULTS**

**Normals**

For the purpose of establishing a control series, the blood galactose tolerance test was performed upon 10 apparently normal individuals (fig. 1). As in Althausen's cases, only values up to 30 mgm. per cent were obtained in these normal individuals.

**Suspected cases of hyperthyroidism**

In 68 patients the diagnosis of hyperthyroidism was suspected clinically. These cases were subjected to repeated estimations of the basal metabolic rate and, upon each, at least one blood galactose tolerance test was performed.
Of 30 cases of hyperthyroidism with hypermetabolism (basal metabolic rate greater than plus 20 per cent) the tolerance to galactose was unequivocally depressed in 27, fell in the doubtful 30-40 mgm. range in 2, and was normal in one (fig. 1). These 30 cases were subjected to subtotal thyroidectomy and in every instance microscopy substantiated the diagnosis of hyperthyroidism according to the generally accepted histologic criteria for thyroid hyperactivity. Thus there was but one instance among these 30 cases in which a pathologically proven case of hyperthyroidism failed to be associated with an abnormality in the galactose tolerance curve, the peak level reaching only 26.7 mgm. per cent in this case.

In 6 additional cases of definite clinical hyperthyroidism who were not operated upon the basal metabolic rate was elevated and the galactose test revealed depressed tolerance. Two of these cases were treated by a course of roentgen rays. The third case represented a recurrence of toxicity following previous thyroidectomy, and the remaining 3 cases left the hospital untreated.

Therefore of 36 cases of definite clinical hyperthyroidism with hypermetabolism galactose tolerance was depressed in 33, doubtful in 2 and normal in 1. In 30 of these examined microscopically the histologic appearance of the thyroid gland agreed with the clinical diagnosis. The single case in which galactose tolerance was normal occurred in this latter group.

Reference to figure 1 reveals the fact that no correlation exists between the degree of depression of galactose tolerance and the degree of hypermetabolism as measured by the basal metabolic rate.

The following 23 cases represent those patients in whom the diagnosis of hyperthyroidism, at first held, was ultimately disproven. An appraisal of the basal metabolic rate on the one hand and the galactose tolerance on the other as laboratory aids in the diagnosis of hyperthyroidism will be made in the light of the ultimate diagnoses reached.

(a) Elevation of the B.M.R. (over plus 20 per cent) with normal galactose tolerance. In 9 cases in which the presumptive diagnosis was hyperthyroidism, the basal metabolic rate was over plus 20 per cent and galactose tolerance was normal. Two of these cases were subjected to surgery on the basis of hypermetabolism alone. One of these was a woman three months pregnant with a basal metabolic rate of plus 29 per cent. The other possessed an adenomatous goiter and a B.M.R. of plus 26 per cent. In each instance microscopy failed to reveal any evidence of thyroid hyperactivity. In two other instances, in this group, bed rest alone reduced the hypermetabolism to within normal limits, at which level it remained thereafter. In the remaining 5 cases, during the course of investigation, the hypermetabolism was found to be incidental to a state of compensated hypertensive cardiovascular disease.

These 9 cases illustrate several of the circumstances under which an elevated basal metabolic rate accompanied by certain suggestive physical findings may be erroneously ascribed to thyroid toxicity. Pregnancy, hypertension and anxiety states while apparently elevating the basal metabolic rate in many instances have no effect upon galactose tolerance.

(b) Equivocal B.M.R. (plus 10 to plus 20 per cent) with normal galactose tolerance. Four cases of suspected hyperthyroidism had basal metabolic rates in the doubtful plus 10 to plus 20 per cent range. The blood galactose test was normal. Two of these patients, on long range observation and thorough study, proved to be psychoneurotics. In one other case the symptomatology subsided spontaneously during the course of study and the originally held suspicion of hyperthyroidism was dropped. In the fourth case a final diagnosis of hypertensive cardiovascular disease was established.

This group again demonstrates instances in which determinations of the basal metabolic rate failed to eliminate or substantiate the presumptive diagnosis of hyperthyroidism. Subsequent study eliminated the diagnosis of hyperthyroidism. Here again the B.M.R. was shown to be influenced by various non-thyroid extraneous factors which, however, failed to alter the galactose tolerance.
(c) Normal B.M.R. with depressed galactose tolerance. This group comprises two cases. 

The first was a 62 year old woman with chronic fibro-ulcerative tuberculosis (positive sputum) and diabetes mellitus. She also presented hyperkinesis, mild fine digital tremor and certain neurotic stigmata. Two basal tests, one week apart were both plus 4 per cent. The tolerance to galactose was markedly depressed, the peak level reaching 116.2 mgm. There was no hepatomegaly or jaundice. The second case was a male 74 years of age who had the remarkable combination of decompensated arteriosclerotic cardiovascular disease, diabetes mellitus, chronic type XXIV pneumococcic empyema and pathologically proven sigmoid carcinoma, and who had been treated for frank hyperthyroidism since 1924 by a competent surgeon who considered him now (1940) to be in the "burned-out stage" of hyperthyroidism. His B.M.R. was plus or minus 1 per cent while decompensated. His peak galactose level was 72 mgm. evidencing markedly depressed tolerance. One brom-sulphalein liver function test revealed 5 per cent retention of the dye in 30 minutes. These 2 cases illustrate the difficulty in interpreting abnormal galactose tolerance in suspected cases of hyperthyroidism unsubstantiated by hypermetabolism and complicated by other extensive pathologic processes.

(d) Normal B.M.R. and normal galactose tolerance. The basal metabolic rate and galactose tolerance tests were normal in 7 cases of suspected hyperthyroidism. In each instance the suspicion of hyperthyroidism was eliminated by further clinical observation. An adenoma of the thyroid was removed from one of these cases and microscopy revealed no evidence of toxicity.

(e) Basal metabolic rate not estimated. In one case the basal metabolic rate was not determined because of lack of cooperation on the part of the patient. The peak galactose in this instance was 26 mgm. The presence of a thyroid adenoma necessitated removal. Microscopy revealed no evidence of toxicity.

Patients previously thyroidectomized

We have had the opportunity of performing the test upon 9 individuals who had had thyroidectomies for hyperthyroidism within the past one to seven years and who were suspected now of suffering from a recurrence of hyperthyroidism. Only 3 cases of the total group showed normal galactose tolerance and normal basal metabolism. Of the 6 with depressed tolerance, 3 had normal basal metabolic rates and 2 had elevated basal metabolic rates; in one case the basal rate was not estimated. In only one of these 6 cases was the previous thyroidectomy considered to have been sufficiently inadequate to require reoperation. This case showed hypermetabolism.

Thus of 9 patients who had previous thyroidectomies for hypermetabolism, one to seven years previously, only 3 exhibited normal galactose tolerance, and only one of the six with depressed galactose tolerance presented sufficient evidence of recurrent hyperthyroidism to warrant a second operation.

Post-operative follow-ups

Between ten and fourteen days following subtotal thyroidectomy the galactose tolerance test was repeated in 14 cases, in 12 of which the basal metabolic rate was also re-estimated. In 6, the B.M.R. was reduced post-operatively but was still abnormally high. In this group of 6, galactose tolerance remained abnormally depressed in 4, became even more depressed in 1, and reached normal levels in the last case. The remaining 6 metabolic rates returned to normal post-operatively. Galactose tolerance in these cases remained abnormally depressed in 1, became further depressed in 2, was unchanged in 1 and returned to normal in 2. In the remaining 2 cases without post-operative estimations of the basal metabolic rate, the galactose tolerance was unchanged in one instance and became even further depressed in the other. Hence in only 21 per cent of these 14 cases did galactose tolerance become normal ten to fourteen days after subtotal thyroidectomy. Althausen (3) found galactose tolerance to return to normal in 18 of 22 cases (82 per cent). The post-operative interval was stated, in his publication, as being "at the time of discharge from the hospital."
MacLagan (15) also observed a return to normal tolerance in the majority of his post-operative cases. It was noted that post-operative galactose tolerance returned to normal in those cases in which Lugol’s solution, in therapeutic doses, had been able to favorably effect galactose tolerance pre-operatively, whereas the galactose tolerance remained appreciably depressed post-operatively where no effect was observed in galactose tolerance during the pre-operative use of iodine. Whether the response of this test to pre-operative iodine medication is as good an indication of adequate preparation for surgery as the reduction in hypermetabolism is a subject for further investigation.

Non-thyroid cases with abnormal galactose tolerance

It is obvious that galactose tolerance is abnormal in the presence of hyperthyroidism. We have observed, however, that galactose tolerance may also be abnormal in certain disease processes which appear entirely independent of the status of the thyroid gland. Forty-six such instances were encountered (fig. 2). The peak galactose was over 40 mgm. per cent in 35 cases and fell in the doubtful range (30-40 mgm.) in the remaining 11. The various clinical syndromes represented will be discussed individually.

(a) Liver cases. Althausen presented parenchymatous liver disease as one of the two pathologic conditions which, other than hyperthyroidism, influence blood galactose tolerance. We found this fact to be true in 7 cases of hepatocellular jaundice. In fact, the most elevated blood galactose level that we have encountered (199 mgm. per cent) occurred in a case of severe hepato-cellular jaundice. Two cases of obstructive jaundice of short duration, with no laboratory evidence of hepato-cellular damage, showed normal galactose tolerance. Two cases of chronic cholecystitis without laboratory or clinical evidence of liver cell damage had unequivocal depressions in tolerance to galactose. Both of these patients had symptoms of long duration and we cannot overlook the possibility of concomitant liver damage.

(b) Cardiac decompensation. Thirteen of 19 cases of decompensated heart disease, of variable etiology, presented depressed galactose tolerance. Three cases fell in the doubtful
zonc. Five of 6 cases upon whom basal metabolic rate estimations were performed evidenced hypermetabolism. Liver dysfunction, on the basis of long standing cardiac decompensation, although suspected, could not be proven as the basic cause of the altered galactose tolerance. Therefore, because of this experience, we do not ascribe any specific diagnostic significance to the test in the presence of cardiac decompensation.

(c) Gastro-intestinal disease. The test was performed upon 8 patients with proven active peptic ulcers. Six of these had abnormally depressed galactose tolerance. In no case was the basal metabolic rate abnormal nor was there clinical suspicion of hyperthyroidism or of liver dysfunction. A case of tuberculous ileitis and 2 cases of enteritis with diarrhea of unknown etiology also presented depressed galactose tolerance. What role increased intestinal absorption may have played in these cases is unknown. Two cases of inoperable gastric carcinoma presented normal galactose tolerance.

(d) Psychoneurotics. Of 15 psychoneurotics studied, only one had depressed tolerance to galactose. The basal metabolic rate was normal, there was no clinical evidence of hyperthyroidism, and liver function tests were within normal limits in this case.

(e) Miscellaneous cases. In 2 cases of the menopausal syndrome, 2 of lobar pneumonia (convalescent), 2 of healed pulmonary tuberculosis, 2 of essential hypertension, one of diabetes mellitus (of 5 studied), and one case each of skull fracture, chronic bronchiectasis, iodine poisoning, fever of unknown origin and healed Pott's disease of the spine exhibited depressed galactose tolerance. In each instance the cause of this intolerance was unknown.

Miscellaneous normal values. We have already enumerated 14 cases of psychoneurosis, 6 of decompensated heart disease, 4 of diabetes mellitus, 2 of inoperable gastric carcinoma, 2 of active peptic ulcer and 2 of obstructive jaundice with normal galactose tolerance. In addition normal values were obtained in 2 cases of inactive compensated rheumatic heart disease, and in one case each of chronic nephritis, Still's disease with amyloidosis, pernicious anemia, concussion of the brain, gastric syphilis and calculous cholecystitis.

Comparison of the galactose tolerance test with liver function tests

MacLagan's view of the role of the liver in affecting the blood galactose tolerance test has been noted. An attempt to correlate the bromsulphalein and/or the hippuric acid synthesis test (oral) with blood galactose tolerance was made in 25 cases. Of 21 cases so evaluated with depressed tolerance to galactose, 12 had normal liver function and 9 had abnormal liver function. Of the 4 cases with normal galactose tolerance, one case had normal liver function and 3 cases had abnormal liver function. Thus we see a total lack of correlation of the blood galactose test as performed with these two laboratory methods of estimating liver function. Because of the multiplicity of the functions of the liver cell and the inadequacy of the various laboratory procedures in testing these functions as a whole, the possible role of the liver in the mechanism of the blood galactose tolerance test cannot be negated by these results.

Eliminating those cases in which repetition of the test was performed after iodine therapy, galactose tolerance was redetermined in 6 patients in order to check uniformity in successive determinations. The greatest variation between peak galactose values in any case was 11.7 mgm. per cent and the average variation was 5.8 mgm. per cent.

DISCUSSION

Throughout this series of 162 cases our blood galactose values more nearly approximated those of Althausen than those reported by MacLagan. Repetition of the test in the same individual disclosed excellent uniformity of successive results.

The blood galactose tolerance test was positive in 33 of 36 cases of hyperthyroidism, doubtful in 2, and negative in one. In 30 of these 36 cases the clinical picture and the hypermetabolism were augmented by microscopic evidence of hyperactivity of the thyroid. Including this series with the American and
English cases reported thus far, we find the test to be definitely positive in 187 of 207 cases studied, or a percentage accuracy of 90.3 per cent.

In 23 cases, in which the presumptive diagnosis of hyperthyroidism was originally held and subsequently rejected, the basal metabolic rate was either misleading or inconclusive in over half. In 21 of these, galactose tolerance was normal. Of the 3 cases subjected to surgery in this group no histologic evidence of hyperactivity of the thyroid gland was present. We were unable to determine the cause of the depressed tolerance in 2 cases.

The negative value of the test in aiding in the exclusion of the diagnosis of hyperthyroidism must be emphasized. In only one instance in our 162 cases was the test falsely negative.

Whereas a normal galactose tolerance test almost invariably excludes the diagnosis of hyperthyroidism, abnormal tolerance has been encountered in many disease processes other than hyperthyroidism. This fact has been emphasized in our series of 46 cases which showed depressed galactose tolerance and which represented a heterogeneous collection of various disease entities. In the vast majority (35 cases) the blood galactose peaks were unequivocally elevated. In the remainder the results fell in the doubtful zone. One hundred per cent of the cases of parenchymatous liver disease, 68 per cent of the patients with cardiac decompensation, 6 of 8 cases of active peptic ulcer, 2 cases each of the menopausal syndrome, lobar pneumonia, healed pulmonary tuberculosis, chronic calculous cholecystitis, enteritis with diarrhea, and isolated instances of tuberculous ileitis, psychoneurosis, diabetes mellitus, skull fracture, chronic bronchiectasis, and healed Pott's disease exhibited depressed tolerance to galactose.

Althausen has offered impressive experimental evidence in support of his contention that abnormal galactose tolerance in hyperthyroidism may be totally accounted for by an increase in the rate of intestinal absorption of sugars. He likewise presented parenchymatous liver dysfunction as an additional factor which may depress galactose tolerance, but fails to consider the state of the liver as a factor in the mechanism of the depressed tolerance observed in hyperthyroidism. The demonstrable presence of liver damage, however, in a substantial percentage of hyperthyroids is well recognized. We cannot but conclude that the liver plays at least some role in the altered galactose tolerance in hyperthyroids. Altered liver function also exists in many other disease processes, some of which have been included in our group of non-thyroid cases with abnormal galactose tolerance. Our attempt to correlate standard liver function tests with the galactose tolerance test was unsuccessful. Thus, in the light of our experience, we believe that to explain the mechanism of the test on the basis of either increased intestinal absorption or hepatic dysfunction or to a combination of these two factors is to unjustifiably simplify a complex metabolic process. As Rowe contended, no one single factor should be indicted as the causative agent in abnormal galactose tolerance, but the test must rather be viewed as the algebraic sum of complex demonstrable and undemonstrable antagonistic and reinforcing agents.

Whatever the complex factors in the mechanism of the test may be, their
summation rarely produces a normal result in hyperthyroidism. A positive test, however, may represent hyperthyroidism or any one of a heterogeneous group of disease processes, which, for reasons frequently obscure, may involve galactose metabolism.

Frequently, hypermetabolism co-exists with depressed galactose tolerance and this coincidence of laboratory results must not necessarily be construed as indicating thyroid toxicity. We have encountered this combination most frequently in cardiac decompensation where the basal metabolic rate is elevated because of heart failure and galactose tolerance reduced either because of hepatic dysfunction resulting from long continued passive congestion or because of the activity of unknown agencies.

The alteration of the test noted in the majority of our cases of active peptic ulcer remains unexplained. We can only surmise some relationship to increased intestinal absorption, to an unknown liver factor, or to as yet undetermined agencies.

We investigated the permanency of altered galactose tolerance in hyperthyroids following subtotal thyroidectomy and found that in only 21 per cent of the patients who had been operated upon within a period of ten to fourteen days did the tolerance to galactose return to normal. Furthermore, long-range observation on patients who had been operated upon one to seven years previously revealed normal tolerance in only 3 of 9 cases. Only one of the 6 cases with depressed tolerance to galactose required a second thyroidectomy. Whether such findings reflect insufficient removal of glandular tissue, residual liver damage, complicating endocrinopathies, or the expression of continued constitutional disease is a moot question. For this reason we do not consider abnormal galactose tolerance after previous thyroidectomy to represent a diagnostic measure of re-activation of thyroid tissue.

From the evidence submitted, we believe that the blood galactose tolerance test represents an important adjunct in the diagnosis of hyperthyroidism. In the face of normal galactose tolerance a diagnosis of hyperthyroidism is rarely substantiated. Abnormal galactose tolerance, however, may be encountered not only in hyperthyroidism, but also in at least the variety of disease processes that have been presented.

**SUMMARY**

1. The blood galactose tolerance test was performed upon 162 patients.

2. The technique of the test embodies the principle of yeast fermentation of blood glucose and the determination of the residual reducing substances in the blood.

3. In 10 normal controls, values up to 30 mgm. per cent of galactose were obtained; these results are consistent with those reported by Althausen and differ from those of MacLagan.

4. The 30–40 mgm. per cent range was considered to represent determinations of doubtful interpretation.

5. Values above 40 mgm. per cent were considered to represent unequivocal depressions in galactose tolerance.
6. Repetition of the test in the same individual revealed excellent uniformity of successive determinations.

7. The test was positive in 33 of 36 cases of hyperthyroidism, doubtful in 2, and negative in one.

8. Repetition of the test 10–14 days after thyroidectomy gave normal results in only 21 per cent of patients.

9. The test was normal in only 3 of 9 patients who had had thyroidectomies for hyperthyroidism 1–7 years previous to our observation.

10. The test was negative in 21 of 23 cases of suspected hyperthyroidism, often in the face of hypermetabolism. Not one of this group was ultimately considered to suffer from thyroid disease.

11. An attempt to correlate galactose tolerance with standard liver function tests failed.

12. Depressed galactose tolerance was present in a group of 46 cases representing a heterogeneous collection of disease entities, unassociated with the evidence of thyroid hyperfunction.

13. The test therefore represents a valuable adjunct in the diagnosis of hyperthyroidism. Because of the influence of various non-thyroid diseases upon galactose tolerance, the negative value of the test in excluding the diagnosis of hyperthyroidism outweighs its positive value in establishing the diagnosis of hyperthyroidism.

14. Rowe’s contention that galactose tolerance depends upon a multiplicity of factors appears to represent the most logical interpretation of the mechanism of the test thus far advanced.

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REFERENCES


