with clinitest and if it is positive a glucose-tolerance test should be done. The people whose urine was negative to clinitest would be instructed to bring one-hour postprandial specimens on two subsequent occasions. If either of these were positive a blood-sugar examination would be done, but if they were all negative the patient would be instructed to report back in six months. I suggest that such a scheme is possible and very worth while.

Summary

The results of a comprehensive survey in Halstead, Essex, are reported. Out of 5,843 persons (95.3% of the population) included in the survey, 192 cases of glycosuria were discovered—38 known cases of diabetes and 35 newly discovered cases—a total incidence of 1.2%. The newly discovered cases were in subjects over 40 years, and the maximum incidence was in the 60–69 age-group.

An attempt was made to classify the other cases of glycosuria into various types. If accurate comparisons are to be made it is essential that comparable methods of blood-sugar analysis and comparable diagnostic criteria are used.

The survey confirmed the findings of other surveys that for every known diabetic there is another undiagnosed case. There may be as many as 300,000 undiagnosed cases in the country, and some suggestions are made for the institution of a large-scale postal diabetes detection drive.

It would have been impossible to do this work without the help of a great number of people. Dr. K. J. Atkinson, Dr. W. A. L. Collier, Dr. A. H. Rea, and Dr. P. Train are the four general practitioners in Halstead without whose help the survey would have been impossible. I received great help and encouragement from Dr. S. A. Propert, consultant physician, and Dr. J. B. Penfold, consultant pathologist to the Colchester Hospital Group. The biochemical work was done by Mr. Day, biochemist, Essex County Hospital, Colchester, and Mr. Broughton, biochemist, St. John's Hospital, Chelmsford. I am particularly indebted to Mr. Day for much advice and encouragement. Miss M. H. Bowman, S.R.N., was responsible for half of the field work, and her enthusiasm ensured the completion of the survey. I gratefully acknowledge the assistance I have received from Dr. I. H. Redhead's work, which initiated my interest in such a survey. I am grateful to Ames and Co. for supplying the clinistix and clinitest, and to Mr. Wakeling of that firm for his interest and encouragement.

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INTRAVENOUS GLUCOSE TOLERANCE AS A TOOL IN DEFINITION AND DIAGNOSIS OF DIABETES MELLITUS*

BY

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Since 1917 the glucose-tolerance test has been the procedure on which the definition of diabetes mellitus is based and the means by which the diagnosis of diabetes mellitus is made when other evidence is doubtful.

The test introduced by Jacobsen (1917) was the oral one. Jørgensen and Plum (1923) tried to establish an intravenous glucose-tolerance test, but did not succeed. During the past 20 years some workers have occupied themselves with intravenous glucose tolerance; a few have advocated its use, but most have devoted themselves to the mathematical problems involved in the analysis of the blood-sugar variations after the intravenous injection of glucose. In the meantime the oral glucose-tolerance test has held the field as the time-honoured means of the definition and diagnosis of diabetes mellitus.

In this article I want to suggest that the time has come when we ought seriously to consider discarding the oral glucose-tolerance test and adopting the intravenous one for the *definition* as well as for the *diagnosis* of diabetes mellitus.

However, strictly speaking, glucose tolerance cannot be used to define diabetes mellitus but can only be a means of defining the diabetic state or the degree of "diabeticity."

If we want to use glucose tolerance as the *definitory tool* for diabetes mellitus we must include it in a definition, which could be like this:

DIABETES MELLITUS AND DIABETIC ABERRATION

Diabetes Mellitus: A chronic disease with reduced glucose tolerance in patients not suffering from disease of the pancreas or from acromegaly, Cushing's disease, or phaeochromocytoma.

Diabetic aberration: Any other condition with transitory or permanent reduction of glucose tolerance.

The "other conditions" would be the endocrine disease mentioned and conditions such as fever, starvation, emotional upset, liver disease, brain disease, etc.

This definition stresses the difference between, on the one hand, a very common disease of unknown nature and, on the other hand, a series of unusual diseases in which the diabetic state is an understandable part of the clinical picture and a few more or less well defined, usually transitory, physiological and pathological states.

I do not intend to discuss the problems of definition of diabetes mellitus in more detail, but before leaving it it should be said that so long as the exact mechanism of a disease is not known any definition is, of course, in a certain sense arbitrary, and depends upon the use to which it is to be put. If it be suggested to-day that

*Based on a communication to a meeting of the British Diabetes Association in Birmingham, September, 1961.

diabetes mellitus is a condition which is followed after 15 years by the development of multiple microaneurysms in the retina, I think this might well be a useful proposition for some purposes.

Soon we hope to be able to define diabetes mellitus by the insulin content of the blood, the amount of free insulin in the blood, the insulin production per unit time, or perhaps the ratio between blood insulin and one or more insulin antagonists.

Defining diabetes mellitus with the help of the k-values does not, of course, rule out the possibility that *diabetes mellitus by this definition* is in reality two or more distinct metabolic disorders. On the contrary, it should be an invitation to explore this possibility on a safer ground.

Diagnosis

In the *diagnosis* of diabetes mellitus glucose-tolerance tests are necessary only in some patients. If the patient has a high blood sugar throughout the day, and perhaps even ketosis, he is in a diabetic state, because we know that giving glucose would result in a diabetic glucose-tolerance curve. If he cannot be fitted into any of the negative groups of our definition he has diabetes mellitus.

The glucose-tolerance test from the point of view of diagnosis is important only in doubtful cases—that is, the mild and mildest cases; and then it might be asked why we should diagnose the mildest cases, who have very few or no complaints.

I think there are very good reasons for that to-day. One is that a patient with a mild diabetes mellitus might feel passably well, but we know that he will feel even better and be more fit when his disease is brought under control. Another reason—perhaps a more important one—is that the incidence of severe long-term diabetic vascular disease is high also in patients with mild diabetes mellitus (Lundbæk, 1953, 1959). If it be true that treatment of diabetes mellitus inhibits to a certain degree the development of diabetic angiopathy, then treatment and control are indicated also in mild cases of the disease.

In defining diabetes mellitus and in diagnosing mild cases of the disease we are accustomed to rely upon the oral glucose-tolerance test; but I think most of us will admit that it is a rather clumsy tool. It takes several hours to perform, it depends upon the state of the digestive tract, and the results obtained are not easy to express in a useful way.

By tradition the criteria for normal oral glucose-tolerance test are height and length. Using the Hagedorn–Norman-Jensen method on capillary blood, the normal blood-sugar curve after administration of about 70 g. of glucose is said to rise not higher than 180 to 200 mg./100 ml., and to return to normal fasting levels in not later than two and a half hours.

If asked which of these two criteria is the overriding one, most of us would answer length rather than height. However, there is no unanimity on this point, and most authorities seem to avoid it when discussing the use of the glucose-tolerance test.

Then, again, there is the quantitative aspect: how can we say that one curve is more diabetic than another? It is easy enough with the very abnormal curves and with the nearly normal ones, but most curves are in between. Hagedorn (1921) suggested the use of the so-called "assimilation figure," which is a function of the area below the blood-sugar curve; but this idea has not been generally accepted.

Advantage of the Intravenous Test

The intravenous glucose-tolerance test has the advantage of taking less time (one hour instead of two and a half to three hours), of avoiding the gastro-intestinal tract, and of permitting a simple evaluation which can be stated as one figure. If all this be true, if these advantages are obtainable, why is it that the intravenous glucose-tolerance test is still not more widely used? The reason is, I believe, the confusion caused by the various attempts at analysing the course of blood-sugar fall after intravenous administration of glucose and the exaggerated importance attached by some workers to this aspect of the test.

Jørgensen (1930) expressed his results as the time until fasting values were obtained plus the area under the curve. In the next 20 years the following suggestions were made: number of minutes till the blood sugar reached 100 mg./100 ml., the area below the blood-sugar curve, the number of minutes till the pre-injection blood-sugar level was attained, and the blood sugar two hours after injection of glucose.

Hamilton and Stein (1942) showed that if one plots the blood-sugar values after intravenous injection of glucose in a semilogarithmic system, the values obtained from the 10th or 20th minute to the 60th minute will give a very good approximation to a straight line. The slope of this declining line could be used to give a one-figure expression of the result obtained.

Greville (1943) published a formula which should express the entire course of the blood-sugar fall after injection of glucose in normal people. Amatuzio *et al.* (1953) modified this formula, using the so-called "blood-sugar-excess values," and Hlad and Elrick (1959) suggested another modification of Greville's formula. Conard (1955) and Ikkos and Luft (1957) discussed the mathematical aspects of glucose tolerance in great detail; they came to the conclusion that the simple method of Hamilton and Stein is to be preferred.

All these workers were motivated by their interest in the form of the blood-sugar curve obtained after intravenous injection of glucose, and also by a search for an expression which would show what has been called net metabolic disappearance of glucose. It is, however, doubtful whether this ideal can be attained. We know that in the first minutes after injection the fall of blood sugar observed is partly due to excretion of glucose in the urine and to equilibration in the glucose space. Migration to various intracellular compartments is a cause of blood-sugar fall all through the test. Diminution of hepatic output of glucose is also involved, at least over part of the test period.

Although important advances in our knowledge of the operation of these processes have been obtained with the introduction of hepatic-vein catheterization and isotope tracer studies in man, we cannot claim to have a clear picture of the situation in normal subjects. We know even less about these mechanisms in diabetics, but it is almost certain that in patients with severe diabetes they are not the same as in normal subjects. In this situation I think that it is better to look at the fall in the blood sugar and to try to express it in some simple way. Plotting the blood-sugar values actually observed on semilogarithmic paper gives a close approximation to a straight line, and the slope of this line can be used

as a simple undefined empirical tool: it is steep in normal people, flat in diabetics.

The main point of my argument is, however, the comparison of the virtues of the intravenous and the oral test. From the point of view of precise physiological interpretation it is obvious that the oral test is much more unsatisfactory than the intravenous one.

Intravenous Glucose Tolerance in Normal and Diabetic Persons

The procedure we have used is as follows: 50 ml. of a 50% solution of glucose is injected into a cubital vein in the course of four minutes. After two minutes of injection a stopwatch is started, and capillary blood is drawn from the lobe of the ear every 10 minutes, during the interval between 15 seconds before and 15 seconds after the 10-minute point.

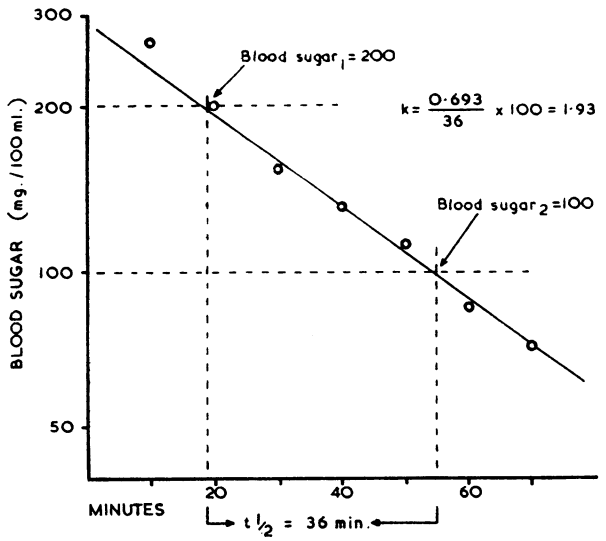

FIG. 1.—An example of the calculation of the k-value. Glucose is injected at time zero. The interpolated blood-sugar values 100 and 200 mg./100 ml. were chosen for the determination of $t_{\frac{1}{2}}$.

Chemical phlebitis has not been observed in more than 500 tests.

The result of an intravenous glucose-tolerance test is expressed by the k-value—that is, the diminution rate of the blood sugar in percentage per minute. The blood-sugar curve forms a straight line on semilogarithmic paper (Fig. 1), which means that the decrease is exponential and

$$Bls_t = Bls_0\, e^{-kt}$$

or

$$Bls_{t_2} = Bls_{t_1}\, e^{-k(t_2 - t_1)}$$

which gives

$$k = \frac{\ln Bls_1 - \ln Bls_2}{t_2 - t_1}$$

If a time interval $(t_2 - t_1)$ is chosen on the abscissa of the semilogarithmic graph during which the blood sugar has fallen from a certain value to half that value ("half-time"), the formula can be simplified to

$$k = \frac{\ln Bls_1 - \ln (0{\cdot}5 \times Bls_1)}{t_{\frac{1}{2}}}$$

where $t_{\frac{1}{2}}$ is the half-time. The numerator can be written

$$\ln \frac{Bls_1}{Bls_1 \times 0{\cdot}5} = \ln 2 = 0{\cdot}693, \text{ which gives}$$

$$k = \frac{0{\cdot}693}{t_{\frac{1}{2}}},$$

but usually this k is multiplied by 100 to obtain the percentage fall of blood sugar,

$$k = \frac{0{\cdot}693}{t_{\frac{1}{2}}} \times 100 \text{ (percentage per minute)}$$

Our group of diabetics are simply "recognized diabetics"—that is, patients being controlled in our diabetic clinic. The age of these patients ranged from 19 to 78 years, with an average of 59. Our non-diabetic group consists of patients with arthrosis, fibrositis, or neurosis, without symptoms of diabetes and without glycosuria. These patients were 17 to 77 years of age; but few old patients were included, the average age being only 43 years. All the patients were out-patients.

Fig. 2 shows the distribution of k-values we have obtained in 64 non-diabetic patients and in 60 diabetics. The curve of the non-diabetics has some skewness to the right, principally because four patients had unusually high values. Our average figure for non-diabetic patients is 1.72. This is very nearly the same as that obtained by Conard (1955). His average figure was 1.74.

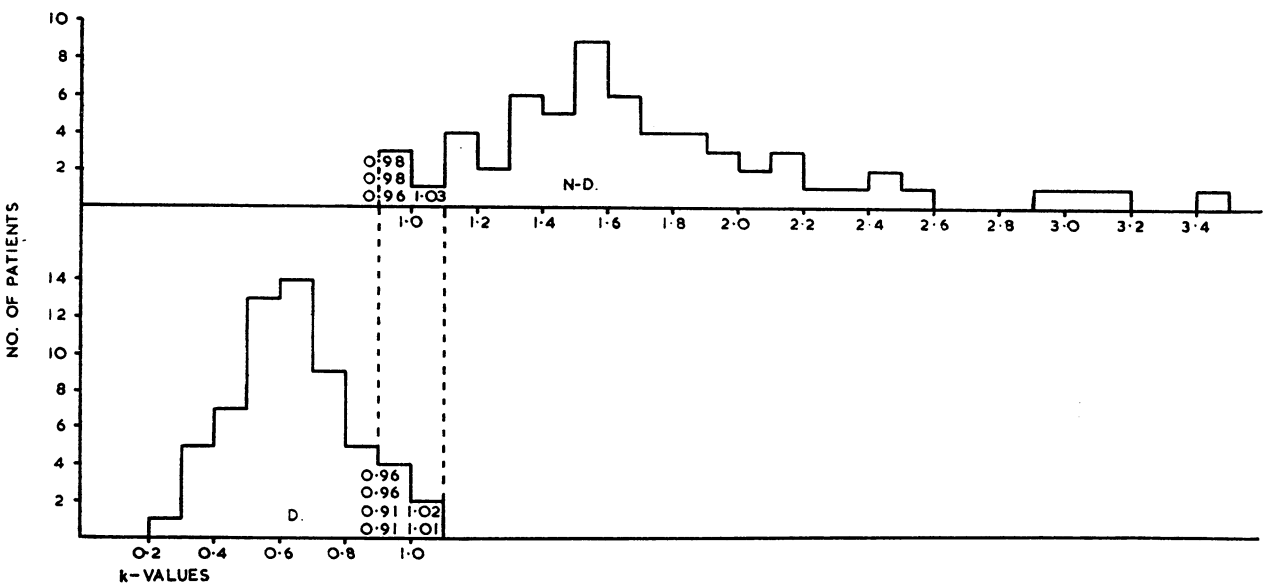

FIG. 2.—Distribution of k-values in 64 non-diabetics (average age 43 years) and in 60 diabetic patients (average age 59 years).

Fig. 3 shows the correlation in non-diabetic patients between the k-values of the intravenous glucose-tolerance test and *body weight* expressed as percentage of ideal weight. Low values are found more often in obese than in non-obese subjects. Two of our very high k-values are from very thin patients.

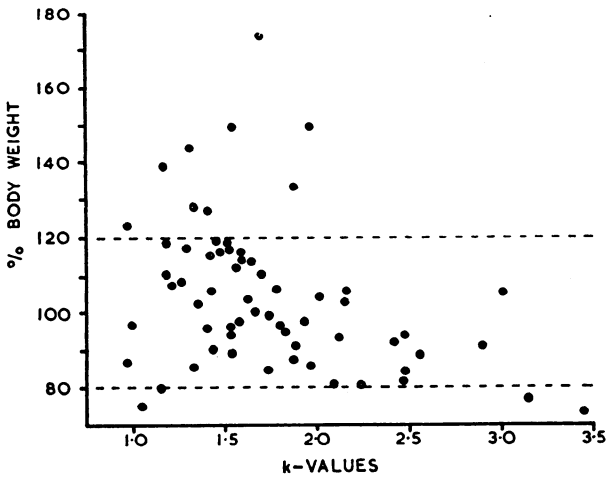

FIG. 3.—Correlation between k-values and body weight as percentage of normal. Non-diabetics.

The average k-value in non-diabetic patients *more than 50 years old* was a little lower than in younger patients—namely, 1.60. When patients with more than 20% overweight were excluded the average value was the same in young and old persons in this series. The four patients with the lowest k-values were aged 43, 43, 56, and 59 years. However, we have too few old people in our series of non-diabetics to elucidate the important problem of the incidence and significance of asymptomatic diabetes mellitus in senility.

The distribution in the group of diabetics (Fig. 2) is more symmetrical than in the non-diabetic group. Our average value for the diabetic group is 0.63. This is not far from Conard's average figure of 0.54. There is an overlapping in the region from 0.90 to 1.05. This borderline zone includes four non-diabetic and six diabetic patients among the total of 124 patients.

If these results were to be applied for *diagnosis* in practice one would say that a value below 0.95 signifies a diabetic state, while a value above 1.05 means non-diabetic. Patients with values between 0.95 and 1.05 would be regarded as observation cases to be followed by repeated tests.

For *defining* diabetes mellitus—for example, in a study dealing with some hormonal, metabolic, vascular, or other aspects in patients with and without diabetes mellitus—one could make a suggestion to compare two groups, one in which the k-values were below 0.80, another in which they were above 1.20.

Among the six patients whose k-values are high for diabetics, four are very mild cases with normal blood sugar throughout the day on moderate carbohydrate restriction. One has normal blood sugar on 12 units of insulin a day, another needs 32 units. This points to a certain correlation between the k-value and the degree of diabetes as judged in the usual way by symptoms and "insulin-requirement." However, in the series as a whole there is only a tendency in this direction, and there are many exceptions.

Fig. 4 shows the correlation between the k-value and the degree of diabetes mellitus expressed by the dose of insulin which the patient took. It appears that in the group of patients with low k-values there are only a few who can managed without insulin, but the percentage of such patients increases gradually up to the group with high k-values. There is a reciprocal fall in the percentage of patients who get more than 20 units of insulin a day, but the correlation is less clear-cut here.

In the study of some particular problem in diabetes mellitus it is often of interest to distinguish between "mild" and "severe" diabetes mellitus, or between a diabetic state which is for the moment under control and one which is uncontrolled. There are many different criteria on which such distinctions can be attempted. It is suggested that the k-value might be usefully employed as one such criterion—for example, by dividing a series of cases into groups with k-values above or below 0.40 for the comparison of the particular findings obtained in study.

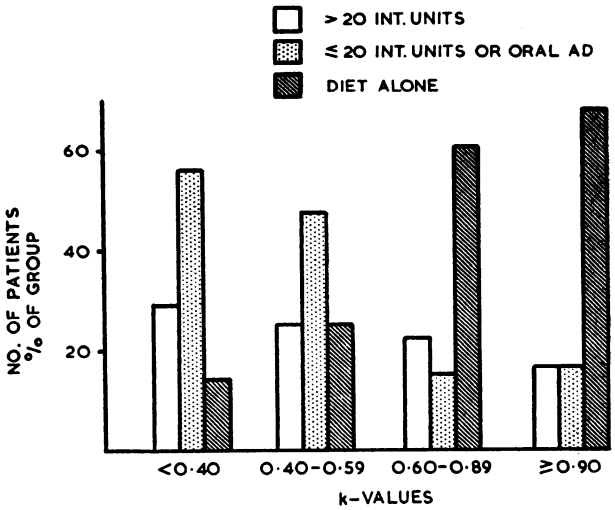

FIG. 4.—Correlation between k-values and degree of diabetes as judged by "insulin requirements."

Oral and Intravenous Glucose Tolerance

Fig. 5 shows the results of a statistical analysis of the correlation between the intravenous and the oral glucose-tolerance test in 45 diabetic patients. The oral test was performed in the ordinary way, on the day after the intravenous test.

The analysis includes the correlation between the individual k-values and the following parameters from the same patient's oral curve: (1) total area below the blood-sugar curve; (2) area of increase—that is, total area minus the area below the fasting value; (3) absolute increase of blood sugar; (4) three-hour deficit—that is, the three-hour value minus the fasting value; (5) the three-hour blood-sugar value; and (6) the percentage fall from the highest value to the three-hour value.

It appears that the only statistically significant correlation found was between k-values and the last blood sugar or the percentage fall. This is what one would expect if one regards the descending limb of the oral curve and the end-point of it as an expression of the clearing of the glucose out of the blood in the same way as the steepness of the intravenous curve.

In judging slight abnormalities on an oral glucose-tolerance curve we usually concentrate on the 2½-hour value. If the information we obtain from the intravenous test is of the same nature as that which we get from the end-point of the oral glucose-tolerance test—

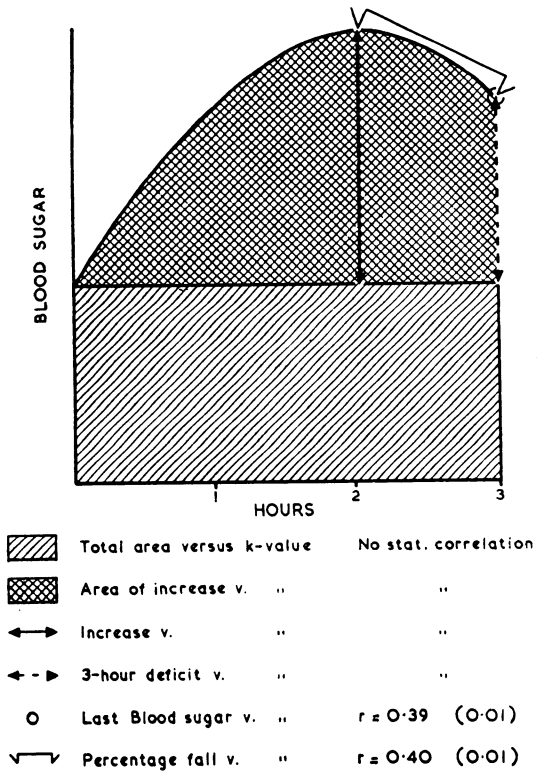

FIG. 5.—Statistical analysis of the correlation between the k-values and various expressions of oral glucose tolerance in individual patients. The Figure is only a model to illustrate the expressions analysed.

as it seems to be—I think there are strong reasons to prefer the k-value, which is, after all, determined by a regular succession of four or five blood-sugar values, instead of the one 2½-hour value in the oral test.

Influence of Diet and Oral Antidiabetic Drugs on Intravenous Glucose Tolerance

The intravenous glucose-tolerance test can be used to verify the result of treatment in diabetes mellitus. The influence of diet has been examined in a series of patients with mild diabetes mellitus. The first test was done while the patient was on a full normal diet. The patients were then put on a diet with about 100 g. of carbohydrate a day, without restriction of the calories. After a week or two, when the average 24-hour blood sugar had dropped down from about 200–300 to about 100–200 mg./100 ml. the test was repeated.

Fig. 6 shows some preliminary results obtained in such a study. The individual k-values before and during dietary treatment are plotted in a 45-degree diagram. It appears that most of the adipose patients have obtained a somewhat higher k-value, while the k-values of most of the non-adipose patients are the same or slightly lower than before.

These results may be compared with the effect of oral antidiabetic drugs. Fig. 7 shows the effect of carbutamide, tolbutamide, and chlorpropamide on the intravenous glucose-tolerance test. These drugs bring about a rise in the k-value which is statistically highly significant (Jensen *et al.*, 1958; Esmann *et al.*, 1959).

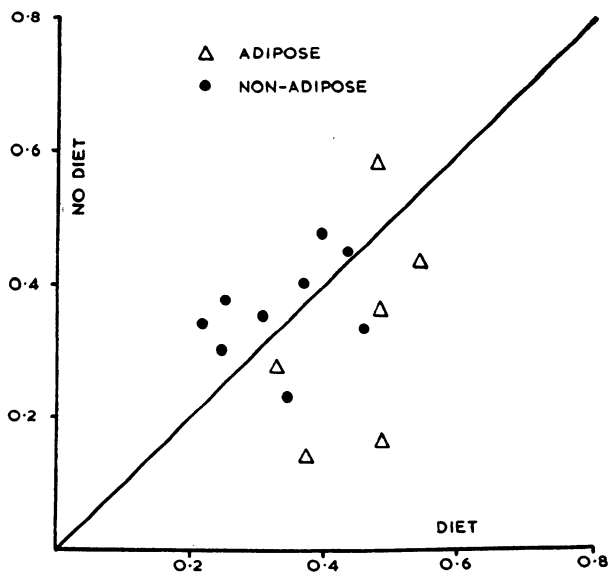

FIG. 6.—Influence of carbohydrate restriction on k-values in adipose and non-adipose diabetics.

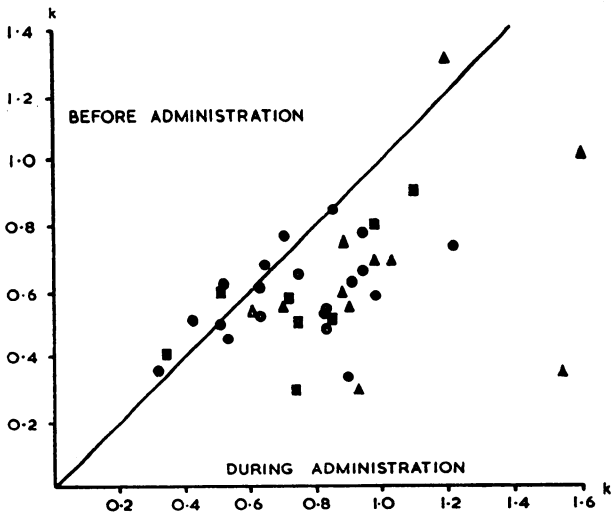

FIG. 7.—Influence of carbutamide (■), tolbutamide (▲), and chlorpropamide (●) on the k-values in mild diabetes mellitus. (From Jensen *et al.*, 1958, and Esmann *et al.*, 1959.)

Oxyhyperglycaemia and Renal Glycosuria

Oxyhyperglycaemia (or "lag curve") is the condition in which there is slight glycosuria and an oral glucose-tolerance curve which rises about 180–200 mg./100 ml., but is back to fasting values two and a half hours after the ingestion of glucose. This condition is mostly found in elderly men, and one always feels uncertain whether these patients should be regarded as and treated as diabetics.

Table I shows the results of intravenous glucose-tolerance tests in 11 patients in whom glycosuria had been discovered accidentally and who turned out, on oral glucose-tolerance test, to be cases of oxyhyperglycaemia. None of these patients had had operations on the stomach. Only one of them is a diabetic by the intravenous test, but two are borderline cases.

Table I also shows the results from three patients in whom repeated oral tests had been inconclusive, sometimes pointing to oxyhyperglycaemia, sometimes to diabetes mellitus. These three patients had low k-values and are being treated as diabetics. For comparison four cases of renal glycosuria are shown. These patients have high normal k-values.

TABLE I.—*Results of Oral and Intravenous Glucose-tolerance Test in Oxyhyperglycaemia and Renal Glycosuria*

Subject	Sex	Age	Oral G.T.T. Fasting	Oral G.T.T. Max.	Oral G.T.T. 2½-hour	I.V. G.T.T.
Oxyhyperglycaemia						
E.J. ..	F	35	85	280	90	1·28
H.B. ..	M	67	100	260	92	0·99
J.H. ..	M	79	111	251	95	0·87
F.K. ..	M	49	128	243	88	1·93
S.A.	M	56	89	238	88	1·24
B.K.J.	F	69	88	223	84	0·99
H.A.N.	M	59	114	218	67	1·28
H.P. ..	M	64	97	205	111	1·83
C.M.	M	66	90	196	113	1·82
C.P. ..	M	62	106	194	62	1·36
A.A.N.	M	56	96	189	71	1·47
Diabetes Mellitus?—Oxyhyperglycaemia?						
J.G. ..	M	61	140	224	80	
			142	235	124	
			90	203	60	0·66
T.D. ..	M	61	130	260	144	
			110	260	123	0·50
J.O.J. ..	M	77	130	246	103	
			126	236	138	0·72
Renal Glycosuria						
P.M.Ø.	M	36	86	171	76	2·58
A.A. ..	F	14	70	108	86	3·05
L.L. ..	F	17	114	167	93	1·83
O.O.	M	16	88	151	79	1·98

Table II shows three clinical developments. The first is the typical development of diabetes mellitus from oxyhyperglycaemia. The second shows the opposite development, but the k-value remains low. The last case is a Newburgh and Conn (1939) type of diabetes—diabetes mellitus disappearing after substantial weight loss. Newburgh and Conn's definition was return to normal of the oral glucose-tolerance test. The intravenous test reveals, however, that the diabetes is still there.

TABLE II.—*Developments of Oxyhyperglycaemia into Diabetes Mellitus or vice versa*

Subject	Age	Sex	Oral G.T.T. Fasting	Oral G.T.T. Max.	Oral G.T.T. 2½-hour	I.V. G.T.T.
Oxyhyperglycaemia into Diabetes Mellitus						
H.T.H.	M	73 1945	95	233	87	
		73 1958	90	243	110	
			151	308	268	0·71
Diabetes Mellitus into Oxyhyperglycaemia						
C.M.J.	M	56 1956	118	302	132	0·63
		56 1960	112	220	65	0·56
Diabetes Mellitus into Oxyhyperglycaemia after Loss of Weight						
H.G.K.	M	39 1959	Acute, severe diabetes with ketosis. Insulin 80 u./day. Weight 123 kg.			
		39 1961	No diabetic symptoms. No insulin. Weight 82 kg.			
			67	192	62	0·79

Intravenous Glucose Tolerance in Insulinoma and "Post-insulinoma Diabetes"

It is known that some patients with insulinoma have a very high intravenous glucose tolerance.

Fig. 8 shows the results obtained in a 60-year-old patient with severe spontaneous hypoglycaemia before and after operation. The k-value of the first intravenous glucose test was 4.52. This is the highest figure

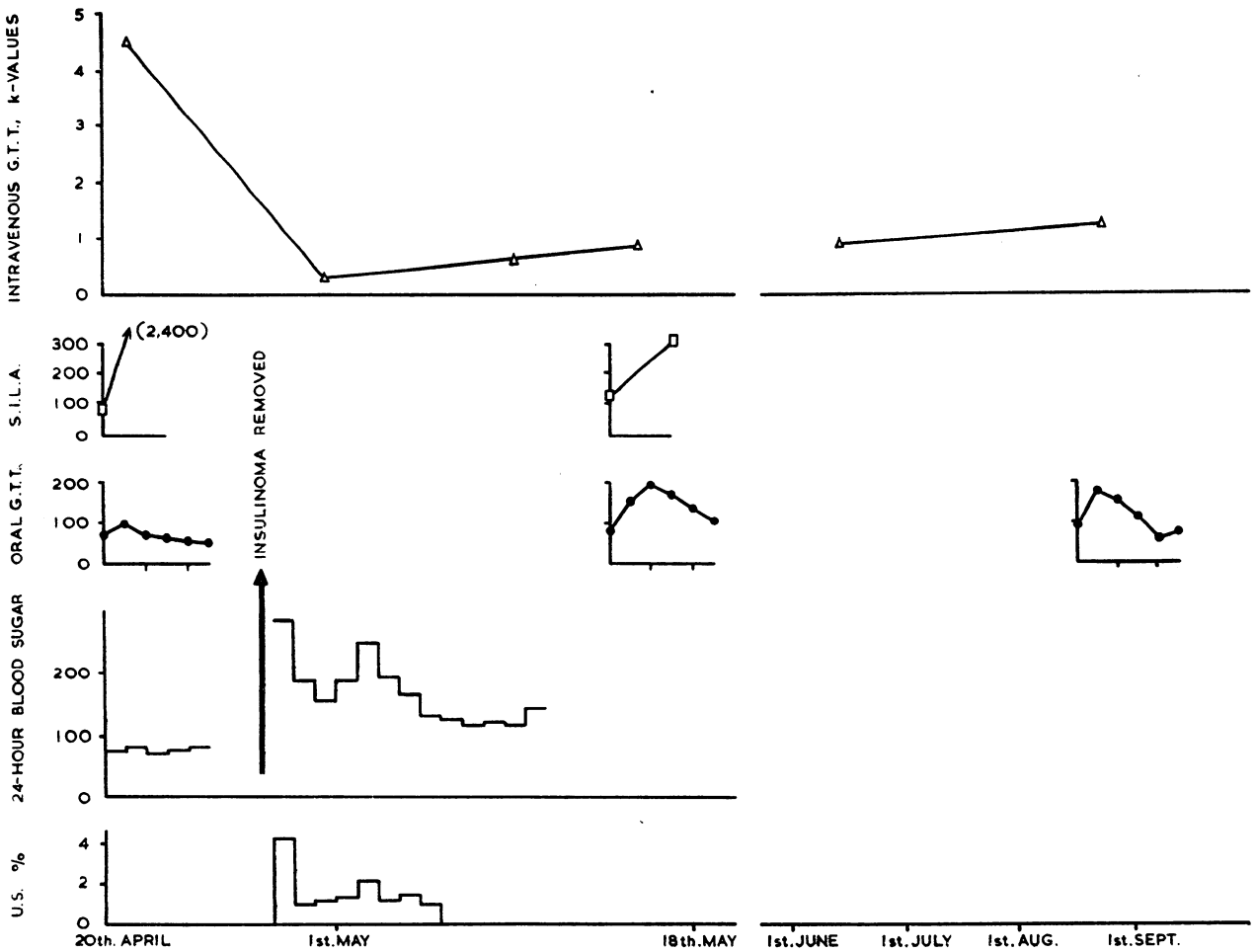

FIG. 8.—Transitory "post-insulinoma diabetes" of several months' duration (see text).

we have met with in our laboratory. The oral blood-sugar curve was flat, as it is in some but not in all cases of insulinoma. The 24-hour blood sugar—the average of three daily determinations—was about 70 mg./100 ml. Serum insulin-like activity was normal in the fasting state, but it rose to 2,400 micro units/ml. after glucose, a value about 10 times normal in the experience of our laboratory with the rat-epididymal-fat-pad method (Lyngsøe, 1962).

After the operation the 24-hour blood-sugar value rose considerably and glycosuria appeared. The blood sugar then decreased to normal values and the glycosuria disappeared after a week. The serum insulin-like activity values before and after glucose became normal.

The k-values after the intravenous test demonstrate the severe diabetic state shortly after the operation. By repeated determinations it was possible to show that this abnormal state subsided only slowly. It took four months before the k-value came up above 1. This shows how slowly the β cells, which have been suppressed while the insulinoma was there, regain their normal capacity for insulin production. The daily blood-sugar determination did not show this slow development, and the second oral test is just inside normal limits—at the time when the k-value is still 0.80.

Detection of Latent Diabetes Mellitus

The important problem of the detection of latent diabetes mellitus is still in a very preliminary state. The method at present recommended for unmasking latent diabetes mellitus is the cortisone-glucose-tolerance test in one of its modifications. Other methods, such as glucose tolerance after a short period of carbohydrate starvation, might be just as useful.

For the cortisone-glucose-tolerance test it might be suggested that the use of the intravenous method would permit a quantitative estimate and allow statistical analysis of the degree of "diabeticity" obtained in groups of persons.

Fig. 9 shows how normal young people react to cortisone or prednisone by a prompt decrease in the k-values if the second test is done two hours after the oral administration of the steroid (Holten *et al.*, 1957).

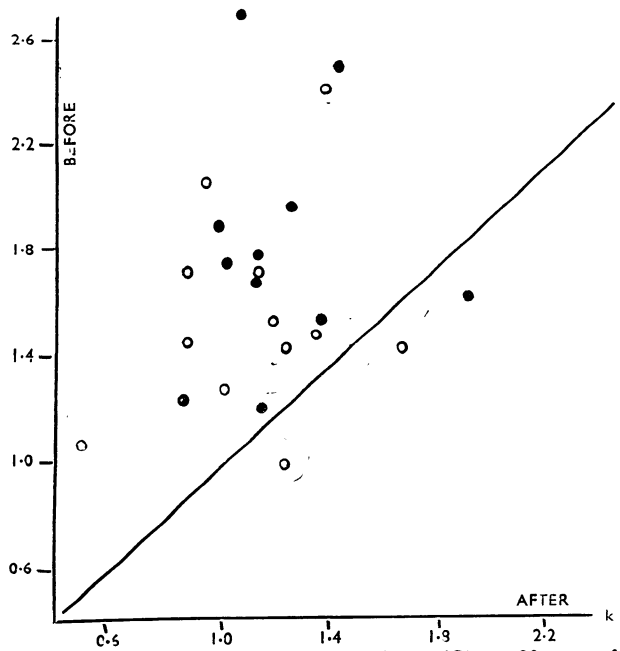

FIG. 9.—Influence of 100 mg. of cortisone (○) or 20 mg. of prednisone (●) on the k-values of non-diabetic patients. (From Holten *et al.*, 1957.)

Summary

The use of the intravenous glucose-tolerance test as a measure of "diabeticity" and the incorporation of it in a definition of diabetes mellitus is discussed.

In a group of diabetics (patients visiting a diabetic clinic) the k-value (the slope of the blood-sugar curve in a semilogarithmic system) was between 0.20 and 1.02.

In a group of somewhat younger non-diabetics (patients without symptoms of diabetes mellitus and without glycosuria) the k-value was between 0.96 and 3.45.

There is a rough correlation between the k-value in diabetes mellitus and the degree of diabetes as judged by the insulin requirement.

A statistical correlation obtains between the k-value and the fall of the blood sugar in the oral glucose-tolerance test.

Some examples are given of the use of the intravenous glucose-tolerance test as a tool in the definition and diagnosis of diabetes mellitus.

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"Thanks to generous response to appeals," says the *Mobile Physiotherapy Service Association's Annual Report for the Year 1961*, "it has been possible to give grants to some services finding it difficult to obtain sufficient income locally for their maintenance or extension. It is sometimes difficult to find local people prepared to form a committee which will undertake to raise £1,000 to £1,200 annually to keep a van on the road. Representatives of the Ministry of Health have stated, however, that they are unable to extend the provision of physiotherapy beyond the hospital and specialist services, and it seems therefore that this work must continue to be sponsored by voluntary bodies; the demand is especially great among the old people." The report notes that the cost of a 5-cwt. van, fitted with shelves and cupboards, is £400, with another £500 for apparatus. Cost of maintenance is £1,000 to £1,200 a year, including the salary and superannuation of a chartered physiotherapist. Visits, which are only arranged on the recommendation of a doctor, cost 9s. to 17s. each, according to the distances to be covered; the maximum charge to a patient is usually a quarter to a third of the total, the balance being met by voluntary subscriptions and donations.