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DIABETES MELLITUS

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PREFACE

Diabetes in the South Pacific was discussed in depth at the Commission's Seventh Conference on Health Services (Vila, New Hebrides, 9 to 13 February 1976).

During the discussions it became apparent that diabetes represents a major health problem in certain countries of the Pacific. It is likely that because of a genetic susceptibility, prevalence will increase in Polynesian and Micronesian societies as they become urbanized. The prevalence in Melanesian groups, on the other hand, is very low and can be expected to increase only slightly with the growth of urbanization.

Dr Paul Zimmet, who attended the Conference on Health Services as a Consultant on diabetes, describes in this Circular the clinical categories of diabetes and outlines methods of detecting the disease.

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I. CLINICAL CATEGORIES OF DIABETES MELLITUS

While it is widely accepted that diabetes mellitus is a disorder characterized by impaired carbohydrate tolerance, there is no clear-cut distinction between normal and abnormal. Clearly, in a person presenting with thirst, polyuria, weight loss, genital pruritus and documented hyperglycaemia, a firm diagnosis of diabetes can be made. However, in most instances diabetes does not present in this fashion and is detected through

(a) routine urinalysis
(b) diabetes surveys
(c) multiphasic screening
(d) patient presenting with another complaint, e.g. recurrent skin infections.

In many of these patients, the problem arises as to the significance of the finding of hyperglycaemia and as to whether treatment should be pursued.

A. DEFINITIONS

The World Health Organization has suggested a number of categories which allow the natural history of diabetes to be studied in several stages.

1. Potential Diabetics:

Individuals who have a normal oral glucose tolerance test (G. T. T.) but in whom diabetes can be forecast with reasonable reliability, e.g.

(a) women who have given birth to an excessively heavy infant (4.5 kg or more) - either live or stillborn;

(b) the healthy identical twin of a diabetic;

(c) the child of two diabetic parents.

2. Latent Diabetics:

Individuals whose glucose tolerance test is now normal but who have been diabetic in the past when under physiological or pathological stress, e.g. pregnancy, acute infections.

In addition, individuals who exhibit abnormal carbohydrate tolerance during a cortisone stress G. T. T. are included in this group.

3. Chemical Diabetics:

Individuals who have an abnormal G. T. T. but are asymptomatic.

4. Clinical Diabetics:

Individuals who have an abnormal G.T.T. and have symptoms and/or complications of diabetes mellitus. The term prediabetes is widely (and loosely) used in the medical literature. It amounts to a theoretical category which all people who eventually develop diabetes have to pass through. It should only be used in a retrospective sense. Glucose tolerance is normal at this stage and there is no specific clinical or biochemical diagnostic marker of the condition. The term prediabetes is often used - quite erroneously - to describe the state represented by potential diabetes.

B. CLINICAL DIABETES

Broadly speaking, all cases of clinical diabetes fall into two categories -

(a) Juvenile-onset (ketosis-prone)

(b) Maturity-onset (non-ketotic).

This division has a patho-physiological basis which was discovered long after the two categories were defined. The biochemical abnormalities of diabetes are due to insulin deficiency. Until 1950, it was believed that all diabetics had a total insulin deficiency and this idea was strengthened by the efficacy of insulin in the therapy of the condition. This concept was destroyed by the pioneering work of Professor J. Bornstein in Melbourne. He demonstrated that while no insulin could be detected in the plasma of juvenile-onset diabetics, it was present in normal or increased amounts in the maturity-onset form. Thus arose the concept of relative insulin deficiency, i.e.

Juvenile-onset - true insulin lack

Maturity-onset - relative insulin lack.

1. Juvenile-onset Diabetes

This category represents 10-15 per cent of diabetics in Western societies and the presentation is classical - as thirst, polyuria, weight loss, lassitude or as keto-acidosis. The people concerned are usually children or young adults and tend to be thin. The onset is usually acute and keto-acidosis may supervene within hours so that treatment with insulin should be commenced without delay. As the pancreas in these individuals cannot produce insulin, the use of oral hypoglycaemics is dangerous and absolutely contra-indicated, as these agents act by stimulating pancreatic insulin release.

However, this form of diabetes is rare in the Pacific region. Most diabetics fit into the maturity-onset group which is discussed below.

2. Maturity-onset Diabetes

The majority of diabetics fall into this category. Individuals are older, fatter and have little or no tendency to ketosis. The symptoms are usually mild and, as mentioned earlier, the disease is often discovered on a routine screening test. Treatment is by diet alone or in combination with an oral hypoglycaemic. Occasionally, insulin is necessary. The main differences between the two forms of diabetes are shown in the following table.

DIFFERENTIAL FEATURES OF THE TWO FORMS OF CLINICAL DIABETES

	JUVENILE-ONSET	MATURITY-ONSET
Age of onset	Children and young adults	Usually 40 years and over
Symptoms	Acute onset	Gradual onset
Ketonuria	Present	Absent or slight
Acidosis	Potential	Rare
Plasma Insulin	Absent	Present
Response to oral hypoglycaemic	Absent	Present
Treatment	Diet and insulin	Diet $\overset{+}{-}$ oral hypoglycaemic

This division into two groups is useful but by no means absolute. Older diabetics occasionally develop a juvenile-onset diabetes, are ketosis prone and require insulin therapy. More rarely, a child's diabetes may be controlled by an oral hypoglycaemic agent. However, these children invariably have the maturity-onset form of the condition. Most young diabetics in the Pacific region fit into the maturity-onset group.

The two forms of diabetes described above are generally referred to as primary diabetes - a term used to obscure the fact that we still know very little about the aetiology of diabetes! However, diabetes may occur secondary to other conditions.

3. Secondary Diabetes

Diabetes may occur as a consequence of:

(a) Pancreatic disease, e.g. pancreatectomy, pancreatitis, carcinoma, haemochromatosis.

(b) Endocrine conditions, e.g. acromegaly, Cushing's syndrome, thyrotoxicosis, pheochromocytoma.

(c) Drug-induced, e.g. oral contraceptives, steroid therapy, diuretics.

Endocrine and drug-induced diabetes often resolves with treatment of the condition or withdrawal of the drug.

II. METHODS OF DETECTION

In recent years the prevalence of diabetes has increased in many of the Pacific Islands. In a few territories the extent of the problem has been determined by well planned diabetes surveys.

On the other hand, the lack of facilities in other territories has made such surveys impossible.

The main methods of diabetes detection and their advantages and limitations are discussed below.

A. TESTS FOR GLUCOSE IN URINE

This is the simplest test for diabetes and is useful as long as the clinician is aware of its inadequacies, e.g.

1. Low renal threshold

(a) A normal person does not show sugar in the urine until the blood glucose level exceeds 180 mg/100 ml (i.e. the renal threshold). However, two to four per cent of people have a low renal threshold for glucose and will show glycosuria with a normal blood sugar.

(b) Glycosuria may be seen in healthy pregnant women - once again because of the low renal threshold.

2. High renal threshold

With advancing age, the renal threshold rises and the blood glucose can rise to 300 mg/100 ml with no glycosuria showing. Thus, many cases of diabetes may be missed in older age groups.

Where blood glucose estimations are not available, obviously urine testing must be the method of choice. However, it is important to know the inherent errors of the method.

To ensure maximum detection, urine specimens should be collected two to three hours after a big meal. If the person has classical symptoms (i.e. thirst, increased frequency of urination, pruritus vulvae, etc.), then the diagnosis is not in doubt. However, if a person with glycosuria has no symptoms, the diagnosis of diabetes may be incorrect.

For the routine urine screening for diabetes, glucose specific paper strips (e.g. Diastix, Clinistix or Tes-Tape) are reliable and the most convenient method.

B. BLOOD TESTS FOR DIABETES

The use of a blood sugar estimation is less likely to cause errors in the diagnosis of diabetes.

1. Fasting blood sugar - while some diabetics may have a normal fasting blood sugar - so that a normal one does not exclude diabetes - a level over 140 mg/100 ml makes the diagnosis likely.

2. Random blood sugar - in most people, it is unusual for the blood sugar to rise above 130 mg/100 ml even after meals. Thus, a random blood sugar over 160 mg% makes diabetes very likely.

If the patient has symptoms of diabetes, glycosuria and a high blood sugar (fasting or random), a glucose tolerance test is quite unnecessary.

3. Glucose tolerance test - this still remains the best and most sensitive test for diabetes. In general, a fixed dose of glucose (50, 75 or 100 gm) is given orally and blood sugar is measured every half-hour for two hours.

In general, it is the two-hour blood sugar that is critical for the diagnosis. Experts vary in their opinion of what actually represents an abnormal figure, i.e. the diagnostic level for diabetes. A level of over 120 mg/100 ml is generally accepted as diagnostic of diabetes.

Because of the many factors than can influence the result, e.g. age, sex, weight, drug therapy, etc., many workers use 130 mg/100 ml as the diagnostic level when it comes to large-scale population studies.

Another useful (but rough) criterion is based on the fact that the two-hour blood sugar rises with age. By using 80 mg/100 ml as the baseline and adding 1 mg/100 ml for each year the following table is obtained:

AGE	2-HOUR BLOOD GLUCOSE (mg/100 ml)
20	100
30	110
40	120
50	130
60	140 etc.

Thus, a two-hour blood sugar of 140 mg/100 ml would be diagnostic of diabetes in a 60-year old but not in a 40-year old subject.

For population screening, a two-hour blood sugar (after a glucose load) is the most useful test. If there are problems in keeping people around for that period a one-hour test might be acceptable. If blood sugar estimations are unavailable in the area only then should urine testing be used as the main test.

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