Diagnosis of Diabetes Mellitus*

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Diabetes Mellitus should be suspected in these groups:

(1) Those having symptoms suggestive of the disease

(2) Those at high risk

(3) Those found to have glycosuria at a routine medical examination; for work, insurance or travel purposes, during pre-operative assessment and at antenatal attendances.

(a) SYMPTOMS OF DIABETES

The common symptoms of diabetes mellitus are POLYURIA (frequent urination of large volume of urine), POLYDIPSIA (excessive thirst), WEIGHT LOSS, WEAKNESS AND TIREDNESS. Other symptoms may include TEMPORARY BLURRED VISION (due to refractive changes in the lens), RECURRENT INFECTIONS, POLYPHAGIA (excessive hunger), PARAESTHESIAE (numbness and tingling) and CRAMPS in the legs, PRURITUS VULVAE, BALANITIS, GENERALIZED ACHES and SEXUAL PROBLEMS.

In the local setting the clinicians should be particularly suspicious in those with infections. Cuts, bruises and wound are slow to heal and easily get infected. Infections may take longer to clear and may occur repeatedly.

IMPOTENCE and DECREASED LIBIDO in the males, IRREGULAR PERIODS, AMENORRHOEA and DECREASED FERTILITY in the females may be presenting features. Markedly raised blood glucose level may precipitate NEUROPATHY (reversible).

SWEET TASTE in the mouth is a rare presenting complaint. Occasionally dentists may be the first to suspect diabetes in patients with XEROSTOMIA (dryness of the mouth) or severe and prolonged GINGIVITIS and PERIDONTITIS (disease of gums and supporting tissues that support and maintain the teeth in the jaw).

Rarely hypoglycaemic symptoms such as faintness, sweating and palpitations several hours after a meal or before meals may be an early symptom.

The clinicians should be aware of diabetes being precipitated by infections, stress and drugs, and occasionally there may be a history of rapid weight gain immediately preceding the onset of symptoms.

The possibility of the disease should also be considered in those presenting with drowsiness and COMA. In children coma is the presenting feature in a significant percentage (about 20%) of the cases. Also in elderly patients (> 60 years) diabetes may be diagnosed for the first time when admitted with coma.

The symptoms of diabetes may be severe and acute in onset (insulin-dependent diabetes) or mild or trivial or be completely absent (non-insulin-dependent diabetes). Especially in adults and the elderly, asymptomatic diabetes or impaired glucose tolerance may have existed for a number of years. Some of these may present with complications such as cataracts, retinopathy, neuropathy, ischaemic heart diasease, stroke or peripheral vascular disease.

(b) THOSE AT AN INCREASED RISK (HIGH RISK GROUP)

Diabetes mellitus or impaired glucose tolerance should be suspected in a large number of patients who are at an increased risk of developing diabetes. These include:—

CLOSE RELATIVE OF DIABETICS
— refer to the article on classification of diabetes

HAVING EXCESS BODY WEIGHT
— risk related both to the degree and the duration of diabetes

BEING A MEMBER OF AN ETHNIC GROUP WITH A HIGH PREVALENCE OF DIABETES.
— in Fiji both ethnic groups should be regarded as such

THOSE IN OLDER AGE GROUP (> 40 YEARS)
— both the prevalence and the incidence of diabetes (NIDDM) increase with age. Type I (IDDM) diabetes is very rare in Fiji.

ADVERSE OBSTETRIC HISTORY
— refer to the article on classification of diabetes.

TAKING ORAL CONTRACEPTIVES AND OTHER DRUGS
— (diuretics, phenytoin, corticosteroids)

BEING SUBJECTED TO STRESS (i.e. infection, trauma and emotional disturbances)
— stress may precipitate diabetes in

* Summary of the lecture given at the CWM Hospital December 1985.

susceptible individuals

IMPAIRED GLUCOSE TOLERANCE IN THE PAST

— refer to the article on the classification of diabetes

TAKING EXCESS AMOUNT OF ALCOHOL

— alcohol may cause diabetes by damaging the pancreas and liver and by increasing weight

HAVING CERTAIN CONDITIONS — PANCREATIC AND ENDOCRINE DISORDERS AND MALNUTRITION

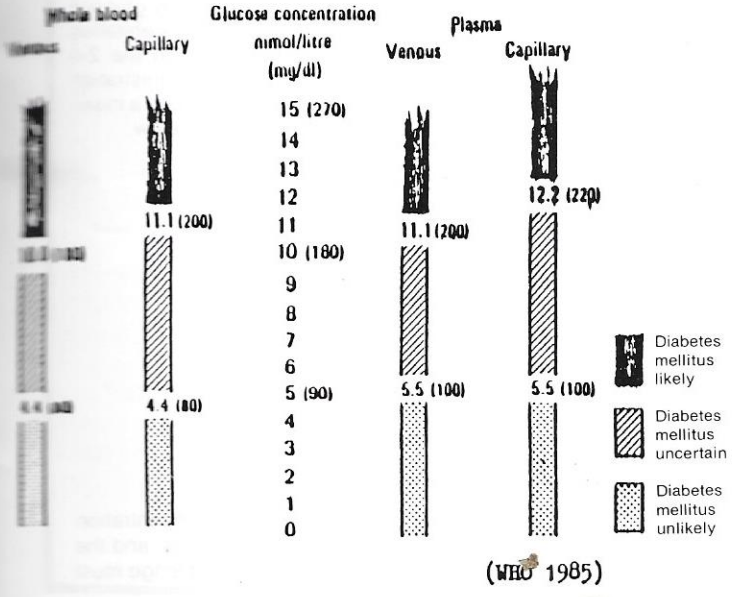
— refer to the article on the classification of diabetes

VISUAL SYMPTOMS, LEG ULCERATIONS, ARTERIAL DISEASE AND NEUROPATHY

— some diabetics especially those with mild or asymptomatic diabetes of long duration may seek medical attention when complications had already occurred i.e. cataracts, retinopathy, neuropathy, ischaemic heart disease, cerebrovascular disease, peripheral vascular disease, cranial nerve palsies and peripheral neuropathy.

THOSE WHO ARE PHYSICALLY INACTIVE (usually are also obese).

Diabetes Mellitus is recognised by finding elevated blood sugar levels. In those with severe symptoms, there is heavy glycosuria and blood glucose is markedly elevation and the diagnosis seldom poses any problem. In these a random blood glucose greater than 180 mg% (or plasma glucose > 200 mg%) is diagnostic of diabetes mellitus. (Figure I). Fasting blood glucose > 120 mg% (plasma glucose > 140 mg% also confirms the diagnosis).



When the symptoms are minimal the above figures may be regarded as diagnostic. Where symptoms are trivial and blood glucose is in the intermediate zone (FigureI) or marginally above the cut off mark, glucose tolerance needs to be done. The diagnostic values for the oral glucose tolerance is shown in Figure II.

Table II
DIAGNOSTIC VALUES FOR THE ORAL GLUCOSE TOLERANCE

	Glucose concentration, mmol/litre (mg/dl)			
	Whole blood		Plasma	
	Venous	Capillary	Venous	Capillary
Diabetes mellitus				
Fasting value	≥6.7 (≥120)	6.7 (≥120)	7.8 (≥140)	7.8 (≥140)
2 hrs after glucose load*	≥ 10.0 (≥180)	11.1 (≥200)	11.1 (≥200)	12.2 (≥220)
Impaired glucose tolerance				
Fasting value	<6.7 (<120)	<6.7 (<120)	<7.8 (<140)	<7.8 (<140)
2 hrs after glucose load*	6.7 - 10.0 (120-180)	7.8 - 11.1 (140-200)	7.8 - 11.1 (140-200)	8.9 - 12.2 (160-220)

*For epidemiological or population screening purposes the 2-hour value after 75g oral glucose may be used alone. The fasting value alone is considered less reliable since true fasting cannot be assured and spurious diagnosis of diabetes may more readily occur (WHO 1985).

For asymptomatic patients, at least one additional test result with a value in the diabetic range is desirable, either from a random or from oral glucose tolerance test.

If the above test fails to confirm the diagnosis of diabetes mellitus, it is advisable to keep the patient under observation and repeat the test at periodic intervals.

ORAL GLUCOSE TOLERANCE TEST

There are a large number of factors other than diabetes that can elevate fasting blood glucose or impair glucose tolerance. These include metabolic disturbances or stresses (i.e. illness, trauma, pregnancy, endocrine disorders and certain drugs), physical inactivity, carbohydrate intake of less than 150 grams/day for several days before the test, the time of the day when test is performed (tests done in the afternoon produce aberrant results), period of fasting (short period < 10 hours can elevate plasma glucose level and prolonged fast > 16 hours can impair glucose tolerance) and glucose load (50 gram load may not be provocative enough in some individuals and 100 gram dose may cause nausea and vomiting).

It is important to know whether the blood glucose estimations had been done on whole blood or plasma and whether venous or capillary blood is used. WHOLE

BLOOD VALUES ARE APPROXIMATELY 15% LOWER THAN PLASMA VALUES.

Oral glucose tolerance is not indicated in most patients suspected of having diabetes. It is indicated for diagnosis of diabetes when blood glucose levels are equivocal, and during pregnancy.

When indicated, the WHO and the National Diabetes Data Group recommendations be followed.

PROCEDURE

- In healthy and ambulatory patients who are known not to be taking drugs that elevate plasma glucose.
- Performed in the morning after at least three days of unrestricted diet (> 150g carbohydrate) and physical activity.
- Overnight fast for 10-16 hours, water may be allowed during this period.
- Subject should be seated and smoking is not allowed during the test.
- glucose load should be 75g of glucose (or partial hydrolysates of starch of the equivalent carbohydrate content) in 250-300 mls of water over 5 minutes in adults. In children the glucose load should be 1.75g/kg body weight upto a maximum of 75 grams.
- blood samples are taken fasting, one-hour and two-hours after glucose load.

INTERPRETATION:

The diagnostic values for oral glucose tolerance is shown in table II. Two classes of responses are identified — diabetes mellitus and impaired glucose tolerance. Values lower than those required for impaired glucose tolerance are normal.

Diagnostic criteria*

Diabetes Mellitus in Nonpregnant Adults

Any one of the following are considered diagnostic of diabetes:

A. Presence of the classic symptoms of diabetes, such as polyuria, polydipsia, ketonuria, and rapid weight loss, together with gross and unequivocal elevation of plasma glucose.

B. Elevated fasting glucose concentration on more than one occasion:

venous plasma ≥ 140 mg/dl (7.8 mmol/L)
venous whole blood ≥ 120 mg/dl (6.7 mmol/L)
capillary whole blood ≥ 120 mg/dl (6.7 mmol/L)

If the fasting glucose concentration meets these criteria, the OGTT is *not required*. Indeed, virtually all persons with FPG > 140 mg/dl will exhibit an OGTT that meets or exceeds the criteria in C below.

C. Fasting glucose concentration less than that which is diagnostic of diabetes (B, above), but sustained elevated glucose concentration during the OGTT on more than one occasion. *Both* the 2-h sample *and* some other sample taken between administration of the 75-g glucose dose and 2 h later must meet the following criteria:

venous plasma ≥ 200 mg/dl (11.1 mmol/L)
venous whole blood ≥ 180 mg/dl (10.0 mmol/L)
capillary whole blood ≥ 200 mg/dl (11.1 mmol/L)

Impaired Glucose Tolerance (IGT) in Nonpregnant Adults†

Three criteria must be met: the fasting glucose concentration must be below the value that is diagnostic for diabetes; the glucose concentration two hours after a 75-g oral glucose challenge must be between normal and diabetic values; and a value between ½-h, 1-h, or 1½-h OGTT value later must be unequivocally elevated.

Fasting value:

venous plasma < 140 mg/dl (7.8 mmol/L)
venous whole blood < 120 mg/dl (6.7 mmol/L)
capillary whole blood < 120 mg/dl (6.7 mmol/L)

½-h, 1-h, or 1½-h OGTT value:

venous plasma ≥ 200 mg/dl (11.1 mmol/L)
venous whole blood ≥ 180 mg/dl (10.0 mmol/L)
capillary whole blood ≥ 200 mg/dl (11.1 mmol/L)

2-h OGTT value:

venous plasma of between 140 and 200 mg/dl) (7.8 and 11.1 mmol/L)
venous whole blood of between 120 and 180 mg/dl (6.7 and 10.0 mmol/L)
capillary whole blood of between 140 and 200 mg/dl) (7.8 and 11.1 mmol/L)

Normal Glucose Levels in Nonpregnant Adults

Fasting value:

venous plasma < 115 mg/dl (6.4 mmol/L)
venous whole blood < 100 mg/dl (5.6 mmol/L)
capillary whole blood < 100 mg/dl (100 mmol/L)

2-h OGTT value:

venous plasma < 140 mg/dl (7.8 mmol/L)
venous whole blood < 120 mg/dl (6.7 mmol/L)
capillary whole blood < 140 mg/dl (7.8 mmol/L)

OGTT values between ½-h, 1-h, or 1½-h OGTT value later:

venous plasma < 200 mg/dl (11.1 mmol/L)
venous whole blood < 180 mg/dl (10.0 mmol/L)
capillary whole blood < 200 mg/dl (11.1 mmol/L)

Glucose values above these concentrations but below the criteria for diabetes or IGT should be considered nondiagnostic for these conditions.

Diabetes Mellitus in Children

Either of the following are considered diagnostic of diabetes:

A. Presence of the classic symptoms of diabetes, such as polyuria, polydipsia, ketonuria, and rapid weight loss, together with a random plasma glucose >200 mg/dl.

B. In asymptomatic individuals, *both* an elevated fasting glucose concentration and a sustained elevated glucose concentration during the OGTT on more than one occasion. Both the 2-h sample *and* some other sample taken between administration of the glucose dose (1.75 g/kg ideal body weight, up to a maximum of 75 g) and 2 h later must meet the criteria below.

Fasting value:

venous plasma ≥ 140 mg/dl (7.8 mmol/dl)
venous whole blood ≥ 120 mg/dl (6.7 mmol/dl)
capillary whole blood ≥ 120 mg/dl (6.7 mmol/dl)

2-h OGTT value and an intervening value:

venous plasma ≥ 200 mg/dl (11.1 mmol/L)
venous whole blood ≥ 180 mg/dl (10.0 mmol/L)
capillary whole blood ≥ 200 mg/dl (11.1 mmol/L)

Impaired Glucose Tolerance (IGT) in Children

Two criteria must be met: the fasting glucose concentration must be below the value that is diagnostic of diabetes, and the glucose concentration 2 h after an oral glucose challenge must be elevated.

Fasting value:

venous plasma < 140 mg/dl (7.8 mmol/L)
venous whole blood < 120 mg/dl (6.7 mmol/L)
capillary whole blood < 120 mg/dl (6.7 mmol/L)

2-h OGTT value:

venous plasma > 140 mg/dl (7.8 mmol/L)
venous whole blood > 120 mg/dl (6.7 mmol/L)
capillary whole blood > 120 mg/dl (6.7 mmol/L)

Normal Glucose Levels in Children

Fasting value:

venous plasma < 130 mg/dl (7.2 mmol/L)
venous whole blood < 115 mg/dl (6.4 mmol/L)
capillary whole blood < 115 mg/dl (6.4 mmol/L)

2-h OGTT value:

venous plasma < 140 mg/dl (7.8 mmol/L)
venous whole blood < 120 mg/dl (6.7 mmol/L)
capillary whole blood < 140 mg/dl (7.8 mmol/L)

Readers are advised to refer to WHO Publication (WHO Study Group on Diabetes Technical Report Series No 727, 1985) and the National Diabetes Data Group criteria (Diabetes, 1979, 28: 1039-1051) for details. These are minor differences between the two. The NDDG criteria for diabetes in non-pregnant adults and in children is reproduced*

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