ORIGINAL ARTICLE

Reasons For Screening And Methods Of Diagnosing Type II Diabetes Mellitus

Lam Tai Pong*, MBBS, FRACGP
Lecturer
General Practice Unit
Department of Medicine
The University of Hong Kong

Summary

The aim of this study was to assess the reasons for screening and the methods of diagnosing Type II diabetic patients. It was a retrospective analysis of patients attending the Ap Lei Chau Clinic of the General Practice Unit of the University of Hong Kong. Of a total patient population of 3,400, 47 new cases of Type II diabetes mellitus were diagnosed between September 1992 and September 1993. Three quarters of these newly diagnosed diabetic patients were asymptomatic at the time of diagnosis. Only 4% presented with the classical symptoms of polyuria and/or polydipsia. About one third required oral glucose tolerance test to confirm the diagnosis. Screening of asymptomatic patients is important to identify many of the undiagnosed Type II diabetic patients. An oral glucose tolerance test (OGTT) should be performed in those whose fasting blood sugar was elevated but not diagnostic of diabetes mellitus.

Key Words: Diabetes mellitus, Chinese, screening, body mass index, oral glucose tolerance test.

Introduction

Type II (non-insulin dependent) diabetes mellitus is a common condition worldwide, particularly in the developed world. In the United States, it is estimated that for every known Type II diabetic patient, there is another undiagnosed Type II patient.[1] How can we identify these undiagnosed Type II patients in a most effective way?

There is a lot of literature on whether asymptomatic patients should be screened for diabetes and what is the best method.[2,3] However, they are mainly based on caucasian patients in countries with well developed health care systems.[4,5] We now recognize that there are differences in characteristics among various ethnic groups including age at diagnosis, methods of treatment, prevalence of complications and body mass index (**BMI**).[6] The objective of this study was to analyze the reasons for screening and the methods of diagnosing Type II diabetes mellitus in Hong Kong Chinese patients.

Subjects and Methods

The study was conducted at Ap Lei Chau Clinic which is the teaching practice of the General Practice Unit of the University of Hong Kong. The clinic began operation in early September 1992 and was accepting all self-referred cases. By September 1, 1993, there were approximately 3,400 patients registered with the practice.

Patients with the diagnosis of Type II diabetes mellitus were listed from the computer records on September 1, 1993. All the files were then reviewed. Patients who had their diabetes first diagnosed during our first twelve months of

Address for correspondence: Dr. Lam Tai Pong, General Practice Unit, The University of Hong Kong, 3/F, Ap Lei chau Clinic, 161 Main Street, Ap Lei Chau, Hong Kong.

service at Ap Lei Chau were categorized as newly diagnosed. The reasons for screening their diabetes by the doctors and their presenting symptoms at diagnosis were entered onto a prescribed form. The methods of confirming the diagnosis were also noted. The data was then analyzed using the SPSS.PC programme.

All the subjects in whom plasma glucose levels were abnormally elevated but not diagnostic of diabetes mellitus (defined as between 6.1 and 8 *mmol/l* for fasting specimen and between 8 and 11.1 *mmol/l* for random specimen) had $75gm$ glucose OGTT performed at our clinic. This was undertaken in the morning after overnight fasting. Patients were asked to continue their usual diet. A diagnosis of diabetes mellitus was made if the plasma glucose at 2-hour post $75gm$ glucose was greater than or equal to 11.1 *mmol/l*.

Plasma glucose was measured with the RefLab™ System Pack Liquid Reagent on an Abbott Spectrum Analyzer. The assay employed the hexokinase-glucose-6-phosphate dehydrogenase double enzyme system.

Results

The prevalence of Type II diabetes mellitus in this patient population was reported in an earlier study.[7] Forty-seven patients had their Type II diabetes first diagnosed between September 1992 and September 1993.

Data on the age, sex, BMI, symptoms at diagnosis, glycosuria, fasting blood sugar (**FBS**), random blood sugar level (**BSL**), BSL at 2 hours after $75gm$ glucose, reasons for suspecting the diagnosis and methods of diagnosis is presented in Appendix 1.

The age and sex distribution of the patients is shown in **Table 1**. Women outnumbered men by two and half times. However, there are generally twice as many women attending our clinic as men.

The mean values of BMI of these diabetic patients are shown in **Table 2** and they were significantly higher when compared to over-30 non-diabetic patients.

Table 1: Age and Sex Distribution of Newly Diagnosed Type II Diabetic Patients

	Men	Women
Mean Age (S.D.)	58.3 (10.9)	63.3 (11.3)
	n = 14	n = 33

Table 2: Mean BMI of Newly Diagnosed Type II Diabetic Patients and Non-diabetic Patients

	Men		Women	
	Diabetic[a]	Non-diabetic[a]	Diabetic[b]	Non-diabetic[b]
Mean BMI (S.D.)	28.1 (5.7)	24.5 (4.0)	27.0 (3.9)	25.0 (4.3)
	n = 14	n = 387	n = 33	n = 1231

[a] $p < 0.02$ (student's t-test)
[b] $p < 0.01$ (student's t-test)

Table 3 shows the distribution of symptoms at diagnosis. "Asymptomatic" patients were those who had the screening test done purely as a result of the doctors' decision to screen, no diabetes related symptoms were recorded in the medical records. The patients might or might not have had specific questions asked in relation to diabetes. Three quarters of the patients did not have any symptoms at the time of diagnosis. Twelve percent (4/33) of the female patients had vaginal symptoms. Only 4% (2/47) of the patients presented with the classical symptoms of polyuria and/or polydipsia. Just over 10% (5/47) were diagnosed separately at various clinics or hospitals and came to us for further long term management. One patient had a history of gestational diabetes mellitus.

Table 3: Distribution of Symptoms at Diagnosis

Symptoms at Diagnosis	Number of Patients	%
Asymptomatic	35	74.5
Vaginal symptoms	4	8.5
Polyuria/polydipsia	2	4.3
Diagnosed at other clinics/hospitals	5	10.6
Past history of Gestational DM	1	2.1
Total	47	100.0

Table 4 shows the distribution of reasons for suspecting diabetes. The reasons might be related to symptoms, past medical history or screening tests.

Thirty of these 47 patients were on treatment for hypertension. Our hypertensive patients were regularly screened for diabetes by blood or urine tests (at first consultation with known hypertension, at diagnosis of hypertension and at twelve-month intervals).

Only 13% (6/47) had symptoms related to diabetes. Over half of the patients (26/47) were suspected to have diabetes as a result of elevated FBS levels (defined as between 6.1 and 8 *mmol/l*). About one fifth (10/47) of the patients had positive screening glycosuria while 4% (2/47) had elevated random BSL.

Table 4: Distribution of Reasons for Suspecting Type II Diabetes Mellitus

Reason for Suspecting Type II Diabetes Mellitus	Number of Patients	%
Raised screening FBS	26	55.3
Positive screening glycosuria	10	21.3
Symptoms e.g. polyuria/polydipsia, vaginal discharge	6	12.8
Raised random BSL	2	4.3
Past history of Gestational DM	1	2.1
Diagnosed at other clinics/hospitals	2	4.3
Total	47	100.0

FBS = Fasting Blood Sugar; BSL = Blood Sugar Level.

Table 5 shows the distribution of methods of diagnosis. WHO criteria for diagnosis were adopted for this study.[8] Nearly half (22/47) of the patients had the diagnosis of diabetes confirmed because of elevated FBS levels. About one third (17/47) required OGTT by WHO standard. Fifteen percent (7/47) had the diagnosis confirmed by elevated random BSL.

Table 5: Distribution of Methods of Diagnosis

Type II Diabetes Mellitus Confirmed by	Number of Patients	%
Fasting BSL	22	46.8
OGTT	17	36.2
Random BSL	7	14.9
Unknown	1	2.1
Total	47	100.0

FBS = Fasting Blood Sugar;
BSL = Blood Sugar Level.

Discussion

Most of our patients did not complain of symptoms at the time of diagnosis. It may be that they were not asked about diabetic symptoms. However, patients did not complain of them either. We did not think it was worthwhile analyzing the related symptoms after the diagnosis had been made because patients might tend to respond positively to leading questions once the condition was confirmed.

Several patients e.g. case 6, 12, 16, 22, 34, 42 & 47 had very high FBS levels (ranged from 14.4 to 18.4 *mmol/l*) or random BSL (ranged from 15.3 to 18.9 *mmol/l*) and yet they did not complain of any diabetic symptoms to their doctors. This demonstrates that some patients may remain asymptomatic despite grossly elevated blood sugar levels.

Screening and Diagnosing Type II Diabetes Mellitus

Twenty patients were screened for glycosuria, the test was positive in only 17. In fact, it is quite possible that many undiagnosed diabetic patients may not show a positive result for glycosuria on urine screening unless the urine sample was taken after a reasonable sized meal. It is still common practice in many countries for urinalysis to be used to screen for diabetes although not recommended in official guidelines of the Colleges or National Associations.[2] With user-friendly reflectance glucometers readily available at reasonable prices these days, there is no reason to continue with the practice of using urinalysis to screen for diabetes.

OGTT was required in about a third of patients to confirm the diagnosis of diabetes. All of these patients had FBS or random BSL which were elevated but not within the diagnostic range. The reluctance of elderly Chinese to accept repeated venepunctures was thought to be an obstacle to arrange OGTT by a previous local study.[9] However, we did not find it to be a problem among our patients despite the fact that 11 out of the 17 patients who required OGTT were 60 or above. Fasting blood specimens were also considered difficult to obtain among elderly Chinese in the same previous study. Again, we did not experience any major difficulties ourselves. This is evidenced by the fact that 26 of these 47 patients had fasting blood taken and 15 of these 26 patients were 60 or above. It is important to explain to the patients the reasons for the blood tests and ensure that they understand them.

It is also interesting to note the 2-hour post 75gm glucose BSL in some patients e.g. case 7, 23 & 39. Their FBS levels ranged from 6.3 to 7.1 mmol/l and yet their 2-hour BSL were between 16.8 to 19.1 mmol/l. Furthermore, the BMI of these patients were only 24.0 to 27.9. Therefore, it is essential to perform OGTT on patients with even slightly elevated FBS levels.

Our study is limited by the small number of patients. It is also a retrospective analysis and many patients did not have all the relevant tests performed. The reasons for suspecting diabetes might also be a reflection of the clinical behaviour of the doctors in our clinic e.g. screening for diabetes among hypertensive patients.

One patient (Case 9) had positive screening for glycosuria. She apparently had diabetes subsequently confirmed by blood tests in a hospital. However, we were unable to obtain results of those tests and she declined further blood taking. There is a possibility that she may not be a true diabetic.

Conclusion

Most Type II diabetic patients are asymptomatic at the time of diagnosis. Urinalysis is not an absolutely reliable method for screening. Patients with a FBS which is elevated but not diagnostic of diabetes should have OGTT which may be the only method to confirm the diagnosis. ∎

References

1. Harris M I, Hadden W C, Knowler W C. Prevalence of diabetes and impaired glucose tolerance and plasma glucose levels in US population aged 20-74 yr. Diabetes 1987; 36: 523-534.

2. American Diabetes Association. Screening for diabetes. Diabetes Care 1993; 16[supple 2]: 7-9.

3. Singer D E, Samet J H S, Coley C M, Nathan D M. Screening for diabetes mellitus. Annals of Internal Medicine 1988; 109: 639-649.

4. Acevedo M M, de la Fuente L, Ferreras M R, Turabian J L. Screening for diabetes. The Journal of Family Practice 1992; 34: 397.

5. Nathan D M, Singer D E. Screening for diabetes. Diabetes Care 1990; 13: 542-543.

6. Jarrett R J. Epidemiology and public health aspects of non-insulin-dependent diabetes mellitus. Epidemiologic Review 1989; 11: 151-171.

7. Lam T P, Lam C L K & Douglas S. The prevalence of Type II diabetes mellitus and its cardiovascular risk factors in a general practice. Hong Kong Practitioner. 1995; 1: 4-10.

8. World Health Organization. Diabetes mellitus. WHO Tech Rep Ser 1985; 727: 103-108.

9. Woo J, Swaminathan R, Cockram C, et al. The prevalence of diabetes mellitus and an assessment of methods of detection among a community of elderly Chinese in Hong Kong. Diabetologia 1987; 30: 863-868.

Appendix 1: Age, sex, BMI, related symptoms, glucose levels, reason for suspecting and method of diagnosis

Case No.	Age	Sex	BMI	Symptoms	Glycosuria	FBS	Random BSL	BSL 2 hours 75gm glucose	DM Confirmed by	Reason for Suspecting DM
1	72	M	22.6	Asymptomatic		7.7		14.6	OGTT	Raised Screening FBS
2	53	M	28.1	Asymptomatic		7.3		14.6	OGTT	Raised Screening FBS
3	60	F	30.5	Pruritus Vulva	+ve			16.2	Random BSL	Vaginal Symptoms
4	63	F	28.1	Asymptomatic	+ve		9.1	13.2	OGTT	Screening Glycosuria +ve
5	66	F	23.6	Asymptomatic	+ve	9.7			Fasting BSL	Screening Glycosuria +ve
6	63	M	23.2	Asymptomatic			18.1		Random BSL	Raised Random BSL
7	51	M	24.0	Asymptomatic		7.1		16.8	OGTT	Raised Screening FBS
8	67	F	28.5	Asymptomatic		7.4		12.9	OGTT	Raised Screening FBS
9	75	F	18.9	Boil on Vulva	+ve					
10	64	F	27.4	Asymptomatic		7.3	7.2	12.9	OGTT	Raised Screening FBS
11	62	F	25.7	Asymptomatic	+ve	10.3			Fasting BSL	Screening Glycosuria +ve
12	67	F	31.0	Asymptomatic	+ve	18.4			Fasting BSL	Screening Glycosuria +ve
13	78	F	26.4	Asymptomatic	-ve	9.0			Fasting BSL	Raised Screening FBS
14	49	M	25.6	Asymptomatic	-ve	6.9		12.5	OGTT	Raised Screening FBS
15	58	F	26.3	Asymptomatic		8.7			Fasting BSL	Raised Screening FBS
16	65	F	25.6	Asymptomatic			18.9		Random BSL	Raised Random BSL
17	64	F	28.7	Asymptomatic		13.7			Fasting BSL	Raised Screening FBS
18	67	F	33.6	Asymptomatic		6.7		11.6	OGTT	Raised Screening FBS
19	79	F	24.9	Referred by Ophthalmologist for Investigation		7.1		12.7	OGTT	Raised FBS
20	50	F	28.3	Asymptomatic		6.9		11.1	OGTT	Raised Screening FBS
21	58	F	30.6	Asymptomatic		11.3			Fasting BSL	Raised Screening FBS
22	62	F	27.9	Asymptomatic	+ve	14.9			Fasting BSL	Raised Screening FBS
23	83	F	27.4	Asymptomatic		7.1		19.0	OGTT	Raised Screening FBS
24	60	F	21.0	Pruritus Vulva	+ve	14.2			Fasting BSL	Vaginal Symptom
25	64	F	33.8	Asymptomatic		7.3		15.4	OGTT	Raised Screening FBS
26	48	F	26.1	Asymptomatic		7.0		11.9	Fasting BSL	Raised Screening FBS
27	37	F	31.5	Vaginal Discharge		10.4			Fasting BSL	Vaginal Symptom and History of Gestational DM
28	60	F	22.6	Asymptomatic		8.4			Fasting BSL	Raised Screening FBS
29	55	F	25.7	Polyuria and Polydipsia	+ve	10.6			Fasting BSL	Polyuria + Polydipsia
30	68	F	25.0	Diagnosed by GP						
31	42	F	23.8	History of Gestational DM	+ve		15.8		Random BSL	History of Gestational DM
32	83	F	32.9	Asymptomatic	+ve	9.3			Fasting BSL	Screening Glycosuria +ve
33	38	F	24.4	Diagnosed by Family Planning Screening	-ve	10.3			Fasting BSL	Raised Screening FBS
34	65	M	26.7	Asymptomatic	+ve	17.0			Fasting BSL	Screening Glycosuria +ve
35	74	F	33.0	Asymptomatic		7.0		17.5	Fasting BSL	Raised Screening FBS
36	63	F	27.7	Asymptomatic		7.2		12.5	OGTT	Raised Screening FBS
37	59	M	25.9	Asymptomatic		7.8		17.7	OGTT	Raised Screening FBS
38	59	M	25.0	Diagnosed by Hospital while on treatment for tuberculosis		11.1			Fasting BSL	Raised Screening FBS
39	75	F	26.1	Asymptomatic		6.3		19.1	Fasting BSL	Raised Screening FBS
40	74	M	30.0	Diagnosed at Health Screening at Community Centre	+ve	10.2			Fasting BSL	Screening Glycosuria +ve
41	64	M	23.7	Asymptomatic	+ve	7.1	11.0		Random BSL	Screening Glycosuria +ve
42	70	F	26.1	Asymptomatic	+ve		15.3		Random BSL	Screening Glycosuria +ve
43	64	F	16.7	Asymptomatic		9.0		14.4	OGTT	Raised Screening FBS
44	33	M	52.7	Asymptomatic		8.7		11.8	OGTT	Raised Screening FBS
45	52	M	45.5	Polyuria + Polydipsia	+ve	9.0			Fasting BSL	Polyuria + Polydipsia
46	70	M	32.8	Asymptomatic		7.1		13.3	OGTT	Raised Screening FBS
47	52	M	28.2	Asymptomatic	+ve	14.4			Fasting BSL	Screening Glycosuria +ve

FBS = Fasting Blood Sugar; BSL = Blood Sugar Level; OGTT = Oral Glucose Tolerance Test.