Prevalence of Vascular Complications among Type 2 Diabetes Mellitus Outpatients at Teaching Hospital in Malaysia

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Introduction

Diabetes mellitus is associated with an increased risk for a number of serious and sometimes life-threatening macro- and microvascular complications. Macrovascular disease, which includes coronary heart disease (CHD), cerebrovascular disease, and peripheral vascular disease, is the leading cause of mortality in people with diabetes. Diabetes mellitus patients carry an increased risk two to four times greater for heart attack, stroke and other complications related to poor circulation [1] and depend on ADA [2] the majority of deaths are due to CHD. In another study by Vijan et al. [3] said that up to 80% of Type 2 diabetic patients will develop or die of macrovascular disease.

Microvascular complications include effects on small vessels, including arterioles, capillaries and venules. The development of these complications starts early in the pathogenesis of Type 2 DM and accounts for morbidity in the form of retinopathy, neuropathy and nephropathy.

In Malaysia, there is a growing public concern due to the escalation of people with diabetes while complication rates and associated diseases amongst diabetics are high. In addition high prevalence of complications such as blindness, end stage renal disease, lower extremity amputations as well as premature cardiovascular disease, stroke and premature mortality related to poor control of blood glucose [4].

The present study was to determine prevalence and focused on presence risk factor affecting on diabetic vascular complications among type 2 diabetic outpatients in tertiary center.

Material and Methods

A prospective study was conducted for study period of one year (1st Jan 2008 till 31st Dec 2008) in order to determine the prevalence diabetic vascular complications and risk factors affect on these complications among type 2 diabetes mellitus in outpatient diabetic care at teaching hospital USM which is located in the state of Kelantan, Malaysia.

The research's protocol was approved by the Human Research and Ethics Committee of the School of Medicine in the Universiti Sains Malaysia. Signed informed consent was obtained from all patients.

All patients with type 2 diabetes mellitus, age range 18 to 88years, were screened for diabetic vascular complications.

The information obtained from the interview included the patient's identification data such as age, sex, and race, alcohol, smoking history, physical activity and level of education. They were classified smoking history to (never, previous, current), the level of education was classified by the level of completion of their formal education either less than secondary school, secondary and more than secondary school and physical activity was classified into active (if the duration of physical activity was equal or more than150min/week), and non active (if physical activity duration was less than 150 min/week). Glycaemic control based on measurement (poor glycaemic control if HbA1c >7%), and blood pressure (BP hypertension if systolic BP> 130 mm Hg or diastolic BP> 80 mm Hg).

Diagnosis of retinopathy is based on finding the diagnostic signs of retinopathy on eye exams by fundoscopy.

Patients were considered to have neuropathy if symptoms of pain anesthesia, paresthesia, muscular weakness, loss of tendon reflexes, and impaired vibration sense.

Patients were considered to have nephropathy if they have microalbuminuria or proteinuria.

Coronary artery disease was diagnosed by documented angina symptoms and confirmed by performed an ECG, or from results of percutaneous transcoronary angiography (PTCA) in patients record.

Cerebrovascular disease was defined by present of transient ischemic attack or stroke in past medical history.

Ethical approval of study

Ethical approval was obtained for this research study from research and ethics committee, USM in January 2008.

Result

A total of 1077 Type 2 diabetic patients were involved in this study. About 476 were males and 601 were females, the mean (± SD) duration of Type 2 DM is 11 (± 6.81) years, ranging from less than one year to forty years. The majority of patients 794 (73.7%) did not achieve target of HbA1c levels ≤ 7.0%. Positive family history of DM was 141 patients while a total of 936 patients had no known family history of diabetes.

Type of vascular complications among type 2 dm patients

Most of the patients, 841 (78%) had microvascular complications alone and 188 (17.5%) had combination of microvascular and macrovascular complications (Figure 1).

Macrovascular complications

In this study most of the diabetic patients 1014 (82.6%) had
no macrovascular complications, 188 (17.5%) had macrovascular complications and out of those 137 (12.8%) had coronary heart disease, only 51 (4.7%) Thad cerebrovascular disease see (Figure 2).

Microvascular complications

Out of 1077 type 2 diabetic patients 1028 (95.5%) had microvascular complications. (Table 1 and Table 2) showed type of microvascular complications.

The major risk factor for the development of diabetic complications were gender, age, BMI, duration of diabetes and hypertension as (Tables 3-8).

Discussion

The frequency of microvascular diabetic complications is clearly correlated to the duration of diabetes, quality of metabolic control (HbA1c) and systolic blood pressure [5]. Only a few investigations have focused on the role of obesity in the development or progression of microvascular complications.

Table 1: Sociodemographic characteristics of Type 2 diabetic patients.

| Variable                  | n (%)       |
|---------------------------|-------------|
| Gender                    |             |
| Male                      | 476 (44.2)  |
| Female                    | 601 (55.8)  |
| Age (years)               |             |
| ≤ 35 years                | 15 (1.4)    |
| >35-50 years              | 194 (18)    |
| >50-65 years              | 626 (58.1)  |
| >65 years                 | 242 (22.5)  |
| Race                      |             |
| Malay                     | 916 (85.1)  |
| Chinese                   | 150 (13.9)  |
| Indian                    | 11 (1.0)    |
| Smoking History           |             |
| Current smoker            | 66 (6.1)    |
| Previous smoker           | 81 (7.5)    |
| Never smoked              | 930 (86.4)  |
| Alcohol History           |             |
| Current drinker           | 10 (0.9)    |
| Previous drinker          | 6 (0.6)     |
| Never drink               | 1081 (88.5) |
| Physical activity         |             |
| Active ≥ 150 min/wk       | 471 (43.7)  |
| Non active < 150 min/wk   | 606 (56.3)  |
| Level of education        |             |
| Less secondary school     | 580 (53.9)  |
| More than secondary school| 497 (46.1)  |
| Family history of diabetes|             |
| Yes                       | 141 (13.1)  |
| No                        | 936 (86.9)  |

Table 2: Frequency and distribution of microvascular complications among Type 2 DM patients.

| Complication               | Male n(%) | Female n(%) |
|---------------------------|-----------|-------------|
| None                      | 36(6%)    | 12(2.5%)    |
| Microvascular             | 466(77.9%)| 373(78.4%)  |
| Microvascular and macrovascular | 97(16.1%)| 91(18.1%)   |
| Total                     | 601(100%) | 476(100%)   |

P =0.014

Table 3: Frequency of diabetic complications according to gender.

| Complication                | Age <35 n(%) | 35-50 n(%) | >50-65 n(%) | >65 n(%) |
|-----------------------------|--------------|------------|-------------|----------|
| None                        | 5(33.3%)     | 31(18%)    | 121(13%)    | 170(70.2%)|
| Microvascular               | 9(60%)       | 153(78.9%) | 509(81.3%)  | 170(70.2%)|
| Microvascular and macrovascular | 16(10.2%) | 10(5.2%)   | 105(16.8%)  | 72(29.8%) |
| Total                       | 15(100%)     | 194(100%)  | 626(100%)   | 242(100%) |

P <0.001

Table 4: Frequency of diabetic complications according to age.

| Complication                | BMI <23 kg/m² n(%) | BMI ≥ 23 kg/m² n(%) |
|-----------------------------|--------------------|--------------------|
| None                        | 0(0%)              | 486(5.5%)          |
| Microvascular               | 155(77.9%)         | 386(78.1%)         |
| Microvascular and macrovascular | 44(22.1%) | 144(16.4%)         |
| Total                       | 199(100%)          | 878(100%)          |

P=0.001

Table 5: Frequency of diabetic complications according to body mass index (BMI).

| Complication                | <10 years n(%) | ≥10 years n(%) |
|-----------------------------|---------------|----------------|
| None                        | 346(8.6%)     | 384(5.7%)      |
| Microvascular               | 411(17.9%)    | 420(77.8%)     |
| Microvascular and macrovascular | 15(11.4%)     | 131(22.8%)     |
| Total                       | 502(100%)     | 557(100%)      |

P <0.001

Table 6: Frequency of diabetic complications according to diabetic duration.

| Complication                | Control n(%) | Uncontrolled n(%) |
|-----------------------------|--------------|-------------------|
| None                        | 15(3.6%)     | 384(77.5%)       |
| Microvascular               | 217(17.9%)   | 420(77.8%)       |
| Microvascular and macrovascular | 48(17.5%) | 140(17.5%)       |
| Total                       | 275(100%)    | 502(100%)        |

P=0.745

Table 7: Frequency of diabetic complications according to HbA1c control.

| Complication                | Normotensive BP <130/80 n(%) | Hypertensive BP ≥130/80 n(%) |
|-----------------------------|------------------------------|------------------------------|
| None                        | 326(35.9%)                   | 16(3%)                       |
| Microvascular               | 421(77.8%)                   | 420(77.8%)                   |
| Microvascular and macrovascular | 38(16.3%)     | 100(18.7%)          |
| Total                       | 541(100%)                    | 536(100%)                    |

P=0.048

Table 8: Frequency of diabetic complications according to hypertension.
Several studies considered that poor glycemic control, disease duration, hypertension and dyslipidaemia are to be important risk factors for microvascular complications [6-8].

This study has shown a prevalence of macrovascular disease of 17.5% among diabetics and percentage of macrovascular disease lower than in study in UAE by Al-Maskari et al. [9] they found prevalence of macrovascular disease in 29.5% of diabetics. The differences in our rates of macrovascular complications among Type 2 DM patients as compared with others could be attributed to differences in study design, and population characteristics of various studies.

Previous studies in Malaysia indicate a high prevalence of suboptimal glycaemic control and that diabetes complications are common [10-12]. Morgan et al. [13] found evidence to show that multiple complications occur in almost one fifth of diabetic patients. In addition, the incidence of individual and multiple complications increases with both age and duration of diabetes.

The present study shows that the prevalence rate of retinopathy were 39.3% alone or in combination with other microvascular complications. The prevalence of retinopathy demonstrates wide variations between countries; in Type 2 DM it ranges from 17% in Switzerland to 52% in the United Kingdom [14].

The results of the present study showed that the overall prevalence of neuropathy was 54.7%, alone or in combination with the other complications. Percentage of neuropathy in this study is higher than in a study by Tesfaye et al. [15] who recruited 3,250 diabetic patients and reported prevalence of neuropathy in 28% of them, but in other studies it counts 25-60% of peripheral neuropathy (16-17).

The results of this study also showed that the overall prevalence of nephropathy was 91.7%. It is considered a high percentage in comparison with other studies on diabetic nephropathy which occurs in 40% in diabetic patients [18] and ADA [19] reported that diabetic nephropathy occurs in 20-40% of patients with diabetes and is the single leading cause of end-stage renal disease (ESRD).

Only 24.6% of patients had optimal controlled, but glycaemic control in the current study insignificant factor affect the development of diabetic complications.

In this study, it did not find any relation between diabetic glycemic control and the presence of macrovascular, similar as in these studies [20-21]. In contrast other study by singer et al. [22] have suggested an association between diabetic glycemic control and the presence of macrovascular complication, or risk of the development of macrovascular complications [23-25].

The major risk factors in this study were gender, age, BMI, duration of diabetes and hypertension. Therefore the rate of diabetic complications may reduce by weight loss and controlled of hypertension.

Conclusion

In conclusion, prevalence of diabetic complications was high. Identifying factors associated with the development of microvascular and macrovascular complications would to be able to prevent the complications. In this study we saw the prevalence of diabetic complications was higher in elder people, longer duration of diabetes associated hypertension and obesity. We recommend screening of high risk type 2 diabetes for diabetic complication and highlight importance of early diagnosis of diabetes and detection diabetic complications so that appropriate treatment initiated at the earliest. It need to focus on the treatment of hypertension and advised the diabetic patients to reduced weight to prevent or decreased the complications of diabetes.

References

1. Ragucci E, Zonszein J, Frishman W (2003) Pharmacotherapy of diabetes mellitus: implications for the prevention and treatment of cardiovascular disease. Heart Dis 5: 18-33.
2. Economic consequences of diabetes mellitus in the U.S. in 1997. American Diabetes Association. (1998) Diabetes Care 21: 296-309.
3. Vijan S, Hayward R (2004) Pharmacologic lipid lowering therapy in type 2 diabetes: background paper for the American College of Physicians. Ann Intern Med 140: 650-658.
4. Mafauzy M (2005) Diabetes control and complications in private primary healthcare in Malaysia. Med J Malaysia 60: 212-217.
5. Girach A, Vignali L (2006) Diabetic microvascular complications can the presence of one development of another? J Diabetes Complications 20: 222-228.
6. The effect of intensive treatment of diabetes on the development and the progression of long-term complications in insulin-dependent diabetes mellitus. The Diabetes Control and Complications Trial Research Group (1993). N Engl J Med 329: 977-986.
7. Intensive blood-glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type II diabetes (UKPDS 33). UK Prospective Diabetes Study (UKPDS) Group (1998). Lancet 352: 837-853.
8. Stratton I, Kohner E, Aldington S, Turner RC, Holman RR, et al. (2001) UKPDS 50: risk factors for incidence and progression of retinopathy in type 2 diabetes over 6 years from diagnosis. Diabetologia 44: 156-163.
9. Al-Maskari F, El-Sadig M (2007) Prevalence of diabetic retinopathy in the United Arab Emirates: A cross-sectional survey. BMC Ophthalmol 16: 7-11.
10. Mimi O, Teng CL, Chia YC (2003) The prevalence of diabetic peripheral neuropathy in an outpatient setting. Med J Malaysia 58: 533-538.
11. Lim T, Lim Y (2005) 13th Report of the Malaysian Dialysis & Transplant Registry. Kuala Lumpur. The National Renal Registry Malaysia Society of Nephrology.
12. Tan S, Shafiee Z, Wu L, Rizal A, Rey J (2005) Factors associated with control of Type 1 diabetes in Malaysian adolescents and young adults. Int J Psychiatry Med 35: 123-136.
13. Morgan C, Currie C, Stott N, Smithers M, Butlert C et al. (2000) The prevalence of multiple diabetes-related complications. Diabetic Medicine 17: 146 -151.
14. Amos A, Mccarty D, Zimmel P (1997) The rising global burden of diabetes and its complications: estimates and projections to the year 2010. Diabet Med 14: S1-85.
15. Tesfaye S, Stevens LK, Stephenson JM, Fuller JH, Plater M, et al. (1996) Prevalence of peripheral neuropathy in type 2 diabetic patients attending a diabetes centre in Turkey. Endoor J 51: 563-567.
16. Tres GS, Lisboa HR, Syllos R, Canani LH, Gross JL, et al. (2007) Prevalence and characteristics of diabetic polyneuropathy in Passo Fundo, South of Brazil. Arq Bras Endocrinol Metabol 51: 987-992.
17. Parving H (1998) Benefits of and cost of antihypertensive treatment in incipient and overt diabetic nephropathy. Journal Hyperten 16: 99-101.
18. Standards of medical care in diabetes. (2007) American Diabetes Association. Diabetes Care 30: S4-S41.
19. Park K (2002) Park’s Textbook of Preventive and Social Medicine. 17th edition.
20. Kirkman MS, McCarron M, Shah J, Duckworth W, Abraina C (2006) The association between metabolic control and prevalent macrovascular disease in Type 2 diabetes. J Diabetes Complications 20: 75-80.
21. Singer DE, Natham DM, Anderson KM, Wilson PW, Evans JC (1992) Association of HbA1c with prevalent cardiovascular disease in the original cohort of the Framingham Heart Study. Diabetes 41: 202-208.
22. Klein R (1995) Hyperglycemia and microvascular and macrovascular disease in diabetes. Diabetes Care 18: 258-268.
24. Stratton I, Adler AI, Neil HA, Matthews DR, Manley SE, et al. (2000) Association of glycaemia with macrovascular and microvascular complications of type 2 diabetes (UKPDS 35): prospective observational study. BMJ 321: 405-412.

25. Selvin E, Marinopoulos S, Berkenblit G, Rami T, Brancati F, et al. (2004) Glycosylated hemoglobin and cardiovascular disease in diabetes mellitus: Golden SH: Meta-analysis. Ann Intern Med 141: 421-431.