Assessment and Prevalences of Diabetic Complications in 722 Thai Type 2 Diabetes Patients

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Background: *The purpose of this study is to determine the percent of patients who have been assessed as having diabetic complications as recommended by American Diabetes Association. The secondary goals were to determine factor(s) associated with reduced assessment of diabetic complication and to determine the prevalence of diabetic complications in Thai type 2 diabetes patients.*

Material and Method: *We conducted a retrospective review of medical records of Thai type 2 diabetes patients who were followed up at the out-patient department (OPD) of Department of Internal Medicine at Siriraj Hospital Mahidol University Thailand during 1st January to 31st December 2006.*

Results: *Of 722 diabetes patients who were recruited, 7.5% were treated by general practitioners (GP), 10.4% by internal medicine residents (Res), 49.9% by internist (Int), 11.8% by endocrinologist (Endo) and 20.5% was indeterminate because they could not identify the field of the health care provider. 38.4% of patients received an eye examination by an ophthalmologist. 42% were screened for diabetic nephropathy. Serum creatinine level was measured in 83.5%. Foot examination was done in only 125 patients (17.3%). We founded that patients taken care by GP and Int received less intensive and less extensive assessment for diabetic complications than those taken care by Res and Endo. The prevalences of diabetic nephropathy and chronic kidney disease of at least stage 3 were 37 and 48.2%, respectively. Diabetic retinopathy occurred in 31.2%, cardiovascular disease in 28.9%, cerebrovascular disease in 10.6% and diabetic foot in 40%.*

Conclusion: *There was a high prevalence rate of diabetic complications in patients with type 2 diabetes. Screening for diabetic complications will help to identify patients at high risk of concomitant complications eventhough some practitioners are not initially aware of the importance of the diabetic complication screening. These data may help the physician decide to modify treatment to prevent disabilities.*

Keywords: *ADA practice recommendation, Diabetic complication*

J Med Assoc Thai 2011; 94 (Suppl. 1): S168-S174
Full text. e-Journal: *http://www.mat.or.th/journal*

Patients with T2DM have high prevalence of diabetic complications, including microvascular and macrovascular complications. In Thailand, the prevalence of diabetic retinopathy was 31%, diabetic nephropathy 44% and macrovascular complication 3-5%, according Thailand Diabetes Registry (TDR) survey in 2005[1]. These lead to higher morbidity and mortality than in healthy subjects. Moreover, direct medical costs for diabetes treatment are higher in diabetes subjects who have diabetic complications than those without complications[2,3]. The Ministry of Public Health ranked T2DM as one of the top ten public health problems in Thailand.

Siriraj Hospital is one of the university hospitals and the tertiary care center in Thailand. Almost 10,000 patients with T2DM have been treated yearly in internal medicine department. Eight thousand (80%) of patients with T2DM have been taken care of at the out-patient department (OPD) of internal medicine department, whereas 2,000 (20%) have been taken care of in the diabetes clinic, Siriraj hospital. At the OPD patients with T2DM have been treated by several clusters of physicians including general practitioners (GP), internal medicine residents (Res), internists, which included internists who were in fellowship training and other specialists (Int), and Endocrinologists (Endo). Due to these several groups of health care providers, the standard of care for each group of those patients may be different. Thus, our primary goal was to determine the proportion of patients who have been

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assessed diabetic complications as recommended by American Diabetes Association segregated by group of health care providers and our secondary goals were to determine factor (s) associated with reduced assessment of diabetic complication and to determine the prevalence of diabetic complications in Thai type 2 diabetes patients.

Material and Method

Subjects

From 8,000 T2DM patients who had attended at internal medicine OPD Siriraj Hospital during January-December 2006, we randomly chose 722 patients to be included in this study. Diabetes patients other than T2DM and those who attended the OPD less than 1 year were excluded. The study was approved by the Institutional Review Board of Faculty of Medicine Siriraj Hospital Mahidol University.

Processes

The medical record of each patient was reviewed. The following data were recorded.

1. General characteristics including education and access to the several levels of the social welfare system. The social welfare system in Thailand can be divided to 4 groups consisting of national health security, social security, medicare and self payment.

2. Laboratory results from the last time the patient presented at the OPD were used.

3. Data of the assessment of diabetic complications according to ADA recommendation[4] included dilated eye examination by ophthalmologists, urine albumin excretion, serum creatinine, and foot examination, as well as appropriate aspirin prescription during the past year were extracted.

4. Data of diabetic complications including: 4.1) Diabetic retinopathy (DR): as diagnosed by ophthalmologist, 4.2) Diabetic nephropathy (DN): diagnosed in patient who had proteinuria more than 30 mg/g creatinine, 4.3) Chronic kidney disease (CKD): diagnosed in patient who had calculated GFR, using Cockcroft formula, less than 60 ml/m^2/min, 4.4) Diabetic foot: in patient who had abnormal foot examination, 4.5) Cardiovascular disease (CVD) and 4.6) Cerebrovascular disease (CVA): as diagnosed by physician taken care him or her. The severities of DR, DN and CKD were segregated according to the criteria defined by the American Diabetes Association[4].

5. Health care providers included general practitioner (GP), internal medicine resident (Res), internists who were in fellowship training and other specialists (Int) and endocrinologist (Endo).

Definition

We decided that the patient received at least 2 out of 4 assessments during the past year as "proper assessment for diabetic complications", then he or she had received adequate assessment.

Statistical Analysis

Continuous data are expressed as mean $\pm$ SD or median (min, max) as appropriate. Comparisons of baseline data between groups were done using Student's t-test and one-way ANOVA. Categorical data are expressed as percentage. Comparisons of baseline data between groups were done using Chi-square test. All statistical analyses were performed with the use of SPSS software, version 17.0. For all analyses, a p-value of less than 0.05 was considered to be statistically significant.

Results

Subject characteristics

Seven hundred twenty two T2DM patients were recruited, only 574 (79.5%) could identify the specialty of the health care provider. Of 574 patients, 54 patients (9.4%) were treated by GP, 75 patients (13.1%) Res, 360 patients (62.7%) by Int and 85 patients (14.8%) by Endo. Table 1 summarizes the subject's clinical and laboratory characteristics.

Assessment for chronic diabetic complications

As shown in Table 2, of 722 patients, 277 patients (38.4%) received an eye examination by ophthalmologists. Three hundred and three patients (42.0%) were screened for diabetic nephropathy. Serum creatinine was measured in 603 patients (83.5%). Only 125 patients (17.3%) received foot examination. According to clusters of health care providers, patients who were taken care of by GP and Int received assessment for diabetic complications less frequently than those taken care of by Res and Endo groups (Table 2).

As shown in Table 2, of 722 patients, 416 (57.6%) received proper assessment for diabetic complications. According to category of health care providers, patients taken care of by Res and Endo received proper diabetic complications assessment more than in patients taken care of by GP and Int groups (77.3 and 81.2% vs. 48.1 and 55.8%, respectively).

From six hundred eighty-four patients, 391 (57.2%) received aspirin prescription for prevention of

Table 1. Clinical and laboratory characteristics

Characteristics	Total n	
Number	722	
Age (yr)	717	64.5 ± 11.9
Gender; n (%)	722	
Male		303 (42)
Female		419 (58)
Height (cm)	259	160.7 ± 8.4
Weight (kg)	580	65.8 ± 12.5
BMI (kg/m2)	230	26.0 ± 4.4
Education; n (%)	238	
None		16 (6.6)
Elementary school		67 (28.2)
Secondary school		67 (28.2)
University		88 (37.0)
Smoking status (%)	428	
Current		23 (5.4)
Ex-smoker		44 (10.3)
Non-smoking (%)		361 (84.3)
Provider; n (%)	574	
GP		54 (9.4)
Resident		75 (13.1)
Internist		360 (62.7)
Endocrinologist		85 (14.8)
Social welfare system; n (%)	603	
National Health Security		33 (5.5)
Social Security		198 (32.8)
Medicare		45 (7.5)
Self payment		327 (54.2)
Duration of diagnosed DM (yr)	585	7.0 (0,38)
Duration of treatment (yr)	687	4.0 (0,38)
Hypoglycemic agent (%)	654	
Diet control only		32 (4.9)
OHA only		535 (81.8)
Insulin only		48 (7.3)
OHA and insulin		39 (6.0)
SBP (mmHg)	584	132 ± 20
DBP (mmHg)	584	75 ± 12
HbA1c (%)	466	7.4 ± 1.7
Triglyceride (mg/dl)	463	148 (32,1,086)
LDL-C (mg/dl)	443	92 ± 33
HDL-C (mg/dl)	437	50 ± 13
Creatinine (mg/dl)	601	1.3 ± 1.3

Continuous data with normal distirbution are presented as means (± SD), others are presented as median (min, max)
M, male; F, female; BMI, body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure; LDL-C, LDL-cholesterol; HDL-C, HDL-cholesterol; OHA, oral hypoglycemic agent.

cardiovascular disease. Aspirin was prescribed in 32.7% of patient with T2DM who were seen by GP whereas 64.3, 62.2 and 53% of patients seen by Res, Int and Endo groups, respectively, were receiving aspirin (p = 0.001).

Prevalence of chronic diabetic complications

As shown in Table 3, the prevalence rates of DR, DN, Diabetic foot, CVD and CVA, in patient with T2DM in this study were 31.2, 37.0, 40.0, 28.9 and 10.6%, respectively. For those patients in whom serum creatinine level was measured, 48.2% had chronic kidney disease (CKD) of at least stage 3 (Table 3). There was no significant difference in prevalence of chronic diabetic complications as segregated by health care provider. Interestingly, when compared to patients with CKD stage 1-2, patients with CKD at least stage 3 had a higher prevalence of other diabetic complications, including DR (33.3 vs. 23.2%), diabetic foot (41.5 vs. 23.8%) and CVD (37.9 vs. 23.2%). Of the 125 patients who received foot examination, 40% had diabetic foot. Patients who received satisfied diabetic complication assessment had lower rate of cardiovascular complications (25.1 vs. 34.4%, p = 0.008).

Discussion

In this study, we demonstrated that the assessment for chronic diabetic complications is heterogeneity in clinical practice among different health care groups. About 40-50% of patients received annual eye and urine examinations and only 16% received annual foot examination, whereas serum creatinine level was measured more frequently. Patients who received proper diabetic complication assessment had a lower rate of diabetic complication especially cardiovascular complications. This finding has provided important insights into the benefit effect of diabetic complication assessment. We found that different groups of health care providers have different levels of awareness about the assessment for diabetic complications. Endocrinologists and internal medicine residents, who are in a training program, are more alert in performing screening for diabetic complications. These points raise important questions about how to most effectively allocate resources toward improved attainment of the ADA recommendations for screening of diabetic complications[4]. ADA recommendations may help to identify patients at high risk of concomitant complications and further actions may be taken to prevent disabilities.

A recent study[5] has demonstrated that screening for diabetic nephropathy, followed by optimized treatment resulted in a 44% reduction of the

Table 2. Compares number (percent) of patients received diabetic complication assessment within each cluster of health care provider

	Total n (%)	Number (%)					p-value
		GP (n = 54)	Res (n = 75)	Int (n = 360)	Endo (n = 85)	NA (n = 148)	
Eye examination							
- No	445 (61.6)	40 (74.1)	44 (58.7)	232 (64.4)	38 (44.7)	91 (61.5)	0.04
- Yes	277 (38.4)	14 (25.9)	31 (41.3)	128 (35.6)	47 (55.3)	57 (38.5)	
Urine albumin Examination							
- No	419 (58.0)	29 (53.7)	29 (38.7)	206 (57.2)	31 (36.5)	124 (83.8)	< 0.001
- Yes	303 (42.0)	25 (46.3)	46 (61.3)	154 (42.8)	54 (63.5)	24 (16.2)	
Serum creatinine Measurement							
- No	119 (16.5)	19 (35.2)	3 (4.0)	48 (13.3)	10 (11.8)	30 (21.6)	< 0.001
- Yes	603 (83.5)	35 (64.8)	72 (96.0)	312 (86.7)	75 (88.2)	109 (78.4)	
Foot examination							
- No	597 (82.7)	46 (85.2)	51 (68.0)	310 (86.1)	55 (64.7)	135 (91.2)	< 0.001
- Yes	125 (17.3)	8 (14.8)	24 (32.0)	50 (13.9)	30 (35.3)	13 (8.8)	
Diabetic complication assessment							
- Unsatisfied	306 (42.2)	28 (51.9)	17 (22.7)	159 (44.2)	16 (18.8)	86 (58.1)	< 0.001
- Satisfied	416 (57.6)	26 (48.1)	58 (77.3)	201 (55.8)	69 (81.2)	62 (41.9)	

Table 3. Prevalence of chronic diabetic complications

	Total n (%)
DR	
- No DR	190 (68.8)
- NPDR	69 (25.0)
- PDR	17 (6.2)
DN	
- No DN	191 (63.0)
- Microalbumin	81 (26.7)
- Macroalbumin	31 (10.3)
CKD	
- CKD stage 1	113 (23.2)
- CKD stage 2	140 (28.7)
- CKD stage 3	182 (37.3)
- CKD stage 4	40 (8.2)
- CKD stage 5	13 (2.7)
Diabetic foot	
- No diabetic foot	75 (60.0)
- Diabetic foot	50 (40.0)
CVD	
- No CVD	495 (71.1)
- CVD	201 (28.9)
CVA	
- No CVA	621 (89.4)
- CVA	74 (10.6)

%Valid percentages were computed using only patients with available data as follow:
DR, diabetic retinopathy; DN, diabetic nephropathy; CKD, chronic kidney disease; CVD, cardiovascular disease; CVA, cerebrovascular accident

incidence of ESRD and improvements in quality-adjusted life expectancy of 0.18 $\pm$ 0.15 quality-adjusted life years (QALYs)/patient. In addition, the incremental cost-effectiveness ratio was $20,011 per QALY gained for screening and optimized treatment versus no screening. Similarly several studies[6-9] had demonstrated that screening for diabetic complications in patients with type 2 diabetes mellitus can improve clinical outcomes and cost effectiveness. Thus, the more convenient and reachable program for diabetic complications assessment is needed to enhance the screening for diabetic complications. Moreover, complete assessment for diabetic complications could help to identify patient at risk for cardiovascular disease. Recent study[10] showed that the adherence to evidence based medicine tools is the possible method of improving the process of care among general practitioners. General practitioners are the healthcare provider group who takes care of many diabetes patients in Thailand; thus more interventions such as a regular educational program, in addition to better audit methodology to improve awareness of an assessment of diabetic complication aimed for general practitioners are needed to improve successful assessment of diabetic complications and prevention of disability.

Diabetic nephropathy and CKD of at least stage 3 were the most prevalent complications found in this study, occurring in 43.9 and 49% of the patients, respectively. Diabetic retinopathy occurred in 31.2%, cardiovascular disease in 28% and cerebrovascular disease in 10%. The prevalence rates of diabetic complications in this study were similar to those reported in Thailand Diabetes Registry[1,11] and others[12,13]. However, the prevalence of diabetic foot was relatively high (40%); this might be speculated by the fact that only 16% of patients received foot examination. The small number of patients examined might result in falsely high prevalence rate of diabetic foot in this study. Interestingly, we found that the prevalence of CKD was associated with other diabetic complications. Thus, the occurrence of CKD warrants the need for a vigorous search for other associated complications. Since this study focused upon the retrospective reviews of medical record, it is possible that some information were absent. Moreover, the prevalence of diabetic complications may be understated because it is possible that some patients who may have complications never received screening for diabetic complications.

In conclusion, this study demonstrated that there was a high prevalence of diabetic complications in patients with type 2 diabetes mellitus. Screening for diabetic complications will help to identify patients at high risk of concomitant complications; however, some practitioners were not aware of the importance of the diabetic complication screening. These data may help the physician decide to modify treatment to prevent disabilities.

Acknowledgement

This work was supported by grants from Routine to Research Unit, Faculty of Medicine Siriraj Hospital, Mahidol University, Thailand (A.S.).

Potential conflicts of interest

None.

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การประเมินภาวะแทรกซ้อนเรื้อรังจากเบาหวานตามแนวทางของสมาคมเบาหวานแห่งประเทศสหรัฐอเมริกา และความชุกของภาวะแทรกซ้อนเรื้อรังจากเบาหวานในผู้ป่วยเบาหวานไทย

อภิรดี ศรีวิจิตรกมล, ยุวรัตน์ ม่วงเงิน, สาธิต วรรณแสง

ภาวะแทรกซ้อนเรื้อรังในผู้ป่วยเบาหวานเป็นสิ่งที่พบได้บ่อย การป้องกันและการรักษาตั้งแต่ระยะแรกจะช่วยลดภาวะทุพพลภาพของผู้ป่วยได้ สมาพันธ์เบาหวานแห่งประเทศสหรัฐอเมริกา จะมีการจัดพิมพ์แนวทางการดูแลรักษาผู้ป่วยเบาหวานเป็นประจำทุกปีเพื่อให้มีการประเมินภาวะแทรกซ้อนอย่างต่อเนื่อง

วัตถุประสงค์*: เพื่อศึกษาความถี่ของการประเมินภาวะแทรกซ้อนเรื้องรังในผู้ป่วยเบาหวานชนิดที่ 2 ตามแนวทางการรักษาผู้ป่วยเบาหวานของสมาพันธ์เบาหวานแห่งสหรัฐอเมริกา และเพื่อศึกษาความชุกของภาวะแทรกซ้อนเรื้อรังในผู้ป่วยเบาหวานชนิดที่ 2*

วัสดุและวิธีการ*: เป็นการศึกษาแบบ retrospective โดยทบทวนเวชระเบียนของผู้ป่วยเบาหวานชนิดที่ 2 ที่ติดตามการรักษาที่คลินิกอายุรศาสตร์ทั่วไป ตึกผู้ป่วยนอกชั้น 2 โรงพยาบาลศิริราชเป็นเวลามากกว่า 1 ปี ในช่วงวันที่ 1 มกราคม ถึง 31 ธันวาคม พ.ศ. 2549*

ผลการศึกษา*: ผู้ป่วยเบาหวาน 722 คน ที่ทำการศึกษาพบว่ามีเพียงร้อยละ 38.4 ที่ได้รับการตรวจขยายม่านตาโดยจักษุแพทย์ ร้อยละ 42 ที่ได้รับการตรวจไข่ขาวในปัสสาวะเพื่อประเมินภาวะแทรกซ้อนเบาหวานที่ไต และร้อยละ 83.5 ได้รับการตรวจซีรัมครีอะตินีนเพื่อประเมินหน้าที่การทำงานของไต ในขณะที่ผู้ป่วยเพียงร้อยละ 17.3 ที่ได้รับการตรวจเท้าในระยะ 1 ปีที่ผ่านมา โดยพบว่าผู้ป่วยที่ได้รับการดูแลโดยแพทย์ทั่วไป และแพทย์อายุรศาสตร์ทั่วไปนั้น จะได้รับการตรวจประเมินภาวะแทรกซ้อนเรื้อรัง น้อยกว่าผู้ป่วยที่ได้รับการดูแลโดยแพทย์ประจำบ้านอายุรศาสตร์และแพทย์อายุรศาสตร์ต่อมไร้ท่อ จากผู้ป่วยที่ได้รับการประเมิน ภาวะแทรกซ้อนเรื้อรังพบว่าร้อยละ 37 และ 48.3 มีภาวะแทรกซ้อนเรื้อรังที่ไต และมีภาวะไตวายระยะที่ 3 ตามลำดับ ส่วนความชุกของภาวะแทรกซ้อนที่จอประสาทตาคือ ร้อยละ 31.2 โรคหลอดเลือดหัวใจ และหลอดเลือดสมอง คือ ร้อยละ 28.9 และ 10.6 ตามลำดับ โดยพบว่าในผู้ป่วยที่มีภาวะแทรกซ้อนดังกล่าวจะตรวจพบภาวะแทรกซ้อนอย่างอื่นๆ ร่วมด้วยมากขึ้น*

สรุป*: ภาวะแทรกซ้อนเรื้อรังเป็นภาวะที่พบได้บ่อยในผู้ป่วยเบาหวานชนิดที่ 2 การตรวจประเมินภาวะแทรกซ้อนเรื้อรังในผู้ป่วยอย่างน้อยปีละครั้ง จะทำให้สามารถตรวจพบผู้ป่วยที่มีภาวะแทรกซ้อนในระยะแรกเริ่มได้ ซึ่งจะช่วยให้สามารถป้องกันไม่ให้ผู้ป่วยเกิดภาวะทุพพลภาพ แต่อย่างไรก็ดียังมีแพทย์บางกลุ่มไม่ตระหนักถึงความสำคัญของการตรวจประเมินภาวะแทรกซ้อนเรื้อรังในผู้ป่วยเบาหวานชนิดที่ 2*