Improvement of Diabetic Care at Maharat Nakhon Ratchasima Hospital (The Study of Diabcare-Asia from 1997 to 2003)

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Diabcare-Asia, the largest, multicenter observational study in Asia, surveyed the status of diabetic control among Asian diabetics, including Thais. Maharat Nakhon Ratchasima Hospital is a regional hospital in Northeast Thailand that participated in Diabcare-Asia. In 1997, 1998 and 2003, the authors recruited 200, 100, 204 diabetic patients for analysis, respectively. Most (93 per cent) of the patients had type 2 diabetes. In the present study, patients with a BMI $\geq$ 25 kg/m^2 increased from 38, 45 and 47 percent in 1997, 1998 and 2003, respectively. Annual check-ups for diabetic complications increased to nearly 100 per cent by 2003; however, only 72 per cent were examined for diabetic retinopathy, but that *number is up from the 33 per cent in 1997. In the present study, diabetic retinopathy was detected in 8, 16 and 25 per cent of patients, respectively. Diabetic nephropathy (urine albumin $\geq$ 1+ by urine strip) decreased from ~50 per cent in 1997/98 to 19 per cent in 2003. Patients were able to achieve the target blood sugar better than in the past. The number of patients with HbA_{1C} < 7 per cent and FPG $\leq$ 130 mg/dL was 8, 21, 38 and 30, 39 and 40 per cent in 1997, 1998 and 2003, respectively. The proportion of patients who achieved the American Diabetic Association blood pressure, total cholesterol and LDL-C targets in 2004 was < 50 per cent. In conclusion, the present study showed the improvement of diabetic control at Maharat Nakhon Ratchasima Hospital between 1997 and 2003. A similar hospital-based diabetic care system should be implemented at other Thai hospitals for the early identification and prevention of diabetic complications in the future.*

Keywords: *Asia, Diabetes, Management, Thailand*

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Diabetes mellitus (DM), a chronic metabolic illness, is a global public health concern. Although its prevalence varies widely among different populations the rate has generally increased worldwide, particularly in Asia and Africa[1-3]. In Thailand, the prevalence of DM has risen from 5.7 per cent in 1991 to 9.6 per cent in 2000[4,5]. Many disabling or life threatening complications arise from chronic diabetes and these pose a personal burden to the sufferer and a cost to the healthcare system[6,7].

With the growing prevalence of DM and hyperglycemia, hospital-based, health-care professionals will encounter patients with these conditions with increasing frequency. It is well-known that long-term control of blood glucose reduces the rate and severity of complications in patients with diabetes and can significantly lower morbidity and mortality[8].

The Diabetes Control and Complications Trial (DCCT)[9], the United Kingdom Prospective Diabetes Study (UKPDS)[10], the Stockholm Diabetes Intervention Study (SDIS)[11] and the Kumamoto Study[12] all

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showed that intensive diabetes therapy reduced the risks of developing chronic diabetic complications. However, the successful achievement of goals depends on many factors, including age, co-morbidity, socio-economic status and social healthcare support.

Diabcare-Asia, the largest, multicenter observational study in Asia, was established (in 1996 as DCDCP) to monitor the status of diabetic control among Asian diabetic patients. The present study represents a collaboration of various national diabetic associations in 12 participating countries coordinated by Novo Nordisk Asia Pacific Pt Ltd. Singapore, Bio-rad Pacific, Hong Kong. Maharat Nakhon Ratchasima Hospital was randomly selected to represent Thailand in the collaboration.

The objective was to examine the progression of diabetic care as *per* criteria set out by the Diabcare-Asia project and to determine the prevalence of chronic complications among diabetic patients at Maharat Nakhon Ratchasima Hospital. Data collection was undertaken at the hospital in 1997, 1998 and 2003.

Materials and Methods

Setting and subjects

This was a cross-sectional study carried out in the Diabetic Clinic of Maharat Nakhon Ratchasima Hospital, in Nakhon Ratchasima province, Northeast Thailand.

All patients in the diabetic clinic who were cared for and treated at the Out-Patient Department for at least 12 months were recruited. A simple random sampling (1:1) was used to recruit the patients. In this present study, 200, 100 and 204 diabetic patients in 1997, 1998 and 2003, respectively were recruited for analysis. DM was defined according to the American Diabetic Association (ADA)[13-15]. The classification of DM was based on the clinical judgment of the hospital's endocrinologists.

Data collection

Data were collected by reviewing patient medical records, through interviews and laboratory assessments. The data collection form (DCF) was used to record patient-demographics, type and duration of diabetes, risk factors (*i.e.* smoking and alcoholic consumption), diabetic management (frequency and type of interventions) and diabetic complications. The results of laboratory assessments and clinical examinations, performed during the 12 months of recruitment, were accepted for analysis.

Measurements

Body weight (including light indoor clothing) was measured using an electronic balance (to the nearest 0.1 kg) and standing height (without shoes) using a standiometer (to the nearest 0.1 cm). The body mass index - the quotient of weight over height-squared (kg/m^2) was calculated.

Blood pressure was measured at each visit. Annual examinations included: 1) dilated retinal, 2) cardiovascular (for evidence of cardiac or peripheral vascular disease), 3) neurological (for signs of autonomic neuropathy), and 4) foot.

Specimen collections

Serum samples were collected in the morning after the subject had fasted 12 hours. Measurements included fasting plasma glucose (FPG), total cholesterol, triglycerides, high-density lipoprotein cholesterol (HDL-C) and low-density lipoprotein cholesterol (LDL-C).

In 1997, glycosylated hemoglobin (HbA_{1c}) was measured at the Maharat Nakhon Ratchasima Hospital, but in 1998 and 2003, for standardization of HbA_{1c} of all the participated hospitals, capillary whole blood samples were collected and sent to the Department of Clinical Pathology, Siriraj Hospital, to assess for HbA_{1c} using the Bio-Rad HbA_{1c} Sample Preparation Kit (Bio-Rad Pacific Ltd, Hong Kong).

Serum was measured for blood urea nitrogen and creatinine at 6- to 12-month intervals. Urine samples were collected in sealable plastic containers and urinalysis performed at the laboratory.

Statistical analysis

Statistical analyses were performed using SPSS 9.0 (SPSS, Inc, Chicago). The results were expressed as means, standard deviations (SD) and percentages. Descriptive statistics were computed for 1997, 1998 and 2003, separately.

Results

In 1997, 1998 and 2003, the authors recruited 200, 100 and 204 diabetic patients. The proportion of males to females was consistently 1:3. Most of the patients were type 2 DM and the prevalence of overweightedness (BMI $\geq$ 25 kg/m^2) was 38, 45 and 47 percent in 1997, 1998 and 2003, respectively. The demographic and baseline characteristics of patients are presented in Table 1.

Most of the diabetic patients in the present study (92.6 per cent) received mono or combination

Table 1. Demographic and baseline characteristics of diabetic patients

Year	1997	1998	2003
Number of patients	200	100	204
Age (y)	55.1±13.2	57.1±12.7	64.6±17.9
Sex (male: female)	1:3	1:3	1:3
Age at onset of DM (y)	46.9±12.5	48.3±11.0	56.7±17.8
Diabetes duration (y)	8.4±7.0	10.1± 6.5	8.6± 9.7
Type of DM (%)			
Type 1	10.2	2.1	3.4
Type 2	87.8	95.9	96.6
Other specific types	2.0	2.0	0.0
Smoker (%)	7.0	5.2	4.4
Ex-smoker (%)	6.5	10.3	0.5
Alcohol drinker (%)	4.0	2.1	4.9
Body mass index (kg/m^2)	24.2±3.5	25.5±4.36	25.0±4.5
BMI 25 kg/m^2 (%)	38.3	44.8	47.1
Systolic BP	128.9±21.4	129.4±20.6	129.4±16.7
Diastolic BP	77.3±12.5	75.9±10.4	79.6±10.1
Fasting plasma glucose (mg/dL)	169.0±68.9	147.7±38.6	149.2±52.8
HbA_{1C} (%)	9.0±2.1	8.9±1.7	7.7±1.7
Total cholesterol (mg/dL)	197.4±41.1	212.8±45.2	205.7±42.9
Triglyceride (mg/dL)	147.7±88.7	156.6±94.2	159.7±88.7
HDL-C (mg/dL)	NA	50.4±12.2	59.3±18.1
LDL-C (mg/dL)	NA	129.0±47.9	107.66±42.3

All values are shown in mean ± standard deviation (SD). Others were specified, NA; not available

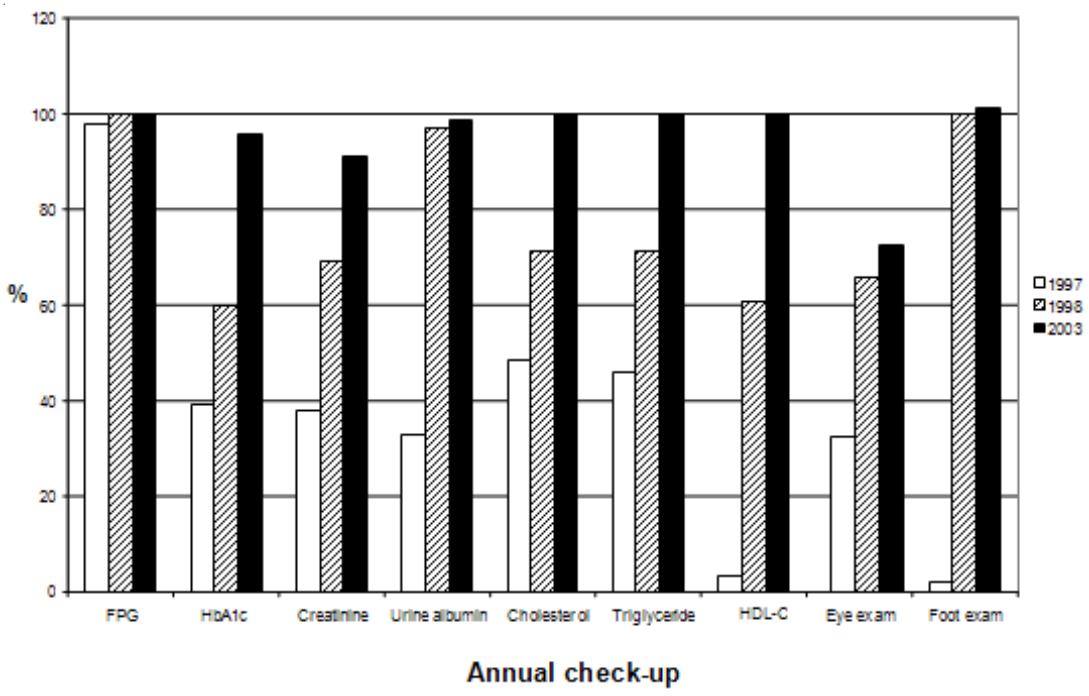

Fig. 1 Percentage of diabetic patients who had an annual check-up by year

Table 2. Management of diabetic patients

Year	1997	1998	2003
Diet (%)	2.5	4.1	7.4
1 OHA (%)	37.7	35.1	39.2
2 OHA (%)	45.7	50.5	53.4
3 OHA (%)	2.5	2.1	1.0
Insulin alone (%)	23.7	7.2	4.9
Insulin + OHA (%)	15.5	9.2	11.8
Herbal (%)	4.4	14.4	2.9

OHA; oral hypoglycemic agents

oral hypoglycemic drugs. However, diet control alone achieved the target of FPG < 130 mg/dL or HbA_{1c} < 7 per cent was increased while insulin therapy alone was decreased during the study (Table 2). The trend to have an annual check-up increased through the study. In 2003, fasting plasma glucose, HbA_{1C}, lipid profiles, serum creatinine, urinalysis and foot examination were measured in over 90 per cent of patients, and retinal examinations in 72 per cent (Fig. 1).

Based on the targets set by the ADA in 2004[10], a fasting plasma glucose (< 130 mg/dL) and HbA_{1c} (< 7 per cent), 38 per cent of patients achieved the goal in 2003, which was higher than in 1997 and 1998. By the end of the present study, most (91 per cent) of the patients achieved the HDL-C target; while only 50, 57 and 30 percent achieved the target for total cholesterol (< 200 mg/dL), triglyceride (< 150 mg/dL) and LDL-C (< 100 mg/dL), respectively**.** However, less than 50 per cent of the patients achieved the blood pressure control goal (systolic and diastolic BP < 130 and < 80 mmHg, respectively), (Table 3).

In Table 4, the authors compared the micro- and macro-vascular complications of diabetes among the three studied years. The prevalence of cataracts and background diabetic retinopathy was lower in 1998 and 2003 than 1997; however, the detection of advanced eye disease and more common use of the term legal blindness were greater in 2003 than in either 1997 or 1998. Relatedly, laser therapy to prevent the progression of diabetic retinopathy has been more available and performed more frequently since 1998. The prevalence of diabetic nephropathy by urinalysis (albuminuria $\geq$ 1+) and diabetic neuropathy evaluated by reviewing patient medical records, inspection for hyperpigmented skin, deformity or ulcer of feet, and positive micro filament test (> 1/10 points), had declined in 2003 compared with 1997 and 1998; however, there were a small number of diabetic patients with renal insufficiency (Cr $\geq$ 2 mg/dL) or end-stage renal disease in the present study.

For macrovascular complications, the prevalence of peripheral vascular disease (presented with dorsalis pedis and/or posterior tibial arterial pulse deficit), stroke, ischemic heart disease (by reviewing patient medical records) and diabetic foot ulcer (by reviewing patient medical records and examination) was low in the present study. The trend-prevalence of ischemic heart disease was, nonetheless, lower in 2003 than previously.

Discussion

Diabetes is a chronic disease causing both micro- and macrovascular complications[6]. The worldwide prevalence of diabetes is projected to increase by

Table 3. Percentage of diabetic patients who reached the targeted control recommend by ADA 2004

Year	1997	1998	2003
HbA_{1C} <7%	7.7	20.7	38.0
Systolic BP <130 mmHg	48.5	47.4	40.2
Diastolic BP <80 mmHg	46.0	43.3	36.8
Fasting plasma glucose <130 mg/dL	30.0	39.2	40.2
Total cholesterol <200 mg/dL	51.6	33.3	49.5
Triglyceride <150 mg/dL	60.9	58.2	57.4
HDL-C >40 mg/dL	NA	81.4	91.2
LDL-C <100 mg/dL	NA	27.6	30.3

NA; not available

Table 4. Diabetic complications of patients by year

Year	1997	1998	2003
Cataract (%)	22.5	42.1	47.4
Background diabetic retinopathy (%)	24.6	14.7	17.4
Advance eye disease (%)	0	1.0	7.1
Legal blindness (%)	0.5	2.1	6.5
Laser therapy (%)	0	7.2	9.1
Urine albumin $\geq$ 1+ (%)	51.5	53.2	19.4
Serum creatinine $\geq$ 2 mg/dL (%)	9.2	3.0	8.6
Diabetic neuropathy (%)	30.2	30.2	16.8
Pulse deficit/claudication (%)	0	2.1	1.5
Active ulcer/gangrene (%)	0	2.1	0.5
Healed ulcer (%)	33.3	1	4.4
Amputation (%)	1	1	1
Stroke (%)	3.5	2.1	5.4
Ischemic heart disease (%)	8.5	8.3	1.5
End-stage renal disease (%)	0	0	0.5

5.4 per cent by the year 2025 with a 170 per cent increase in developing countries, particularly in Asia (including Thailand) and Africa[1-5].

Previous, large studies have shown that diabetic complications can be prevented by good glycemic control combined with other metabolic control of blood pressure and the lipid profile[10,11]. Getting an annual check-up is an important strategy for early identification and management of diabetic complications.

This present study assessed and determined the level of diabetic care and management and evaluated diabetes-related complications. More than 95 percent of patients had type 2 DM and the male to female ratio was 1:3 equivalent to studies in Thailand in 1994 and 2001[4,16] but not with Aekplakorn W et al, showing no difference between men and women[5]. The onset of diabetes in the study was 51.2 years (SD 15.37) comparable to 49.7 years (SD 11.2), the present study of Diabcare-Asia 1998[18].

The average BMI of patients increased over the course of the present study. The number of patients with a BMI of > 23 and > 25 kg/m^2 was 70 and 50 percent, respectively. The prevalence of overweightedness increased from 38 to 47 per cent between 1997 and 2003.

The number of patients checked for HbA_{1c}, serum creatinine, urine albumin, lipid profile, and receiving retinal and foot examinations, increased over the years. The trend to good glycemic control increased; however, the authors found that the number of patients achieving the blood pressure target decreased by ~10 per cent between 1997 and 2003 and only half of the patients achieved the total cholesterol and triglyceride targets. HDL-C and LDL-C measurements were not available at Maharat Hospital in 1997; however, most patients achieved the HDL-C target in 1998 and 2003, though those achieving the LDL-C target was still low.

The trend to have an annual check-up to identify diabetic complications has increased over the years, but only the incidence of albuminuria ($\geq$ 1+), ischemic heart disease and diabetic neuropathy decreased. Other micro- and macrovascular complications (*i.e.*, retinopathy, diabetic foot ulcer, stroke) were unchanged.

Urine microalbumin was not measured in the authors' hospital during the year of study; however, other related studies found the prevalence of early diabetic nephropathy, defined by excessive urine microalbumin (30-300 mg/dL), to be 16.7, 43.5 and 24 percent with negative macroalbuminuria[18-20]. Thus, the incidence of diabetic nephropathy in the present study might have been underestimated.

The present findings must be interpreted within the context of a number of potential strengths and weaknesses. One of the strengths was that the authors demonstrated the serial improvement of the diabetic health care system in a major regional hospital in Thailand (from 1997 to 2003). This improvement might be influenced by gaining knowledge and experience of diabetic care team which was developed by Diabcare-Asia project. However, the weaknesses of the present study were: 1) the method HbA_{1c} measurement differed in 1998 and 2003. Therefore, the results might not be readily comparable among the years of study; and 2) that many diabetic patients had chronic complications such as coronary heart disease, renal failure or stroke treated by other practitioners, thereby masking estimates of complications.

In conclusion, the diabetic health care system at Maharat Nakhon Ratchasima Hospital improved between 1997 and 2003 as shown by the increasing rate of annual check-ups for diabetic complications, better glycemic control and the decreasing incidence of chronic diabetic complications, particularly of diabetic nephropathy and neuropathy.

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พัฒนาการดูแลรักษาผู้ป่วยเบาหวานที่โรงพยาบาลมหาราชนครราชสีมา (โครงการ Diabcare -Asia ระหว่างปี พ.ศ. 2540-2546)

ธัญญา เชฏฐากุล, ฉัตรเลิศ พงษ์ไชยกุล, สุนทร ตัณฑนันท์

โครงการ Diabcare-Asia เป็นโครงการที่ศึกษาผลการให้บริการผู้ป่วยเบาหวานในประเทศต่าง ๆ ในทวีปเอเชียรวมทั้งประเทศไทย สำหรับในประเทศไทยได้มีการศึกษาในโรงพยาบาลศูนย์ และคณะแพทยศาสตร์ ตามภาคต่าง ๆ ของประเทศ ในปี พ.ศ. 2540, พ.ศ. 2541 และ พ.ศ. 2546 โรงพยาบาลมหาราชนครราชสีมาเป็นโรงพยาบาลศูนย์แห่งหนึ่งของภาคตะวันออกเฉียงเหนือที่ได้เข้าโครงการนี้ทุกครั้ง การศึกษานี้เป็นการศึกษาการให้บริการผู้ป่วยเบาหวานที่คลินิกผู้ป่วยนอกโรงพยาบาลมหาราชนครราชสีมาในช่วงเวลาที่กำหนด มีจำนวน 200, 100, และ 204 คนตามลำดับ ผู้ป่วยส่วนใหญ่เป็นเบาหวานชนิดที่ 2 ผู้ป่วยมีดัชนีมวลกายตั้งแต่ 25 กิโลกรัมต่อตารางเมตร มีจำนวนเพิ่มขึ้นตามลำดับจากร้อยละ 38.3, 44.8 และ 47.06 จำนวนผู้ป่วยที่ได้รับการตรวจร่างกายประจำปีเพิ่มขึ้นจนเกือบร้อยละ 100 ในปี พ.ศ. 2546 ยกเว้นการตรวจตาซึ่งตรวจคัดกรองได้ร้อยละ 72.4 ในปี พ.ศ. 2546 เปรียบเทียบปี พ.ศ. 2540 ซึ่งมารับการตรวจคัดกรองเพียงร้อยละ 32.5 ตรวจพบภาวะเบาหวานขึ้นตาร้อยละ 8, 15.7 และ 24.5 ตามลำดับ ตรวจพบภาวะไตเสื่อมจากเบาหวานโดยใช้เกณฑ์การตรวจพบอัลบูมินในปัสสาวะตั้งแต่บวก 1 ขึ้นไป พบได้น้อยลง จากร้อยละ 51.5, 53.2 และ 19.4 ตามลำดับ การควบคุมระดับน้ำตาลในเลือดถึงเป้าหมายมากขึ้น โดยผู้ป่วยที่มีระดับฮีโมโกลบิน เอ วัน ซี ต่ำกว่าร้อยละ 7 พบได้ร้อยละ 7.7, 20.7 และ 38 ส่วนระดับน้ำตาลในเลือดขณะอดอาหาร $\leq$ 130 มก/ดล พบได้ร้อยละ 30.0, 39.2 และ 40.2 ตามลำดับ แต่สิ่งที่ยังต้องปรับปรุงคือการควบคุมความดันโลหิต ระดับไขมันโคเลสเตอรอลรวมและระดับแอลดีแอลโคเลสเตอรอลซึ่งยังควบคุมตามเกณฑ์ของสมาคมเบาหวานอเมริกัน ปี พ.ศ.2547 ได้น้อยกว่าร้อยละ 50 โดยสรุป การศึกษาครั้งนี้ได้นำเสนอ การพัฒนาการให้บริการในการดูแลรักษาผู้ป่วยโรคเบาหวานในโรงพยาบาลมหาราชนครราชสีมา ในระหว่างปี พ.ศ. 2540-2546 การศึกษาแสดงให้เห็นว่าควรมีการพัฒนาและจัดตั้งระบบการดูแลรักษาผู้ป่วยโรคเบาหวานในทุกโรงพยาบาลเพื่อช่วยในการค้นหาภาวะแทรกซ้อนตั้งแต่ระยะแรกและให้การป้องกันการเกิดภาวะแทรกซ้อนจากโรคเบาหวานในอนาคต