Thailand Diabetes Registry Project: Type of Diabetes, Glycemic Control and Prevalence of Microvascular Complications in Children and Adolescents with Diabetes

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Objective: *To determine the etiology, glycemic control and prevalence of microvascular complications in Thai diabetic patients who were diagnosed at the age of less than 18 years and who attended diabetes clinics in university or tertiary care hospitals.*

Material and Method: *A cross-sectional, multi-center, hospital-based diabetes registry was carried out from diabetes clinics of 11 tertiary centers. Demographic data including laboratory results and microvascular complications were recorded.*

Results: *Two-hundred-and-fifty out of the 9419 (2.66%) diabetic patients were diagnosed before the age of 18 years, 78% had Type1 diabetes (T1DM), 18.4% had Type2 diabetes (T2DM) and 3.6% had other types of diabetes. Mean HbA_{1C} of T1DM was 9.3 ± 2.5, T2DM was 9.7 ± 2.6 and other types of diabetes were 8.6 ± 4%. The majority of patients had poor glycemic control according to ADA and WHO guidelines. The percentage of patients who had diabetes for more than 5 years but had not been screened for nephropathy and retinopathy were 57.7% and 16% in T1DM and were 46.4% and 14.2% in T2DM respectively. A significant correlation between microvacular complications (nephropathy and retinopathy) and duration of disease was found in T1DM ($p < 0.001$).*

Conclusion: *The majority of Thai children and adolescents with diabetes had T1DM and unsatisfactory glycemic control. Screening for microvascular complications was under international standard. The national strategic plan for management of this disease especially in this age group should be urgently implemented.*

Keywords: *Juvenile diabetes, Children and adolescents with diabetes, Type of diabetes, Glycemic control, Microvascular complications*

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Diabetes is a chronic illness that requires continuing medical care and patient self-management education to prevent acute complications and to reduce the risk of long term complications. Diabetes in the young, whether in a pediatric or adolescent population, presents with various major medical, physiological, psychosocial and emotional problems that need to be handled with special care. Children have characteristics and needs that dictate individualized care. Management of childhood diabetes must take these major differences into account. Childhood and adolescence diabetes as a group may present with the worst glycemic control, compared with diabetes patients in other age groups[1,2]. In the Diabetes Control and Complication Trial (DCCT), despite similar and extensive support from the multi-disciplinary diabetes treatment team, mean HbA_{1C} levels were higher in patients aged 13 to 17 years (9.2 to 10.1%) compared to those in patients aged 18 to 39 years[3,4]. The Diabcare-Asia, conducted in 1998[5], showed that mean HbA_{1C} level of young patients with T1 DM was 10.7 ± 3% and T2DM was 9.3 ± 2.6%, which is an unsatisfactory level.

In Thailand, with the growing incidence of diabetes, the incidence in childhood and adolescence diabetes, which was formerly found as a rare disease, has also increased[6-8].

Although the incidence of children and adolescents with diabetes is relatively low in Thailand, endocrinologists have been confronted with many problems in taking care of them such as lack of diabetes knowledge, lack of home self monitoring device and strips and poverty. These problems are especially evident in the care of T1DM patients who really need a multi-disciplinary care team and supporting system.

The objectives of this study were to determine the prevalence of childhood and adolescent diabetes and to determine the etiology, glycemic control and microvascular complications in these patients.

Material and Method

A cross-sectional, multicenter, hospital-based diabetes registry was carried out from April 2003 to December 2003. The authors registered diabetic patients from diabetes clinics in 11 tertiary centers. The method of registration and data collection was described in detail in a previous section of this issue[9]. The study was approved by the ethical committee of each participating hospital. Signed informed consent was obtained from all participants. Only patients with childhood or adolescent onset of diabetes at the age of less than 18 years were included in this present report. Diagnosis of T1DM was based on obvious clinical manifestations including a few weeks of polyuria, polydipsia, weight loss, hyperglycemia with ketonemia or diabetic ketoacidosis and all of them needed insulin injections to normalize their blood glucose. Clinical manifestations of T2DM were not as obvious. The onset of diabetes was usually insidious; most T2DM patients were obese and had a positive family history of diabetes. OGTT was also performed to make the diagnosis of T2DM in some cases. Data were expressed as mean ± SD. Statistical analyses were performed using STATA version 8.0 (STATA Corporation, College Station TX, US) Comparison between groups was analyzed by unpaired t-test, Chi-square test, Fishers' Exact test or Mann-Whitney U test, where appropriate.

Results

From the 9,419 patients in this study, 250 (2.66%) were diagnosed as having diabetes before

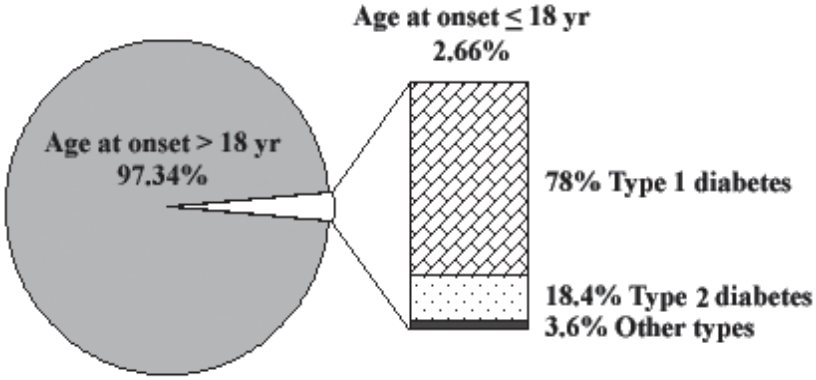

Fig. 1 Etiology of diabetes in children and adolescents with onset of diabetes at ≤ 18 years

reaching the age of 18 years. The ratio of male to female ratio was 2:3 (40.4% vs. 59.6%). Etiology of diabetes in this age group included T1DM (78%), T2DM (18.4%) and other types (3.6%) as shown in Fig. 1. The age at first diagnosis, duration of disease, glycemic control and family history are shown in Table 1. The mean age at diagnosis in T1DM was 9.2 years. Of all those patients, 58% were under the care of pediatric endocrinologists and 42.0% adult endocrinologists. The data showing the nephropathy screening is in Table 2 and retinopathy is in Table 3. In T1DM, the duration of the disease had a significant positive correlation with microvascular complications (nephropathy, $p < 0.001$ and retinopathy, $p < 0.001$). In contrast, only retinopathy was associated with the disease duration in T2DM ($p = 0.002$).

Discussion

The percentage of diabetic patients diagnosed before 18 years of age in this present cohort was 2.66%. The etiology of diabetes included T1DM (78%), T2DM (18.4%) and other types of diabetes (3.6%). The mean age at diagnosis in T1DM was 9.2 years. However, the age at diagnosis of T2DM and other types of diabetes was in the pubertal age group, which is similar to other several epidemiological studies[10-12]. Glycemic control is fundamental to the management of diabetes. The goal of therapy is to achieve HbA_{1C} as close to normal as possible in the absence of hypoglycemia. The American Diabetes Association recommends A_{1C} goal less than 7% for diabetic patients in general[13]. The mean HbA_{1C} of both T1DM and T2DM in the present study were at an unsatisfactory level. Only 17% of

Table 1. The age at diagnosed, duration, family history of diabetes and glycemic control of diabetic patients aged at diagnosis of less than 18 years

	Type 1	Type 2	Other type
No (%)	195 (78.0%)	46 (18.4%)	9 (3.6%)
Age at entry (yr)	16.8±8.8 (1.6-44.8)	26.7±14 (11.1-62)	21.02±1.2 (13.6-47.1)
Age at diagnosis(yr)	9.2±4.5 (0.2-18)	13.4±3 (8-18)	12.7±3.5 (5.2-17.8)
Duration of disease (yr)	7.5±7.4 (0.05-35)	13.2±14.4 (0.05-46)	8.3±9.3 (0.3-29.3)
HbA_{1C}(%)	9.3±2.5	9.7±2.6	8.6±4
Family history of diabetes (%)	44/195 (22.6%)	23/46 (50%)	3/9 (33.3 %)

Data are expressed as mean ± SD (range) or percent

Table 2. Nephropathy screening in both Type 1 and Type 2 diabetes according to duration of diseases

Duration of disease (yr)	Type 1 Diabetes					Type 2 Diabetes				
	Total No.	No. of screening (%)			no	Total No.	No. of screening (%)			no
		yes					yes			
		+ve	-ve	total			+ve	-ve	total	
< 5	98	2 (1%)	15 (7.7%)	17 (8.7%)	81 (41.5%)	18	1 (2.2%)	6 (13.0%)	7 (15.2%)	11 (23.9%)
5-9.9	45	2 (1%)	7 (3.6%)	9 (4.6%)	36 (18.5%)	10	1 (2.2%)	3 (6.5%)	4 (8.7%)	6 (13.0%)
10-14.9	23	8 (4.1%)	5 (2.6%)	13 (6.7%)	10 (5.1%)	2	0 (0%)	1 (2.2%)	1 (2.2%)	1 (2.2%)
15-19.9	15	9 (4.6%)	2 (1%)	11 (5.6%)	4 (2.1%)	5	2 (4.3%)	1 (2.2%)	3 (6.5%)	2 (4.3%)
≥ 20	14	7 (3.6%)	1 (0.5%)	8 (4.1%)	6 (3.1%)	11	3 (6.5%)	4 (8.7%)	7 (15.2%)	4 (8.7%)
Total case (%)	195 (100%)	28 (14.4%)	30 (15.4%)	58 (29.7%)	137 (70.3%)	46 (100%)	7 (15.2%)	15 (32.6%)	22 (47.8%)	24 (52.2%)

Table 3. Retinopathy screening in both Type 1 and Type 2 diabetes according to duration of diseases

Duration of disease (yr)	Type 1 Diabetes						Type 2 Diabetes					
	Total No.	No. of screening (%)					Total No.	No. of screening (%)				
		yes				no		yes				no
		+ve		-ve	total			+ve		-ve	total	
		NPDR	PDR					NPDR	PDR			
< 5	98	2 (1%)	0 (0%)	84 (43.1%)	86 (44.1%)	12 (6.2%)	18	0 (0%)	0 (0%)	17 (37%)	17 (37%)	1 (2.2%)
5-9.9	45	1 (0.5%)	0 (0%)	35 (17.9%)	36 (18.5%)	9 (4.6%)	10	2 (4.3%)	0 (0%)	6 (13%)	8 (17.4%)	2 (4.3%)
10-14.9	23	2 (1%)	4 (2.1%)	14 (7.2%)	20 (10.3%)	3 (1.5%)	2	0 (0%)	0 (0%)	1 (2.2%)	1 (2.2%)	1 (2.2%)
15-19.9	15	4 (2.1%)	2 (1%)	7 (3.6%)	13 (6.7%)	2 (1%)	5	1 (2.2%)	2 (4.3%)	1 (2.2%)	4 (8.7%)	1 (2.2%)
≥ 20	14	0 (0%)	8 (4.1%)	4 (2.1%)	12 (6.2%)	2 (1%)	11	5 (10.9%)	2 (4.3%)	4 (8.7%)	11 (23.9%)	0 (0%)
Total case (%)	195 (100%)	9 (4.6%)	14 (7.2%)	144 (73.8%)	167 (85.6%)	28 (14.4%)	46 (100%)	8 (17.4%)	4 (8.7%)	29 (63%)	41 (89.1%)	5 (10.9%)

T1DM and 22% of T2DM reached the goal of therapy (Fig. 2). The present study showed a poorer glycemic control compared with several other studies[5,14]. The reason for this is not speculated because the pattern of diabetic management may vary in different centers. In addition, the psychosocial background of patients and parents were the major influencing factors in glycemic control. The present study did not have data on numbers and doses of insulin injection. The majority of Thai T1DM received conventional insulin injection and very few of them regularly performed Self Monitoring Blood Glucose (SMBG). Recently, a study from a Thai diabetes youth camp[15] found that after obtaining more diabetes self management skills, the campers had significantly improved their glycemic control (1% reduction of mean pre-post camp HbA_{1c}) and campers with frequent SMBG had better HbA_{1c} levels ($7.3 \pm 0.9\%$).

Lower HbA_{1C} level has been associated with lower microvascular complications and morbidity from diabetes. The recent standard of medical care in diabetes 2006[13], recommended by ADA, suggested that retinopathy screening by ophthalmologists or optometrists should be performed annually within 3-5 years after the onset of T1DM and shortly after the diagnosis in T2DM. Nephropathy screening by microalbuminuria test should be performed annually in T1DM within a diabetes duration of ≥ 5 years and in T2DM at the time of diagnosis. The presented data demonstrated that in patients with a duration of having diabetes for more than 5 years, 81 of 97 (84%) T1DM and 24 of 28 (85.7%) T2DM patients had retinopathy screening. In contrast, only 41 of 97 (42.3%) T1DM and 15 of 28 (53.5%) T2DM patients had nephropathy screening.

Half of T1DM and one-third of T2DM had positive nephropathy screening. The percentage of T1DM and T2DM with positive retinopathy screening was 13.7% and 29.2% respectively. The present study also demonstrated that the retinopathy had positive correlation with duration of disease, and is similar to several previous studies where patients were treated with a conventional regimen. Currently, experts[13,16] recommend MultiDose Insulin (MDI) injection therapy especially in T1DM for better glycemic control and prolonging the microvascular complications onset.

The results of this large diabetes registry suggested that the presented young diabetic patients should receive more intensive management, including a diabetes self management education program. They should also be strictly scheduled for evaluation of diabetic complications yearly to prevent future serious long term complications especially renal failure and blindness. A multidisciplinary health professional team, an intensive glucose control program with anti-

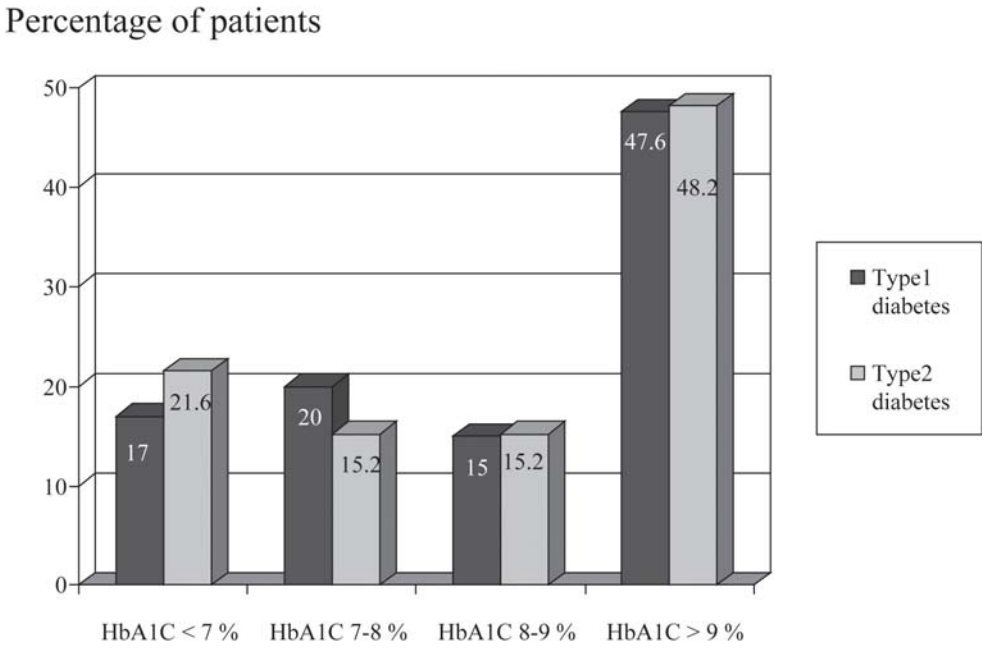

Fig. 2 Percentage of patients in different levels of glycemic control (HbA1C) in T1DM and T2DM

diabetic agents or insulin therapy, a self monitoring glucose devices, and a supporting system for diabetes care should be urgently provided for this group of patients.

Conclusion

The prevalence of childhood and adolescence onset of diabetes in this present study was 2.66%. The majority of them had T1DM and had unsatisfactory glycemic control and inadequate screening of microvascular complications. The results should alert the national health care policy makers to establish national guidelines for the management of diabetes and the screening program for other diabetic complications in children and adolescents with diabetes.

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โครงการลงทะเบียนผู้ป่วยเบาหวานในประเทศไทย: ชนิดของเบาหวาน ผลการควบคุมระดับน้ำตาล และอุบัติการณ์ของภาวะแทรกซ้อนหลอดเลือด ในเบาหวานเด็กและวัยรุ่น

สุภาวดี ลิขิตมาศกุล, สุทธิพงศ์ วัชรสินธุ, เพชร รอดอารีย์, ฉัตรประอร งามอุโฆษ, ชัยชาญ ดีโรจนวงศ์, สมพงษ์ สุวรรณวลัยกร, ธัญญา เชฏฐากุล, พงศ์อมร บุนนาค, ณัฐพงศ์ โฆษชุณหนันท์, ณัฐเชษฐ์ เปล่งวิทยา, รัตนา ลีลาวัฒนา, สิริเนตร กฤติยาวงศ์, ยุพิน เบ็ญจสุรัตน์วงศ์, ธงชัย ประฏิภาณวัตร

วัตถุประสงค์*: เพื่อศึกษาชนิดของเบาหวาน ผลการควบคุมระดับน้ำตาลและอุบัติการณ์ของภาวะแทรกซ้อนหลอดเลือดในผู้ป่วยเบาหวานที่เริ่มเป็นโรคก่อนอายุ 18 ปี ที่มารับการรักษาที่คลินิกเบาหวานที่โรงพยาบาลมหาวิทยาลัย และโรงพยาบาลศูนย์*

วัสดุและวิธีการ*: เป็นการเก็บข้อมูลโดยการลงทะเบียนผู้ป่วยเบาหวานที่มาติดตามการรักษาที่คลินิกเบาหวานในโรงพยาบาลมหาวิทยาลัยและโรงพยาบาลระดับตติยภูมิ 11 แห่ง มีการเก็บข้อมูลทั่วไป ประวัติผู้ป่วย การตรวจรักษา ผลการตรวจทางห้องปฏิบัติการ ผลการรักษาและการตรวจคัดกรองภาวะแทรกซ้อนทางหลอดเลือดไตและตา*

ผลการศึกษา*: พบมีจำนวนผู้ป่วยที่ได้รับการวินิจฉัยเบาหวานก่อนอายุ 18 ปี รวม 250 คนในจำนวน 9,419 คน คิดเป็นร้อยละ 2.7 มีสาเหตุเบาหวานคือ เบาหวานชนิดที่หนึ่งร้อยละ 78 เบาหวานชนิดที่สองร้อยละ 18.4 และเบาหวานชนิดอื่น ๆ ร้อยละ 3.6 ค่าระดับน้ำตาลเฉลี่ย HbA_{1C} ของเบาหวานชนิดที่หนึ่ง ชนิดที่สองและชนิดอื่น ๆ เท่ากับ 9.3 ± 2.5 %, 9.7 ± 2.6 % และ 8.6 ± 4 % ตามลำดับ ผู้ป่วยส่วนใหญ่มีการควบคุมระดับน้ำตาล HbA_{1C} อยู่ในเกณฑ์ไม่ดีเมื่อเทียบกับเกณฑ์มาตรฐานที่กำหนดโดย ADA และ WHO จำนวนเปอร์เซ็นต์ของผู้ป่วยเป็นเบาหวานนานเกิน 5 ปีที่ไม่ได้รับการตรวจคัดกรองภาวะแทรกซ้อนทางหลอดเลือดไตและตา คิดเป็นร้อยละ 57.7 และร้อยละ 16 ในกลุ่มเบาหวานชนิดที่หนึ่ง และในกลุ่มเบาหวานชนิดที่สองคิดเป็นร้อยละ 46.4 และร้อยละ 14.2 ตามลำดับ ในผู้ป่วยเบาหวานชนิดที่หนึ่ง พบว่าภาวะแทรกซ้อนที่ตรวจพบทางไตและตามีความสัมพันธ์กับระยะเวลาของการเป็น โรคเบาหวานอย่างมีนัยสำคัญทางสถิติ ($p < 0.001$)*

สรุป*: ผู้ป่วยเบาหวานที่เริ่มเป็นโรคในเด็กและวัยรุ่น ส่วนใหญ่มักมีการควบคุมน้ำตาลเฉลี่ยอยู่ในเกณฑ์ไม่ดี และไม่ได้รับการตรวจคัดกรองภาวะแทรกซ้อนทางไตและตาอย่างเหมาะสม การวางแผนเพื่อการพัฒนากระบวนการรักษาโรคเบาหวานในกลุ่มผู้ป่วยนี้ ควรจะต้องได้รับการสนใจเป็นอย่างยิ่ง*