Thailand Diabetes Registry Project: Prevalence of Hypertension, Treatment and Control of Blood Pressure in Hypertensive Adults with Type 2 Diabetes

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Objective: *To determine the prevalence of hypertension, patterns of antihypertensive treatment and level of blood pressure control in adult Thai type 2 diabetic patients who attended diabetes clinics in university and tertiary-care hospitals.*
Material and Method: *A cross-sectional, multi-center, hospital-based diabetes registry of 8,884 adults 18 years old and older was carried out from diabetes clinics of 11 tertiary centers. Demographic data, including use of antihypertensive drugs and blood samples were collected and analyzed for prevalence, associated factors, patterns of antihypertensive therapy and level of blood pressure control.*
Results: *The prevalence of hypertension in adult Thai type 2 diabetic patients was 78.4 (6,965)%. Antihypertensive drugs were prescribed in 84.4 (5,878)% of all hypertensive patients. The achievement of blood pressure control (less than 130/80 mmHg) was 13.85%. The percentage of patients receiving 1, 2, 3, 4, and 5 drugs were 45 (2,645)%, 33.4 (1,963)%, 16.8 (987)%, 4.4 (259)%, and 0.4 (24)% respectively. Angiotensin-converting enzyme inhibitors were the most commonly prescribed antihypertensive agents (54.6%), followed by diuretics (43.8%), and calcium channel blockers (34.6%).*
Conclusion: *Blood pressure control in hypertensive adults with type 2 diabetes was suboptimal. Strategies to improve awareness and adequacy of blood pressure control in these subjects should be seriously considered.*

Keywords: *Diabetes registry, Diabetes, Hypertension, Antihypertensive drugs*

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Hypertension is very common in patients with diabetes and is a major contribution to both micro- and macrovascular complications. Data from the National Institute of Health in the year 2000 have shown that approximately 73% of adults with diabetes mellitus use antihypertensive medication or have blood pressure levels of > 130/80 mm Hg[1]. Current evidence supports that aggressive blood pressure control reduces vascular morbidity and mortality[2,3]. Most current guidelines recommend aggressive management of hypertension in diabetic subjects with target blood pressure of less than 130/80 mmHg[4,5]. However, most surveys revealed that the majority of hypertensive diabetic patients can not achieve this target[6-10]. Control of hypertension in diabetic patients usually requires multiple drugs[2,3]. Virtually all classes of antihypertensive agents could be used to control blood pressure in diabetes. However, drugs that inhibit the renin-angiotensin system are usually the preferred agents in most guidelines since a number of clinical trials have documented the benefit of these drugs in diabetic patients[4,5].

The objectives of the present study were to determine the prevalence of hypertension and its associated factors in adult Thai type 2 diabetic patients in OPD setting in university and tertiary-care hospitals. The achievement of target blood pressure control and patterns of antihypertensive agents were also analyzed.

Material and Method

A cross-sectional, multi-center, hospital-based diabetes registry was carried out from April 2003 to December 2003. The authors registered diabetic patients from diabetes clinics of 11 tertiary centers. The method of registration and data collection were described in detail in the previous section of this issue. The study was approved by the ethics committee of each participating hospital. Signed informed consent was obtained from all participants. Only adults aged 18 years or older with type 2 diabetes were included in the present study. Blood pressure was measured twice, at least 1 minute apart, by automated blood pressure machine (Omron T4). Mean values of both systolic and diastolic blood pressure were used to define blood pressure levels. Hypertension was defined by mean blood pressure levels equal to or more than 140/90 mmHg or the use of antihypertensive agents. Data were expressed as mean $\pm$ SD. Statistical analyses were performed using STATA version 8.0 (Stata Corporation, College Station TX, US) Comparisons between groups was analysed by t-test, Chi-square test or Fisher's exact test, where appropriate with 0.05 level of significance.

Results

This study included 8,884 type 2 diabetic patients, aged 18 years or older (3,000 males and 5,884

Table 1. Comparisons between baseline characteristics of adult type 2 diabetic subjects with and without hypertension (n = 8,884)

Characteristics	Subjects with hypertension n = 6,965	Subjects without hypertension n = 1,919	p-value
Age (yr)	62.0 $\pm$ 10.5	55.2 $\pm$ 12.0	<0.001
Sex (% male)	32.7	34.1	0.26
Duration of diabetes (yr)	11.2 $\pm$ 7.7	8.2 $\pm$ 6.7	<0.001
Body mass index (kg/m^2)	26.0 $\pm$ 4.3	24.7 $\pm$ 4.1	<0.001
HbA_{1c} (%)	8.1 $\pm$ 1.8	8.2 $\pm$ 2.0	0.33
Creatinine (mg/dl)	1.2 $\pm$ 0.9	1.0 $\pm$ 0.5	<0.001
Total cholesterol (mg/dl)	197.3 $\pm$ 42.7	196.2 $\pm$ 40.2	0.28
Triglyceride (mg/dl)	155.5 $\pm$ 105.6	144.4 $\pm$ 105.2	<0.001
HDL-C (mg/dl)	53.2 $\pm$ 14.8	54.3 $\pm$ 15.2	0.0029
LDL-C (mg/dl)	114.4 $\pm$ 35.4	114.3 $\pm$ 35.7	0.91
Diabetic retinopathy			<0.001
NPDR* (% of subjects)	23.9	15.0	
PDR** (% of subjects)	10.6	4.8	
Coronary artery disease (% of subjects)	10.0	3.3	<0.001
Stroke (% of subjects)	4.7	1.6	<0.001

* NPDR = non proliferative diabetic retinopathy
** PDR = proliferative diabetic retinopathy

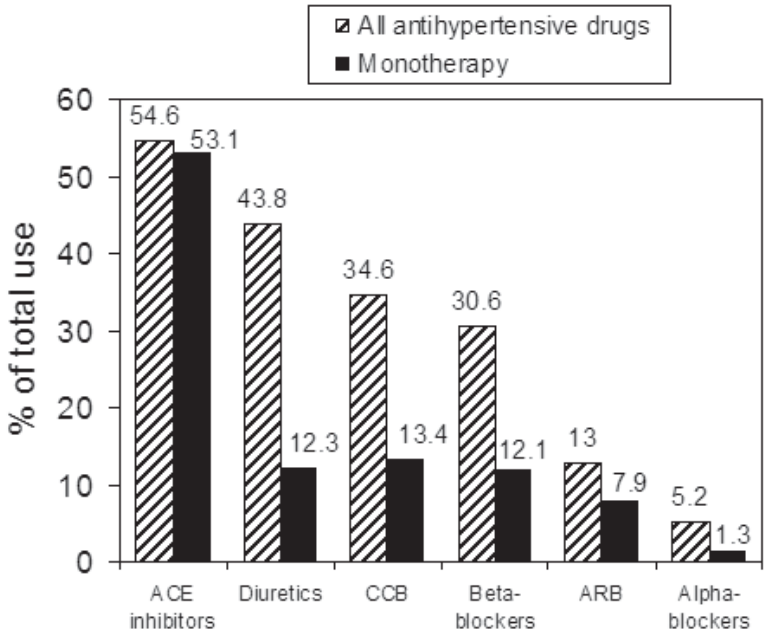

Fig. 1 Use of Antihypertensive drugs (% of total) among adult hypertensive type 2 diabetic subjects. Striped bars indicate per cent of all antihypertensive drugs. Black bars indicate per cent of antihypertensive drugs among subjects who received antihypertensive monotherapy (n = 2,645)

females). The prevalence of hypertension was 78.4% (6,965). Baseline characteristics of subjects with and without hypertension are shown in Table 1. By multivariate analysis; age, body mass index, duration of diabetes, serum creatinine and serum triglycerides were independently associated with hypertension. The prevalence of both microvascular and macrovascular complications was significantly higher in hypertensive subjects. The percentage of hypertensive patients who could achieve target blood pressure of less than 130/80 mmHg was 13.85%. Most hypertensive patients (84.4%) (5,878) currently received one or more antihypertensive agents. Mean $\pm$ SD blood pressure levels among those receiving antihypertensive agents were 147.6 $\pm$ 22.3/79.0 $\pm$ 11 mmHg. Systolic blood pressure target (less than 130 mmHg) could be achieved in 20.1% (1,182) and diastolic target (less than 80 mmHg) in 52.6%. The mean number of antihypertensive agent use per subject was 1.82 $\pm$ 0.89, range 1-5 drugs. The percentage of subjects receiving 1, 2, 3, 4 and 5 drugs were 45% (2,645), 33.4% (1,963), 16.8% (987), 4.4% (259) and 0.4% (24) respectively. Angiotensin-Converting Enzyme Inhibitors (ACEI) were the most commonly prescribed antihypertensive agents (54.6%), followed by diuretics (43.8%), calcium channel blockers (CCB) (34.6%) and beta-blockers (BB) (30.6%) (Fig. 1). Among patients who received antihypertensive monotherapy, ACEI were also the most often prescribed agents (53.1%), followed by CCB (13.4%), diuretics (12.3%), BB (12.1%) and angiotensin-receptor blockers (ARB) (7.9%) (Fig. 1). The most commonly used antihypertensive combination for those receiving 2 antihypertensive agents were ACEI/diuretics (29%), followed by diuretics/CCB (12.6%), ACEI / CCB (11.1%) and ACEI/BB (10.8%) (Table 2).

Table 2. Antihypertensive combination among diabetic subjects receiving 2 antihypertensive drugs (n = 5,878)

Drug combination	%
ACEI/diuretics	29.0
CCB/diuretics	12.6
ACEI/CCB	11.1
ACEI/BB	10.8
Diuretics/BB	10.2
CCB/BB	8.9
ARB/diuretics	7.5
ARB/CCB	3.5
Other combinations	6.4

ACEI = angiotensin-converting enzyme inhibitors, CCB = calcium-channel blockers, BB = beta-blockers, ARB = angiotensin-receptor blockers

Discussion

Individuals with diabetes who also have hypertension are at significantly increased risk of cardiovascular morbidity and mortality. A number of clinical trials have consistently demonstrated the importance of intensive blood pressure control among individuals with diabetes[2,3]. The United Kingdom Prospective Diabetes Study (UKPDS) has clearly shown the benefit of achieving tighter blood pressure control in reducing both macrovascular and microvascular complications[2]. In the Hypertension Optimal Treatment (HOT) study, subjects with diabetes who were randomized to a target diastolic blood pressure of 80 mmHg or less had a significant 50% reduction in major cardiovascular events compared to those with a target diastolic blood pressure of 90 mmHg[3]. Intensive blood pressure control has also been shown to retard the progression of diabetic nephropathy. Since the publication of these studies, the aggressiveness in blood pressure control in patients with diabetes has been emphasized in a number of clinical practice guidelines, including the American Diabetes Association and the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC7) guidelines[4,5]. These guidelines advocate the target blood pressure of less than 130/80 mm Hg for people with diabetes. However, a considerable gap exists between guideline recommendations and the actual treatment to achieve target blood pressure control in hypertensive patients with or without diabetes. In the general population, the report from the National Health and Nutrition Examination Survey (NHANES), conducted between 1999 and 2000, showed that 28.7% of the participants had hypertension[6]. Of these, 68.9% were aware of their hypertension, 58.4% were treated, and 31% were controlled. Although the awareness and treatment of hypertension had improved when compared to previous NHANES surveys, the control of blood pressure was still suboptimal. The control of blood pressure in European countries was even worse than that in the US; i.e. less than 10% of hypertensive subjects were controlled[7]. In subjects with diabetes, data from NHANES III (phase 1 and 2), conducted between 1988 to 1994 revealed that 71% of US adults with diabetes were hypertensive, with 71% having awareness of the condition, 57% being treated, but only 12% meeting the JNC 6 goal of 130/85 mmHg[8]. Surveys in people with diabetes in other countries have shown quite similar results. A survey done in 2,331 patients with type 2 diabetes in Australia reported that 69% of the subjects were hypertensive, with 59% being treated, but only 31% of those treated were adequately controlled[9]. In a survey that compared hypertension management among those with or without diabetes, diabetic subjects were more likely to be hypertensive (73 vs 66%) but received less intensive antihypertensive treatment, with only 27% having blood pressure of less than 140/90 mmHg[10] .

The results from the present study were similar to reports from previous studies. The prevalence of hypertension, defined by blood pressure of 140/90 mmHg or more or use of antihypertensive agents, was 78%. More than 80% of those with hypertension received antihypertensive drugs. However, target blood pressure of less than 130/80 mmHg could be achieved in only 14% of hypertensive subjects. Although the number of subjects receiving antihypertensive agents in the present study was high, almost half of them received only a single agent. Data from other studies have shown that aggressive blood pressure control to achieve target levels usually required multiple drugs. In the UKPDS, the average number of antihypertensive drugs in the tight control group was 2.8 with the achievement of systolic blood pressure of 144 mmHg[2]. In the Hypertension Optimal Treatment trial, the corresponding number was 3.3 which could achieve systolic blood pressure of 138 mmHg[3]. The mean number of antihypertensive agent use per patient in the present study was only 1.82, which should explain the low success rate of blood pressure control in the presented patients. ACEI were the most commonly prescribed agents in the present study, both in mono- and combination therapy. The pattern of antihypertensive use in the present subjects is similar to that recently reported from the United States[11,12]. The percentage of ACEI usage among US adult diabetics has increased from 24.3% during the 1988-1994 National Health and Nutrition Examination Survey to 45.3% during the 1999-2002 Survey[11]. The increasing use of ACEI is most likely influenced by recent studies that consistently demonstrated the beneficial effects of this class of drugs in hypertensive diabetic subjects.

There are a number of possibilities that may explain the inadequate control of blood pressure in subjects with diabetes. The lack of physician's concern may be one of the reasons, especially in patients with mild hypertension. "Clinical inertia", as proposed by Philips et al may be caused by various reasons[13]. Underestimation of risks associated with hypertension may be partly dependent on lack of knowledge on risk assessment[14]. Another study found that many clinicians appeared to overestimate their adherence to

hypertension guidelines, compared to actual figures[15]. The cost of the medications and anticipation of adverse effects of the drugs may be another possibility. Some physicians may be reluctant to add another drug to diabetic patients who may already use multiple drugs. It must also be realized that the achievement of target blood pressure control, especially systolic blood pressure is truly difficult. Most studies have shown that a combination of 3 or more drugs is usually required to achieve blood pressure target. However, a number of clinical studies have shown that the achievement of blood pressure target is potentially attainable, and the benefits of tight blood pressure control clearly outweigh the risks. Economic analyses also demonstrated that aggressive blood pressure control is cost-saving and is actually more cost-effective than many other therapeutic strategies in diabetic subjects, including tight glycemic control[16]. To overcome these obstacles, the program to improve awareness and adequacy of blood pressure control should be nationwide and directed towards both physicians and patients and should be vigorously implemented.

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โครงการลงทะเบียนผู้ป่วยเบาหวานในประเทศไทย: ความชุกของโรคความดันโลหิตสูง, การรักษาและการควบคุมความดันโลหิตในผู้ป่วยเบาหวานชนิดที่ 2 ที่เป็นผู้ใหญ่

พงศ์อมร บุนนาค, ณัฐเชษฐ์ เปล่งวิทยา, ชัยชาญ ดีโรจนวงศ์, สมพงษ์ สุวรรณวลัยกร,ณัฐพงศ์ โฆษชุณหนันท์, ยุพิน เบ็ญจสุรัตน์วงศ์, สิริเนตร กฤติยาวงศ์, รัตนา ลีลาวัฒนา, ธงชัย ประฏิภาณวัตร, ฉัตรประอร งามอุโฆษ, ธัญญา เชฏฐากุล, กอบชัย พัววิไล, สิริมา มงคลสัมฤทธิ์, เพชร รอดอารีย์

วัตถุประสงค์*: เพื่อศึกษาถึงความชุกของโรคความดันโลหิตสูง, การใช้ยาลดความดันโลหิต และการควบคุมความดันโลหิตในผู้ป่วยเบาหวานชนิดที่ 2 ที่เป็นผู้ใหญ่ที่มารับการรักษาที่คลินิกโรคเบาหวานของโรงพยาบาลมหาวิทยาลัยและโรงพยาบาลศูนย์*

วัสดุและวิธีการ*: การศึกษานี้เป็นการลงทะเบียนผู้ป่วยเบาหวานที่มารับการรักษาที่คลินิกเบาหวานของโรงพยาบาลระดับตติยภูมิทั้งหมด 11 แห่ง มีการเก็บข้อมูลด้านประวัติ, การตรวจร่างกายและการตรวจเลือดเพื่อนำมาวิเคราะห์หาความชุกของความดันโลหิตสูง, ปัจจัยที่เกี่ยวข้อง, การใช้ยาลดความดันโลหิตและการควบคุมความดันโลหิตในผู้ป่วยเหล่านี้ ในผู้ป่วยที่เป็นผู้ใหญ่ที่มีอายุ 18 ปีขึ้นไปจำนวน 8,884 ราย*

ผลการศึกษา*: ความชุกของความดันโลหิตสูงในผู้ป่วยเบาหวานชนิดที่ 2 ที่เป็นผู้ใหญ่คิดเป็นร้อยละ 78.4 ร้อยละ 84.4 ของผู้ป่วยที่มีความดันโลหิตสูงได้รับยาลดความดันโลหิต ร้อยละ 13.85 ของผู้ป่วยที่มีความดันโลหิตสูงสามารถควบคุมความดันโลหิตได้น้อยกว่า 130/80 มิลลิเมตรปรอท ร้อยละของผู้ป่วยที่ได้รับยาลดความดันโลหิต 1, 2, 3, 4 และ 5 ชนิดเท่ากับ 45, 33.4, 16.8, 4.4 และ 0.4 ตามลำดับ ยาในกลุ่มที่ยับยั้ง angiotensin-converting enzyme เป็นยาที่มีการใช้มากที่สุด (ร้อยละ 54.6) ตามด้วยยาขับปัสสาวะ(ร้อยละ 43.8) และยาต้านแคลเซียม (ร้อยละ 34.6)*

สรุป*: การควบคุมความดันโลหิตสูงในผู้ป่วยเบาหวานชนิดที่ 2 ยังทำได้น้อยกว่าเกณฑ์เป้าหมายมาก ดังนั้นจึงควรมีมาตรการที่ช่วยส่งเสริมให้มีการตระหนักถึงความสำคัญของโรคความดันโลหิตสูงและช่วยให้มีการควบคุมโรคที่ดีขึ้น*