Prevalence and Risk Factors of Peripheral Arterial Disease in type 2 Diabetic Patients at HRH Princess Maha Chakri Sirindhorn Medical Center

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Objective: To study the prevalence and risk factors of PAD in type 2 diabetes.

Material and Method: The crossectional study randomly enrolled 219 diabetic patients to study in Year 2006-2007. All subjects were checked up and recorded basic information and affecting factors to risk of PAD. ABI scores were measured by Colin VP-1000 machine. The affecting factors to PAD risk were analyzed to obtain form descriptive (percent and number) and inferential statistics (odds ratio).

Results: There were 219 diabetic patients included in this study with 61.2% of females and 38.8% of males. The prevalence of PAD and intermittent claudication symptoms were 60.3% and 60.7%, respectively. The patients who had current smoking, hypertriglyceridemia, low HDL and HbA1c $\geq$ 7.0% have statistically significant increased risk of PAD odds ratio of 31.89 (95% CI = 4.31-236.0), 5.20 (95% CI = 1.67-16.18), 7.05 (95% CI = 2.29-21.72) and 2.74 (95% CI = 1.07-7.06), respectively, while the groups who had older age ($\geq$ 60 years), duration of DM of $\geq$ 10 years and waist circumference of $\geq$ 90 cm. in men or $\geq$ 80 cm. in women have not statistically significant increased risk of odds ratios of 1.84 (95% CI = 0.77-4.43), 1.11 (95% CI = 0.41-3.04) and 1.69 (95% CI = 0.51-5.6). The patients who had combinations of microvascular complication, previous history of CHD and stroke had significantly statistic risk of odds ratio 8.97 (95% CI = 2.82-28.60) and 5.63 (95% CI = 1.91-16.57) although we needed to measure ABI score in all type 2 diabetes with high risks and CVD.

Conclusion: The diabetic patients with high risk and CVD have high prevalence of PAD. Patients with suspected PAD may needs further examination and patients who have increased risk of PAD may require interventions to prevent vascular complications.

Keywords: Peripheral arterial disease, PAD, Prevalence, Risk factors, Type 2 diabetes

Peripheral arterial disease (PAD) is atherosclerosis of peripheral vessel wall and this disease is commonly occurred at lower extremities. Typical symptoms of PAD are defined as intermittent claudication, which is discomfort of a defined group of muscles that is induced by exercise and relieved with rest. This disorder results from an imbalance between supply and demand of blood flow that fails to satisfy ongoing metabolic requirements[1]. Asymptomatic PAD is found in a large number of diabetic patients about 20 to 50 percent[2] thus, the patients without these symptoms who have increased atherosclerosis risks such as diabetes mellitus, hyperlipidemia, cigarette smoking and hypertension[2] and/or having atherosclerosis risk equivalence such as history of CHD and stroke[2,3] need to measure Ankle Brachial Index (ABI) by non-invasive machine (Colin-VP1000) which of having high accuracy, less error and requiring minimal technical skill and time[4]. Typical PAD symptoms was defined as intermittent claudication (IC) symptoms that found

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higher than non-diabetes 4 times[5] although we used Edinburgh claudication Questionnaire (ECQ) which of having sensitivity (91.3%) and specificity (99.3%)[6] to screening in diagnosis of IC symptoms. However, only IC symptoms had poor tool to diagnosis PAD because of low sensitivity[7] and then we needed to measure ABI for diagnosis. Nowadays, ABI which is a non-invasive and reliable method was worldwide used to diagnose PAD and automated measurement of ABI (colin-vp1000) because of less time, less error, easy to using, high accuracy and reliability[4]. The diagnostic PAD were defined as patients with or without symptoms who had ABI score less than to equal 0.9 where as suspected PAD as patient with intermittent claudication symptoms who had ABI score between 0.91 to 1.0[8]. The suspected PAD needs further investigation by exercise ABI (TBI, segmental pressure, or duplex ultrasound examination)[5].

PAD which is systemic atherosclerosis vessels could be occurred in different of vessel sites such as coronary, carotid, vertebral, femoral, iliac and cerebral arteries although this disease could be also predicted of atherosclerosis vessels in many difference of sites and other cerebrovascular events[9]. The patients who have PAD are increased risk of CHD and stroke about 4 and 2 times and more than, it is increased 10 years-mortality rate from these disease about 60 percent[10]. The risk of PAD which of diabetes mellitus, hyperlipidemia, current smoking and hypertension is increased risk of intermittent claudication symptoms about 2.6, 1.2, 1.4 and 2.2 times in the following[11]. Many studies in different country such as Malaysia[12], China[13], Taiwan[14], India[15], United States[16] and Saudi Arabia[17] were shown prevalence of PAD in type 2 diabetes about 23, 16.7, 10, 11.8, 20 and 61.4 percent in the following. Our study aim to study the prevalence of PAD and examine risk factors associated with PAD in type 2 diabetes at HRH Princess Maha Chakri Sirindhorn Medical Center in Nakornnayok province.

Objective

To study the prevalence of peripheral arterial disease and examine factors affecting peripheral arterial disease in type 2 diabetic patients.

Material and Method

This study was a cross-sectional study design. It included all patients attending diabetic clinic in outpatient unit of Internal Medicine Department at HRH Princess Maha Chakri Sirindhorn Medical Center Faculty of Medicine of Srinakharinwirot University during the year 2006-2007. Inclusion criteria were type 2 diabetes aged at 15 or more.

These subjects were checked for blood chemistry profiles and examined diabetic (micro and macro-vascular complications) by endocrinologist after they were explained for the details of project and signed in the consent form. ABI was measured by Colin VP-1000 machine and the ABI values were automatically calculated by the machine which of easy technique and less error than other measurement.

We diagnosed peripheral arterial disease which of ABI value less than or equal to 0.90 (with or without intermittent claudication symptoms) and suspected peripheral arterial disease which of ABI value over than of 0.9 and having intermittent claudication. This diagnostic criterion of peripheral arterial disease was defined according to American College Cardiology/American Heart Association guidelines for the management of patients with peripheral arterial disease and Edinburgh claudication questionnaire (ECQ) was used for diagnostic of intermittent claudication.

Basic information of patients and factors associated with peripheral arterial disease were collected using case record form containing information of age, sex, weight, height, waist circumference, duration of diabetes, hypertension status, smoking status, history of coronary heart disease, history of stroke, dyslipidemia status, hemoglobin A_{1C} (HbA$_{1C}$), renal insufficiency (serum Creatinine ≥ 1.5 mg/dL) diabetic retinopathy, diabetic nephropathy (microalbumin urea ratio ≥ 30 mg/g), intermittent claudication and ABI values.

The data were analyzed by SPSS version 11.5. Percent and number of subjects were calculated for descriptive statistics and logistic regressions were used to estimate odds ratios between affecting factors and prevalence of peripheral arterial disease. A p-value of < 0.05 was considered statistically significant.

Results

There were 219 diabetic patients included in this study. Among these, 61.2% were females and 38.8% were males. Table 1 describes demographic and clinical characteristics the patients. A half of subjects were younger than 60 years (51.6%). Majority of the subjects had less than 10 years of DM (64.8%), obesity by BMI 25 or over (68.9%) and waist circumference over than limit (82.2%). Percents of subjects with current smoking, history of CHD and history of stroke were 11.0%, 25.1% and 4.6% respectively. Microvascular complications in type 2 DM that was defined by diabetic retinopathy, diabetic neuropathy and diabetic

Table 1. Characteristics of patients

Characteristics	Categories	Number	Percent
Age (year)	<60 years	113	51.6
	≥ 60 years	106	48.4
Sex	Male	85	38.8
	Female	134	61.2
BMI ≥ 25	No	68	31.1
	Yes	151	68.9
Duration ≥ 10 (year)	No	142	64.8
	Yes	77	35.2
Hypertension	No	32	14.6
	Yes	187	85.4
Current smoking	No	195	89.0
	Yes	24	11.0
History of CHD	No	164	74.9
	Yes	55	25.1
History of stroke	No	209	95.4
	Yes	10	4.6
Hypercholesterolemia	No	12	5.5
	Yes	207	94.5
Hypertriglyceride	No	48	22.0
	Yes	170	78.0
	Unknown	1	.5
Low-HDL	No	161	73.5
	Yes	58	26.5
Insulin treatment	No	120	54.8
	Yes	99	45.2
Statin treatment	No	14	6.4
	Yes	205	93.6
ASA treatment	No	41	18.7
	Yes	178	81.3
Hba1c ≥ 7	No	118	53.9
	Yes	101	46.1
Renal insufficiency (Cr ≥ 1.5)	No	155	70.8
	Yes	64	29.2
Diabetic Retinopathy	No	149	68.0
	Yes	70	32.0
Diabetic Neuropathy	No	112	51.1
	Yes	107	48.9
Waist male ≥ 90 cm, female ≥ 80 cm	No	39	17.8
	Yes	180	82.2
History of intermittent claudication	No	86	39.3
	Yes	133	60.7
Diabetic Nephropathy (micro albumin urea ≥ 30)	No	94	42.9
	Yes	125	57.1
ABI ≤ 0.9	No	87	39.7
	Yes	132	60.3
ABI 1 ≤ 9.0, 2 = 9.01-1.0, 3 > 1.0	≤ 9.0	132	60.3
	9.01-1.0	37	16.9
	> 1.0	50	22.8
ABI ≤ 1.0	> 1.0	50	22.8
	≤ 1.0	169	77.2

nephropathy by microalbumin urea ≥ 30 mg/g had lesser than amount of patients in diabetic retinopathy (32.0%) and diabetic neuropathy (48.9%) while as larger than amount of patients in diabetic nephropathy (57.1%)

One hundred and thirty two out of 219 type 2 diabetes patient had peripheral arterial disease which of prevalence about 60.3%. Thirty-seven patients were diagnosed as suspected peripheral arterial disease (16.9%). Fig. 1 illustrates the prevalence of peripheral arterial disease in subjects with selected factors. The prevalence of peripheral arterial disease was higher in patients with male gender, older age group, obesity, over limit waist circumference, more than 10-year duration of having DM, history of hypertension, history of smoking, history of heart disease and history of stroke.

In table 2, factors associated with ABI ≤ 0.9

were analyzed, it is found that patients who had history of current smoking, hypertriglyceride, low-HDL and HbA1c ≥ 7.0 % have significantly increased risk of 31.89, 5.20, 7.05 and 2.74 time as compared those having no risk. Patients with older ages (≥ 60 years), duration of DM ≥ 10 years and waist circumference (male $\geq$ 90 cm., female ≥ 80 cm.), the risk was 1.84, 1.11 and 1.69 as compared to those with no risk. However, this was not statistically significant. Patients who have combination of history of CHD and stroke were found to have elevated risk of peripheral arterial disease than other patients without these combinations with statistically significant odds ratio of 5.63 (95% CI = 1.91-16.57). In addition, having combination of diabetic retinopathy and nephropathy was also statistically increased risk significant at odds ratio of 8.97 times (95%

Table 2. Factors associated with ABI ≤ 0.9

Factors	Categories	Number	Percent	p-value odds ratios	Adjusted 95%CI	Lower 95%CI	Upper
Age	<60 years	62	54.9%				
	$\geq$ 60 years	70	66.0%	0.17	1.84	0.77	4.43
Sex	male	60	70.6%				
	female	72	53.7%	0.39	0.67	0.27	1.66
Duration of DM $\geq$ 10 (year)	No	71	50.0%				
	Yes	61	79.2%	0.84	1.11	0.41	3.04
Hypertension	No	8	25.0%				
	Yes	124	66.3%	0.68	0.74	0.19	3.00
History of current smoke	No	110	56.4%				
	Yes	22	91.7%	0.00	31.89	4.31	236.10
Hypertriglyceride	No	16	33.3%				
	Yes	115	67.6%	0.00	5.20	1.67	16.18
Low-HDL	No	80	49.7%				
	Yes	52	89.7%	0.00	7.05	2.29	21.72
Hba1c $\geq$ 7	No	53	44.9%				
	Yes	79	78.2%	0.04	2.74	1.07	7.06
Waist circumference male $\geq$ 90, female $\geq$ 80 (cm)	No	18	46.2%				
	Yes	114	63.3%	0.39	1.69	0.51	5.60
Category Combination of CHD and Stroke	No component	78	49.7%				
	At least one component	54	87.1%	0.00	5.63	1.91	16.57
Category Combination of Diabetic Retinopathy and Nephropathy (microalbumin $\geq$ 30)	No component	29	32.2%				
	At least one component	103	79.8%	0.00	8.97	2.82	28.60

The analysis was adjusted for age, sex, BMI, duration of DM, hypertension, history of smoke, history of CHD, history of stroke, hypercholesterolemia, hypertriglyceridemia, low-HDL, waist circumference, Hba1c, renal insufficiency, diabetic retinopathy, microalbumin urea.
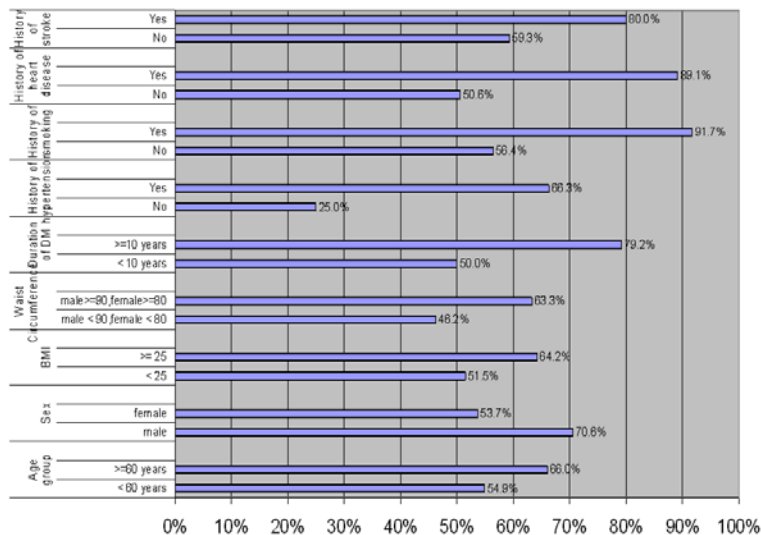
Fig. 1 Prevalence of peripheral arterial disease among patients with selected factors

CI = 2.82-28.60) compare to no having combination.

Discussion

The prevalence of PAD at HRH Princess Maha Chakri Sirindhorn Medical Center in Nakornnayok province was 60.3 percent that higher than 2 previous studies (12.6%, 45%) in Thailand[18,19] similar to that of a multi-country study in Asian (61.4%)[17] since our patients who had higher than amount of previous history of CHD and stroke their pathologic atherosclerosis disease were measured ABI score by different machine that affecting sensitivity and accuracy of method. The patients who were older age ($\geq$ 60 years) and long duration of DM ($\geq$ 10 years) had tendency to increase risk of PAD than another groups since these risks associated with poor metabolic controlling in DM[13,20]. The patient group which of ABI score $\leq$ 0.9 and no having PAD symptoms had amount of 16.4% that having previous history of CHD and stroke in higher than no having the previous history although we need to measure ABI score in all patients having high risks because of these symptoms not effective tool for screening PAD. About 17% of the patients were diagnosed as suspected PAD and needs further investigation for definitive diagnosis of PAD such as exercise ABI (TBI, segmental pressure, or duplex ultrasound examination)[8].

Conclusion

Prevalence of PAD is about 6 in 10 of DM patients that is higher than other studies in Thailand. Moreover about 1 in 6 of the patients are suspected PAD. Prevalence of PAD is higher in patients with male gender, older age group, obesity, over limit waist circumference, more than 10-year duration of having DM, history of hypertension, history of smoking, history of heart disease and history of stroke. Current smoking and uncontrolled metabolic components (hypertension, low-HDL and HbA1c $\geq$ 7.0) had significantly increased risk of PAD while the another group having older ages, long term duration of DM and metabolic syndrome by IDF criteria (waist circumference $\geq$ 90 cm. in male and $\geq$ 80 cm. in female) had also tendency to increase risk of PAD. Patients with suspected PAD may needs further examination and patients who have increased risk of PAD may require interventions to prevent vascular complications.

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การศึกษาความชุกและปัจจัยเสี่ยงของภาวะหลอดเลือดแดงส่วนปลายอุดตันในผู้ป่วยเบาหวานชนิดที่ 2 ในโรงพยาบาล ศูนย์การแพทย์สมเด็จพระเทพรัตนราชสุดาฯ

สมลักษณ์ จึงสมาน, อรุณชัย แสงพานิชย์, นิยม ละอองปักษิณ

วัตถุประสงค์: เพื่อศึกษาความชุกและปัจจัยเสี่ยงต่อการเกิดโรคหลอดเลือดแดงส่วนปลายแข็งและอุดตันในผู้ป่วยเ บาหวาน ชนิดที่ 2

วัสดุและวิธีการ: การศึกษานี้เป็นการเก็บข้อมูลภาคตัดขวาง โดยสุ่มผู้ป่วยเบาหวานชนิดที่ 2 มาจำนวน 219 คน ในระหว่างปี พ.ศ. 2549 ถึง 2550 ผู้ร่วมโครงการทุกคนจะได้รับการตรวจเช็คสุขภาพและบันทึกข้อมูลพื้นฐานที่เป็นปัจจัยเสี่ยงต่อการเกิดโรคหลอดเลือดแดงส่วนปลายแข็งและอุดตัน การวัดค่า ABI ใช้เครื่อง Colin VP-1000 ค่าปัจจัยเสี่ยงต่างๆ ต่อการเกิดโรคจะถูกวิเคราะห์ทางสถิติโดยใช้โปรแกรม SPSS และ คำนวณเป็นค่า odds ratio โดยมีนัยสำคัญทางสถิติที่ $P < 0.05$

ผลการศึกษา: ในผู้ป่วยเบาหวานจำนวน 219 คนเป็นหญิงจำนวนร้อยละ 61.2 และชายจำนวนร้อยละ 38.8 ความชุกของโรคหลอดเลือดแดง ส่วนปลายแข็งและอุดตัน และอาการ intermittent claudication เท่ากับ ร้อยละ 60.3 และ ร้อยละ 60 ตามลำดับ ผู้ป่วยที่ยังสูบบุหรี่, มีระดับไตรกรีเซอร์ไรด์สูง, ระดับซีรั่ม HDL ต่ำ และค่า HbA1C $\geq$ 7.0% มีความเสี่ยงต่อการเกิดโรคอย่างมีนัยสำคัญทางสถิติโดยมีค่า odds ratio เท่ากับ 31.89 (95% CI = 1.67-16.18), 7.05 (95% CI = 2.29-21.72) และ 2.74 (95% CI = 1.07-7.06) ตามลำดับ ในขณะกลุ่มที่มีอายุ $\geq$ 60 ปี ระยะเวลาที่เป็นเบาหวาน $\geq$ 10 ปี และค่าเส้นรอบวงเอว (ในชาย $\geq$ 90 ซม., ในหญิง $\geq$ 80 ซม.) แม้ว่ามี โดยค่า odds ratio = 1.84 (95% CI = 0.77–4.43), 1.11 (95% CI = 0.41-3.04) และ 1.69 (95% CI = 0.51-5.6) แต่ไม่มีนัยสำคัญทางสถิติในการเพิ่มความเสี่ยงต่อการเกิดโรค ผู้ป่วยที่มีองค์ประกอบของภาวะแทรกซ้อนที่หลอดเลือดขนาดเล็กจากเบาหวานมากกว่าหนึ่งชนิดและมีประวัติการเกิดโรคหลอดเลือดหัวใจร่วมกับโรคหลอดเลือดสมอง มีความเสี่ยงต่อการเกิดโรคหลอดเลือดแดงส่วนปลายแข็งและอุดตัน อย่างมีนัยสำคัญทางสถิติโดยค่า odds ratio เท่ากับ 8.97 (95% CI = 2.82 – 28.60) และ 5.63 (95% CI = 1.91 – 16.57)

สรุป: ผู้ป่วยเบาหวานชนิดที่ 2 ที่มีความเสี่ยงสูงและมีโรคหัวใจและหลอดเลือดมีความชุกของภาวะหลอดเลือดแดงส่วนปลายอุดตันสูง ส่วนผู้ที่สงสัยภาวะหลอดเลือดแดงส่วนปลายอุดตัน ผู้ป่วยควรมีการตรวจค้นเพิ่มเติมเพื่อสรุปการวินิจฉัยโรคและป้องกันภาวะแทรกซ้อนทางหลอดเลือด