Risk Factors for Stroke in Thai Patients†

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Abstract

Objective : To demonstrate risk factors for stroke in Thai patients at King Chulalongkorn Memorial Hospital.

Design : Analytic cross-sectional study.

Setting : Stroke unit, Department of Neurology, King Chulalongkorn Memorial Hospital.

Material and Method : The patients admitted to the stroke unit of King Chulalongkorn Memorial Hospital with the diagnosis of acute stroke and community - based age control matched subjects were recruited. They were counselled about the possible risk factors for stroke and the stroke patients' medical records were carefully reviewed within 72 hours after admission. This study was done from November 2001 to May 2002. There were two hundred stroke cases and one hundred control subjects enrolled in the present study. The possible risk factors were compared between the two groups.

Results : The male : female stroke patients were 1.2 : 1 with a mean age of 63.10 ± 12.76 years. The etiology of stroke was ischemic 78 per cent and hemorrhagic 22 per cent. The mean duration of stroke onset was 4.11 ± 1.96 days. The risk factors for stroke with their relative risks were: transient ischemic attack (TIA) 9.3, previous stroke 9, moderate to severe hypertension (HT) 6.5, heart disease 5.2, hyperlipidemia 4.6, diabetes mellitus 4.5, current smoking 3.8 and daily drinking 3.6. Whereas, physical exercise showed a protective effect on the development of stroke.

Conclusion : Risk factors for stroke in Thai patients at King Chulalongkorn Memorial Hospital were TIA, previous stroke, moderate to severe HT, heart disease, hyperlipidemia, diabetes mellitus, current smoking and daily drinking. Physical exercise was a positive predictor.

Key word : Risk Factors, TIA, Previous Stroke, Hypertension, Heart Disease, Hyperlipidemia, Diabetes Mellitus, Smoking, Drinking

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Stroke is the leading cause of death and leading cause of long-term disability in both developed and developing countries[1,2]. There are multiple risk factors for stroke that are amenable to prevention and modification. This clearly reduces overall stroke risk and must become part of standard primary care. There are many studies of risk factors for stroke in Western countries but only a few in the Eastern part especially in Southeast Asia. The authors investigated the possible risk factors for stroke in Thai patients. Assuming that difference in culture, lifestyle-associated activities and education may cause different risk factors for stroke compared with other countries.

Table 1. Demographic characteristics of stroke cases and control subjects.

	Stroke cases	Control subjects
Age (yr): mean ± SD	63.10 ± 12.76	60.49 ± 10.54
Sex : Male : Female	1.2 : 1	1 : 1.73
Education (%)		
Illiterate	12	7.5
School	67	53.0
Vocation	16	32.5
College	5	7.0
Marital status (%)		
Single	23.0	21.5
Married	71.0	74.5
Divorced	6.0	4.0

Objective

The present study was designed to investigate the risk factors for stroke in Thai patients.

MATERIAL AND METHOD

The authors performed a prospective case-control study of risk factors for stroke during November 2001 to October 2002.

Patients

The patients admitted to the stroke unit of King Chulalongkorn Memorial Hospital with the diagnosis of acute stroke were recruited. Head CT scans were performed on admission to confirm the diagnosis in all patients. Stroke patients who were in a coma, did not respond to verbal commands or were not co-operative were excluded.

Control subjects

Community-based control subjects matched with case subjects by age range were corrected.

Information ascertainment

Data collection and interviews were conducted specifically to investigate the risk factors profiles for stroke among patients and case control subjects. The patients or their relatives and friends were interviewed and their medical records were carefully reviewed within 72 hours after admission. The questionnaire included questions on medical history, occupation, physical activity, lifestyle and other risk factors. All the subjects who were interviewed gave informed consent. The study protocol was approved by the ethical committee board of the faculty.

Definitions

Definitions were as follows: Stroke: acute onset of a focal neurological deficit related to cerebral ischemia lasting longer than 24 hours, in which the CT scan excluded other cerebral pathology[3]. Transient ischemic attack (TIA): an event in which neurological symptoms develop and disappear over several minutes and completely resolve within 24 hours. Hypertension (HT): systolic blood pressure (BP) ≥ 140 mmHg or diastolic BP ≥ 90 mmHg ; mild HT if diastolic BP 90-104 mmHg, moderate HT if diastolic BP 105-114 mmHg, severe HT if diastolic BP ≥ 115 mmHg. Diabetes mellitus: venous plasma glucose ≥ 126 mg/dl. Hyperlipidemia: plasma cholesterol ≥ 200 mg/dl. Current smoker: a person who smoked at least one cigarette per day for the preceding 3 months or more. Ex-smoker: a person who smoked at least one

Table 2. Mean of blood pressure in stroke cases and control subjects.

	Stroke cases	Control subjects
Systolic BP (mmHg): mean ± SD	169.93 ± 21.90	146.45 ± 19.51
Diastolic BP (mmHg): mean ± SD	101.09 ± 10.40	92.90 ± 4.92

cigarette per day for 3 months or more at some period during his/her life but had not smoked for the preceding 3 months or more. Occasional drinker: a person who took alcohol on special occasions or 1 to 2 drinks/month. Weekend drinker: a person who took alcohol during the weekend. Daily drinker: someone drinking daily or on most days. Cardiac diseases included atrial fibrillation, previous diagnosed myocardial infarction, heart failure and other cardiac abnormalities that are conventionally considered cardiac sources of emboli. Physical exercise: current engagement in active physical exercise that caused perspiration and breathlessness, such as brisk walking, running, swimming, cycling, squash etc.

Statistical analysis

Descriptive results of age, sex, education and marital status were analyzed by using mean ± SD. A conditional logistic regression was used to analyze the case-control pair-matched data set. Odd ratios of stroke for risk factors understudy were estimated with adjustments for potentially confounding variables by multivariate analysis of the regression model. The significance level was set at $p < 0.05$.

RESULTS

A total of 200 stroke cases and 100 control subjects matched by age range were studied. Table 1 demonstrate the demographic characteristic of case and control subjects. The etiology of stroke was cerebral ischemia in the majority of cases (78%) and cerebral hemorrhage 22 per cent. The mean duration of stroke onset was 4.11 ± 1.96 days. Ninety four patients received medical treatment and six underwent surgery. The profile of hypertension in both groups is shown in Table 2 and Fig. 1. 44.5 per cent of the stroke cases had regular treatment for HT, whereas, 93.5 per cent of control cases got treatment regularly.

The data of diabetes mellitus, cardiac diseases, hyperlipidemia, TIA and previous stroke of cases and control subjects are demonstrated in Table 3. All of them were treated with medication. Concerning smoking and drinking habits, the stroke cases were current smokers and daily drinkers more than the control subjects (Fig. 2, 3). The number of cigarettes smoked per day in current smokers compared with cases and controls was 16.26 ± 10.12 and 16.81 ± 8.96. The duration of smoking in stroke cases was

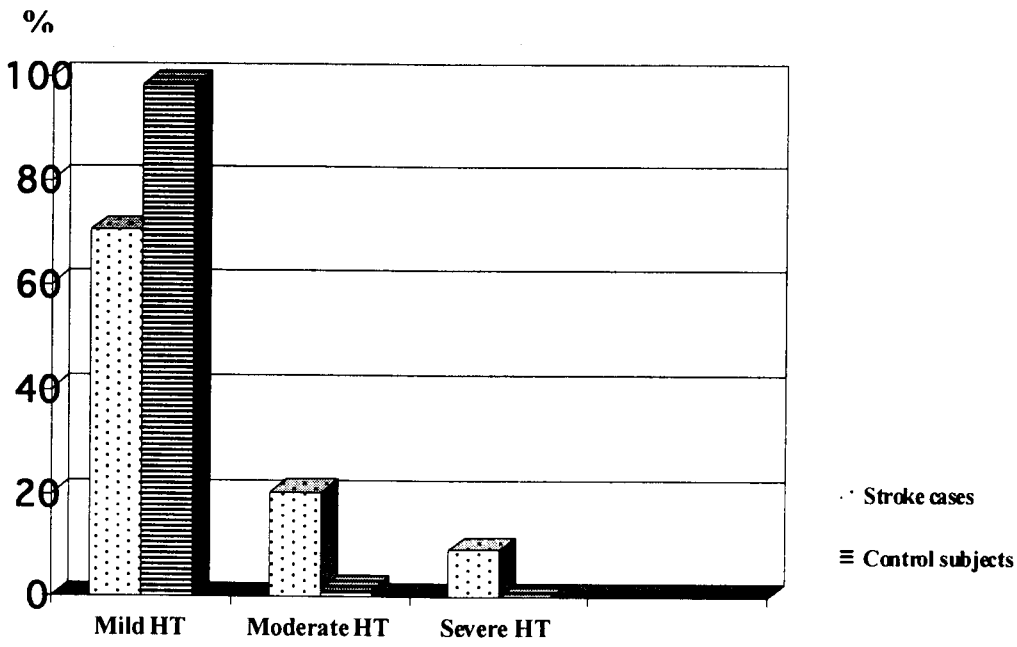

Fig. 1. Profile of HT in stroke cases and control subjects.

Table 3 Profile of diabetes mellitus, cardiac diseases, hyperlipidemia, TIA and previous stroke in stroke cases and control subjects.

	Stroke cases	Control subjects
Diabetes mellitus		
Number (%)	23	13.5
Plasma glucose level (mg/dl)	225.74 ± 102.82	172.41 ± 50.29
Duration of DM (yr)	6.58 ± 5.74	8.22 ± 6.10
Ischemic heart disease		
Number (%)	16	4
Duration of IHD (yr)	6.54 ± 9.2	11.29 ± 14.06
Hyperlipidemia		
Cholesterol level (mg/dl)	263.75 ± 52.51	241.24 ± 35.76
Cholesterol 200-299 mg/dl (%)	17	17
Cholesterol ≥ 300 mg/dl (%)	7	4
Duration of hyperlipidemia (yr)	4.79 ± 3.62	5.59 ± 5.83
Transient ischemia attack		
Number (%)	11	2
Pervious stroke		
Number (%)	11	0

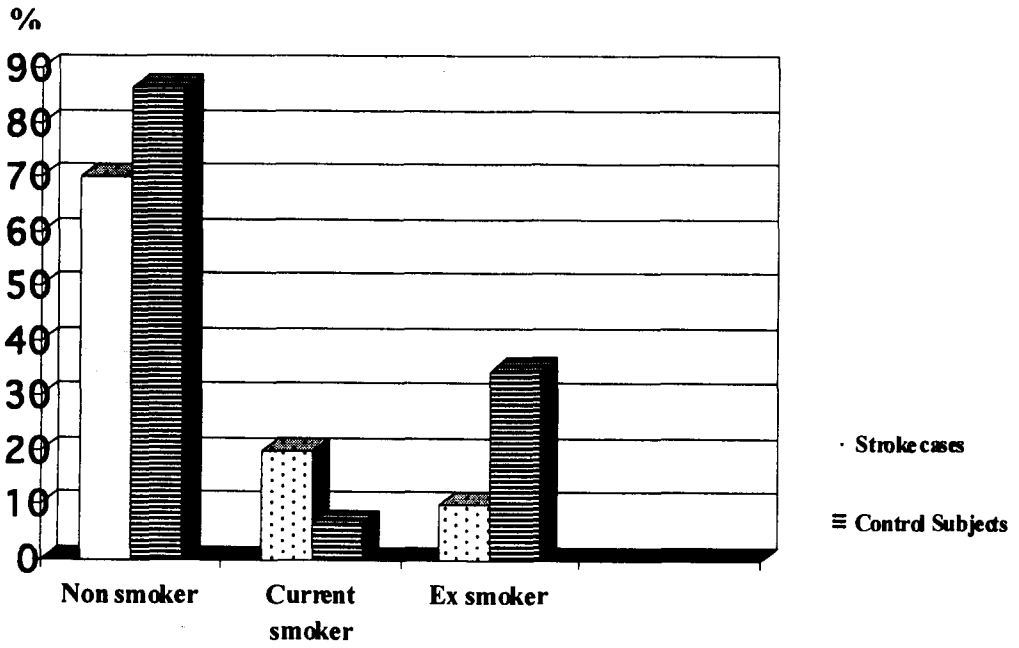

Fig. 2. Profile of smoking in stroke cases and control subjects.

21.96 ± 13.11 and for controls was 20.0 ±10.95 years. The control group exercised more frequently than the stroke cases (Table 4). The estimates of stroke risk for the examined risk factors are shown in Table 5. A significant increased risk of stroke was asscociated with moderate to severe HT (odds ratio, 6.5 [95% confidence interval, 2.55 to 1294.16]); diabetes mellitus (4.5 [1.08 to 7.31]); cardiac disease (5.2 [1.24 to 17.37]); Hyperlipidemia (4.6 [1.18 to 39.41]); TIA (9.3 [4.14 to 666.04]); previous stroke (9.1 [3.31 to

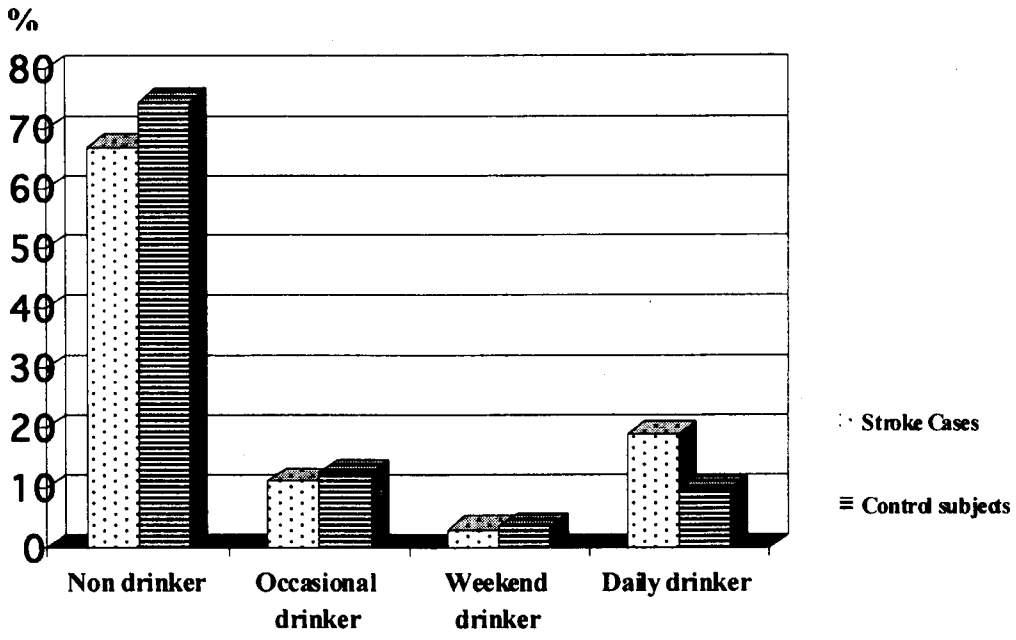

Fig. 3. Profile of drinking in stroke cases and control subjects.

Table 4. Profile of exercise in stroke cases and control subjects.

	Stroke cases	Control subjects
Non exercise (%)	83	55.5
Exercise 1-2 times/week (%)	6	9.5
Exercise ≥ 3 times/week (%)	11	35
Duration of exercise/session (minute)	29.11 ± 6.18	33.84 ± 18.51
Duration of exercise (year)	6.39 ± 8.12	8.67 ± 6.43

281.16]); current smoker (3.81[0.994 to 12.05]); daily drinker (3.68 [0.975 to 11.085]). Whereas, regular exercise significantly decreased the risk for stroke.

DISCUSSION

The incidence of stroke is strongly related to age and sex. Older people have a much greater stroke risk than younger people. Men a have higher risk than women. The present results are similar to previous studies[1,2]. The mean age of stroke cases in the present study was 63.10 ± 12.76 years, comparing men to women it was 1.2 : 1.

Hypertension is the most important risk factor for stroke. The degree of risk increases with higher levels of pressure and becomes particularly strong with levels over 160/95 mmHg. The present study demonstrated that moderate to severe HT significantly increased 6.5-fold of stroke risk while mild HT was not significant. In the Framingham Study, a sevenfold increased the risk of cerebral infarction was observed in patients who were hypertensive[4]. The study of You et al indicated that hypertension increased risk of stroke for young adults 6.8 fold[5]. Hypertension has an effect in various vascular mechanisms including small vessels disease, carotid disease and increased cardiac diseases.

Similarly, the role of diabetes mellitus in the development of stroke has been well documented in general populations, in particular the elderly[6]. In the present study, 23 per cent of stroke cases and 13.5

Table 5. Profile of risk factors in stroke cases.

	Relative risk	95% confidence interval	P-value
Moderate to severe HT	6.5	2.55 to 1294.16	0.011
Diabetes mellitus	4.5	1.08 to 7.31	0.034
Ischemic heart disease	5.2	1.24 to 17.37	0.023
Hyperlipidemia (≥ 300 mg/dl)	4.6	1.18 to 39.41	0.032
TIA	9.3	4.14 to 666.04	0.002
Previous stroke	9.1	3.31 to 281.16	0.003
Current somking	3.8	0.99 to 12.05	0.051
Daily drinking	3.7	0.98 to 11.08	0.055

per cent of control subjects had a history of diabetes, presenting a 4.5-fold increased risk of stroke related to diabetes. The risk can be partly attributed to the higher prevalence of hypertension and heart disease among diabetes, but even after controlling these factors, diabetes independently doubles stroke risk[6,7]. The Honolulu Heart Program showed that impaired glucose tolerance was strongly associated with an increased risk of thromboembolic stroke[6]. The study of Tuomilehto et al suggested that the duration of diabetes is an important factor contributing to the risk of stroke[8].

The role of cholesterol in stroke mirrors that of coronary artery disease, and appears to be associated with accelerated atherosclerosis. An elevated cholesterol has been linked to increased stroke risk[9,10]. The present study demonstrated that if serum cholesterol was elevated ≥ 300 mg/dl, the stroke risk would increase 4.6-fold.

The majority of strokes result from thromboembolic events, the heart is often the source of such an embolism. In the elderly population, atrial fibrillation represents the largest high-risk group. Other cardiac disorders, including focal wall motion abnormalities, valvular disease, cardiomyopathy, patent foramen ovale, and significant aortic arch atheroma, have also been associated with increased stroke risk. The estimate of 5.2-fold increase risk associated with ischemic heart disease in the present study was higher than previous studies. You et al found that heart disease increased the risk of stroke due to cerebral infarction 2.7-fold[5]. It has been well established that myocardial infarction is associated independently with an increased frequency of strokes[12].

TIA reflect focal areas of retinal or cerebral ischemia of sufficient duration to cause neurologic symptoms and signs. The ischemia is brief and does not persist long enough to develop a functionally significant cerebral infarction. Recurrent TIA may be benign, and stop spontaneously, but in up to 30 per cent of patients, a functionally significant stroke will develop within 5 years[11]. The present study showed that TIA presented a 9.3-fold increased the stroke risk significantly. A previous stroke attack also increased the risk of recurrence. The authors found that the relative risk of a previous was stroke 9.1, higher than other risk factors. Previous studies demonstrated the annual risk of a second stroke was around 5 per cent with a 5-year cumulative risk of recurrence 25 per cent[9,12], although it may be as high as 42 per cent [9].

A number of studies reported that both the duration of smoking and the amount of cigarettes smoked per day correlated with the rate of strokes and coronary heart diseases[13,15]. A meta-analysis of 32 studies showed that smoking increases the relative risk of stroke by 50 per cent in all age groups, more in women than in men, and is well correlated to the number of cigarettes smoked per day[13]. The study of You et al indicated a 2.6-fold increased risk of cerebral infarction for young current smokers[5]. The present study found that the current smokers had a significantly increased risk of stroke compared to relative risk of 3.8. The mean of cigarettes smoked per day was 14.35 ± 7.11 and the duration of smoking was 22.95 ± 12.90 years. Cigarette smoking may increase fibrinogen content and platelet aggregation. Its detrimental effects on endothelial cell function, nitric oxide production, and HDL cholesterol levels have been documented[14].

Recent studies on alcohol consumption have found that moderate alcohol intake has a beneficial effect on the prevention of stroke[15]. The National Stroke Association on Stroke Prevention Guidelines and the study by Sacco in 1999 reported that moderate consumption of stroke up to two drinks per day was

significantly protective for development of stroke. However, consumption of seven drinks per day or more was associated significantly with an increased risk of stroke[15]. Seppa et al suggested that binge drinking increased both systolic and diastolic BP. When blood alcohol concentration fell, these BP values fell to less than normal levels, usually at night, which might partially explain these vascular alcohol-related events[16]. The present study found that daily drinkers had a significantly increased stroke risk of 3.6-fold. Most of the presented stroke patients reported binge drinking. However, the present result had limitation of the exact amount of alcohol consumption per day in daily drinkers

Many studies have shown a direct relationship between physical inactivity or sedentary lifestyle, and increased incidence of stroke[17,18]. In a study by Sacco et al on the incidence of strokes, subjects who had experienced the first stroke were compared to a randomized control group. They found that subjects who engaged in mild- to- moderate and heavy exercise showed a reduced incidence of ischemic strokes even after adjustment for the other risk factors and for medical conditions that could cause limitation in physical activity. This protective effect of physical activity was found in women and men, in young and old, and in all the racial and ethnic groups studied [17]. A prospective cohort study by Wannamethee and Sharper of 7735 men, aged 40 to 59 at first screening, followed subjects for 9.5 years. Moderate and vigorous physical activity was associated with a reduction in the incidence and mortality of strokes in men[18]. The present result was similar to previous studies[17-19]. Light to moderate physical activity showed a protective effect on the development of stroke. The effect of acute, short-term exercise on cerebral blood flow and cerebral metabolism was reported by Doering et al[19]. They concluded that active and passive exercise increased cerebral oxygen saturation and cytochrome enzyme levels and also induced cerebral activation and initiation of auto-regulatory mechanisms.

SUMMARY

From the present study, the risk factors for stroke in Thai patients were TIA, previous stroke, moderate to severe hypertension, cardiac disease, hyperlipidemia (cholesterol level ≥ 300 mg/dl), diabetes mellitus, current smoking, and daily drinking, whereas, physical exercise had a beneficial effect for stroke protection. Those risk factors are either modifiable or preventable. A better integration of stroke risk factor management with medical and behavioral interventions is needed in order to reduce the stroke incidence and mortality.

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ปัจจัยเสี่ยงของโรคหลอดเลือดสมองในผู้ป่วยไทย†

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วัตถุประสงค์ : ศึกษาปัจจัยเสี่ยงที่ทำให้เกิดโรคหลอดเลือดสมอง ในผู้ป่วยไทย

รูปแบบการวิจัย : สังเกตเชิงวิเคราะห์ ณ ช่วงเวลาใดเวลาหนึ่ง

สถานที่ทำวิจัย : Stroke Unit หน่วยอายุกรรมประสาท และฝ่ายเวชศาสตร์ฟื้นฟู โรงพยาบาลจุฬาลงกรณ์

ประชากรและวิธีการศึกษา : ทำการศึกษาหาปัจจัยเสี่ยงที่อาจทำให้เกิดโรคหลอดเลือดสมอง โดยการสัมภาษณ์และศึกษาจากเวชระเบียนผู้ป่วย ที่ได้รับการวินิจฉัยว่าเป็นโรคหลอดเลือดสมองเฉียบพลัน ภายใน 72 ชั่วโมง จำนวน 100 คน เปรียบเทียบกับอาสาสมัครปกติที่มีอายุในช่วงเดียวกัน จำนวน 200 คน โดยการใช้แบบสอบถาม ทำการศึกษาตั้งแต่เดือนพฤศจิกายน 2544 ถึง พฤษภาคม 2545

ผลการวิจัย : ผู้ป่วยโรคหลอดเลือดสมองจำนวน 100 คน เป็นเพศชาย 55 คน เพศหญิง 45 คน คิดเป็นอัตราส่วน 1.2 : 1 สาเหตุของโรคเกิดจากภาวะเส้นเลือดสมองตีบ/อุดตัน 78% เส้นเลือดสมองแตก 22% เมื่อเทียบกับกลุ่มควบคุมพบว่าปัจจัยเสี่ยงและค่าการเสี่ยง (relative risk) ที่ทำให้เกิดโรคหลอดเลือดสมองเรียงลำดับจากมากไปน้อย มีดังนี้ TIA 9.3, ประวัติเคยเป็นอัมพาต 9.1, โรคความดันโลหิตสูงระดับปานกลางถึงรุนแรง 6.5, โรคหัวใจ 5.2, โรคไขมันในเลือดสูง 4.6, โรคเบาหวาน 4.5, สูบบุหรี่เป็นประจำ 3.8, ดื่มเหล้าเป็นประจำ 3.6 ส่วนการออกกำลังกายอย่างสม่ำเสมอเป็นปัจจัยที่ช่วยลดความเสี่ยงต่อการเกิดโรคหลอดเลือดสมอง

สรุป : ผลการศึกษาพบว่าปัจจัยเสี่ยงของโรคหลอดเลือดสมองในคนไทยคล้ายคลึงกับการศึกษาในต่างประเทศ แต่ค่าการเสี่ยงมีความแตกต่างกันบ้างในบางปัจจัย

คำสำคัญ : ปัจจัยเสี่ยง, ทีไอเอ, ประวัติเคยเป็นอัมพาต, โรคความดันโลหิตสูง, โรคหัวใจ, โรคไขมันในเลือดสูง, โรคเบาหวาน, สูบบุหรี่, ดื่มเหล้า

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จดหมายเหตุทางแพทย์ ฯ 2546; 86 (ฉบับพิเศษ 2): S291-S298

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