Risk Factors of Stroke in Pathumthani Province, Thailand

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Objective: To study risk factors of stroke in Pathumthani.

Material and Method: Pathumthani comprises of seven districts. One sub-district was selected from each district. The subject group was those aged 30 years or older. Staffs of Sub-District Health Promotion Hospitals were trained to assist in the data gathering based on questionnaires on blood sugar and lipid levels. The staffs conduct cross-sectional analyses of the information.

Results: Of 714 subjects, most were female (66.9%). The average age was 56 years (SD 10.7). Forty-six point two percent had their body mass index of 25 kg/m² or more. Fifty-six point four percent had larger waist circumference than average. Sixty point eight percent had their cholesterol levels over 200 mg/dl while 14.9% had their blood sugar levels of 126 mg/dl or higher. Seven subjects (1.0%) had stroke. As for the risk factors, 32.4% had hypertension; 16.9% had hyperlipidemia; 13.1% had diabetes mellitus; 8.9% smoked and 2.0% had heart diseases. Forty-eight point seven percent had at least one risk factor, among these, 55.2%, 29.9%, 12.0%, 2.9% and 0.0% had one, two, three, four and five factors, respectively.

Conclusion: The prevalence rate of stroke in Pathumthani was one in 100 people aged 30 years or older. The observed important risk factor of stroke was hypertension. Nearly half of the subjects had at least one risk factor. Suggested ways in changing the behaviors are the control of the disease, the diets and the increasing physical exercise.

Keywords: Stroke, Risk factor, Prevalence, Behavior, Cross-sectional, Community-based

The traditional definition of stroke published by the World Health Organization in 1978 is "a neurological deficit of cerebrovascular cause that persists beyond 24 hours or is interrupted by death within 24 hours"[1].

Stroke affects more than 1.5 million people annually in the world population, and approximately one-third (5.5 million) is fatal[1,2]. Stroke has been the cause of disability of 4.9 million people worldwide[2]. It is estimated that in the year 2020, it will be the second and the fifth most frequent cause of death and disability, respectively[3]. Ischemic stroke is, globally, one of the most important causes of death and disability[4].

The risk factors of stroke include: 1) hypertension, 2) smoke, 3) diabetes mellitus, 4) heart diseases, and 5) hyperlipidemia. Other factors comprise of age, stress, obesity, excessive alcohol intake, and lack of physical exercise[5-11].

The most important risk factor is hypertension (odds ratio = 2.6)[12], yet quite a few other factors including smoking, alcohol abuse, hyperlipidemia, dietary risk score, and abdominal obesity (as measured by high waist-to-hip ratio) are also significant for both ischemic and hemorrhagic strokes[1]. The knowledge as regards warning signs of stroke and a network hotline number 1669 were provided so that the patients see physicians as soon as possible within three hours[13,14].

The present study discovered the risk factor of stroking that can lead to more accurate behavior modification for health promotion and prevention of stroke and differs from other research in that the present research looked for a relationship between the general information and the presence or absence of the stroke risk factors. This research included physical examination, laboratory investigations and notification of results to everyone involved, as well as the relay of knowledge on the warning signals of stroke and provide the network telephone number in the event of having warning signals so that the affected person can see the doctor as soon as possible. So, this is the objective of this study on risk factors of stroke in Pathumthani Province.

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Material and Method

Study design

Cross-sectional design.

Sample size and selection

The population studied was those aged 30 or more, because in the high-risk group of stroke, no case of stroke was found in subject less than 30 years of age[15]. The calculated sample size was 714 subjects according to prevalence of hypertension (hypertension is high risk of stroke) which is 21.4% in 15 years old and over (Health Survey Report of Thai Population 2009). Purposive sampling was employed in Pathumthani, comprising of seven districts. One sub-district was selected from each district. Seven Sub-District Health Promotion Hospitals voluntarily participated. Moreover, the sample size was proportionate to the population of each sub-district.

Instrumentality

Instruments used were a personal data-recording form, results of the blood test, physical examination, and questionnaire.

Quality assurance

The investigators created the questionnaire. It was then verified by three experts, namely a specialist in cerebral blood vessels, a professional-level nurse working in the province-level disease control and an instructor in statistics. As for the blood investigation, the blood was sent to be analyzed at the laboratory of Thammasat University Hospital.

Definition

Hypertension, diabetes mellitus, heart diseases, and hyperlipidemia were diagnosed by the doctors.

Smoking status by interview; non-smoker is the one who never smoked and a smoker is the one who smokes regularly or used to smoke recently and now stopped already.

Data gathering

The investigators trained staffs of the Sub-District Health Promotion Hospitals to assist in the data collection process including, using questionnaire, and blood collection process.

The staffs at the Sub-District Health Promotion Hospitals had coordinated with village health volunteers (VHV) in recruiting volunteers for blood collection, interviews, recording their names and notifying them to not eat or drink between 8.00 p.m.

to the next morning, when the blood collection took place.

The principal investigator set a field schedule for the team, which comprised of herself, physicians, laboratory instructors, and staffs, to coordinate and take field trips to the Sub-District Health Promotion Hospitals in the community. At each hospital, each subject received an information sheet, signed a consent form, had his/her blood drawn, had snacks, gave an interview for the questionnaire, saw a physician for the physical examination and obtained the knowledge as regards to stroke for the behavioral change, health promotion, and stroke prevention[16,17].

Data analysis

The data were analyzed for frequency and percentage of group variable, mean and standard deviation of continuous variable. Association were analyzed for univariate logistic regression analysis, odds ratio (ORs), and 95% confidence interval (CIs) were used to illustrate the association between general data with presence of at least one risk factors of stroke (hypertension, smoking, diabetes mellitus, heart diseases, hyperlipidemia). The *p*-value less than 0.05 were considered significant.

Ethics

The present study was approved by the Human Research Ethics Committee of Thammasat University.

Results

From 714 volunteers, most were female (478 subjects, 66.9%). One hundred and twenty-seven were between the age of 45-49 years (17.8%), and 125 of them were 60-64 years old (17.5%). The mean age was 56 years (SD 10.7). Six hundred and sixty-six subjects were Buddhists (93.3%). Four hundred and seventy-four subjects completed the primary-school education (66.4%). Five hundred and twenty-five subjects were married (73.7%). One hundred and sixty-one lived at Thanyaburi districts (22.5%) and 159 subjects at Lam Luk Ka districts (22.3%), respectively (Table 1).

As regards to the health status, 330 subjects had their body mass index (BMI) of 25 kg/m^2 or more (46.2%), and 170 subjects of 23-24 kg/m^2 (23.8%). Four hundred subjects had larger waist circumference than average (56.4%). Sixty-three subjects smoked regularly (8.9%). Three hundred and twenty-four subjects had their blood sugar levels of 100-125 mg/dl

Table 1. Number and percentage of sample by general data (n = 714)

General data	Number	%
Sex		
Female	478	66.9
Age group (years)		
30-44	108	15.1
45-49	127	17.8
50-54	100	14.0
55-59	90	12.6
60-64	125	17.5
65-69	86	12.0
70+	78	10.9
Mean 56, SD 10.7, min 30, max 89		
Religion		
Buddhism	666	93.3
Others	48	6.7
Education level		
Illiterate	21	2.9
Primary	474	66.4
Secondary	113	15.8
University	74	10.4
Others	32	4.5
Marital status (n = 712)		
Single	57	8.0
Married	525	73.7
Widow/widower	108	15.2
Separated	22	3.1
Geographical area (district)		
Lat Lum Kaeo	60	8.4
Khlong Luang	70	9.8
Mueang Pathumthani	93	13.0
Sam Khok	104	14.6
Lam Luk Ka	159	22.3
Thunyaburi	161	22.5
Nong Suea	67	9.4

Table 2. Number and percentage of sample by health status

Health status	Number	%
Body mass index (BMI) (kg/m^2) (n = 714)		
0-23	214	30.0
23-24	170	23.8
25+	330	46.2
Mean 25.4, SD 4.3, min 16.4, max 47		
Waist circumference (cm) (n = 709)		
Normal	309	43.6
Over (80+ in female, 90+ in male)	400	56.4
Mean 86.1, SD 10.3, min 57, max 130		
Smoking status (n = 707)		
Non-smoke	644	91.1
Smoke	63	8.9
Fasting blood sugar (mg/dl) (n = 707)		
47-99	278	39.3
100-125	324	45.8
126-406	105	14.9
Mean 112.1, SD 35.7, min 47, max 406		
Total cholesterol (mg/dl) (n = 683)		
0-200	268	39.2
201-574	415	60.8
Mean 208, SD 53.3, min 0, max 574		

Table 3. Number and percentage of sample by diseases

Diseases	Number	%
Stroke (n = 705)	7	1.0
Hypertension (n = 707)	229	32.4
Hyperlipidemia (n = 708)	120	16.9
Diabetes mellitus (n = 705)	92	13.1
Heart diseases (n = 703)	14	2.0

(45.8%) while 105 subjects had such levels of 126 mg/dl or more (14.9%). Four hundred and fifteen subjects had their total cholesterol levels over 200 mg/dl (60.8%) (Table 2).

As regards to the disease status, seven subjects had stroke (1.0%), four of which were male. Two hundred and twenty-nine (32.4%), 120 (16.9%), 92 (13.1%), and 14 (2.0%) subjects had hypertension, hyperlipidemia, diabetes mellitus, and heart diseases, respectively (Table 3).

Considering five risk factors of stroke, namely hypertension, smoking, diabetes mellitus, heart diseases, and hyperlipidemia, 348 subjects had at least one of these factors (48.7%). Among these, 192 (55.2%), 104 (29.9%), 42 (12.1%), 10 (2.9%), and 0 (0%) had one, two, three, four, and five factors, respectively (Table 4).

The analysis into associations of the presence and absence of the risk factors showed that sex, age group, educational level, and geographical area were significantly associated with the risk factors ($p<0.05$) (Table 5).

Discussion

The crude prevalence of stroke is similar to that of other researches which was 8.51/1,000 (95% confidence interval [CI] 3.9-16.1), representing 9 of 1,057 participants (18 years or older). The age-adjusted prevalence was 12.3/1,000 in the US population in the year 2000[18]. This was less than that found in Thai Epidemiologic Stroke (TES) study in the year 2004-2006 with the crude prevalence of

Table 4. Number and percentage of sample by risk factors (5 factors; hypertension, smoke, diabetes mellitus, hyperlipidemia, heart diseases)

Risk factors	Number	%
No factor	366	51.3
1-5 factors	348	48.7
1 factor		
Hypertension	98	28.2
Smoke	42	12.1
Hyperlipidemia	30	8.6
Diabetes mellitus	18	5.2
Heart diseases	4	1.1
2 factors		
Hypertension, hyperlipidemia	40	11.5
Hypertension, diabetes mellitus	31	8.9
Hypertension, smoke	12	3.4
Diabetes mellitus, hyperlipidemia	6	1.7
Hyperlipidemia, smoke	5	1.4
Diabetes mellitus, smoke	4	1.1
Hypertension, heart diseases	3	0.9
Hyperlipidemia, heart diseases	2	0.6
Smoke, heart diseases	1	0.3
3 factors		
Hypertension, diabetes mellitus, hyperlipidemia	29	8.3
Hypertension, hyperlipidemia, heart diseases	5	1.4
Hypertension, diabetes mellitus, smoke	3	0.9
Hypertension, hyperlipidemia, smoke	3	0.9
Hypertension, diabetes mellitus, heart diseases	2	0.6
4 factors		
Hypertension, diabetes mellitus, hyperlipidemia, heart diseases	10	2.9
5 factors		
Hypertension, smoke, diabetes mellitus, hyperlipidemia, heart diseases	0	0.0

1.88% (95% CI 1.69-2.07) in a general population aged 45-80 years[19].

The majority of the sample group was obese with larger waist circumference than average based on the BMI. When only those with BMI less than 23 kg/m² were analyzed, the associations were higher for both ischemic and hemorrhagic strokes[20,21]. Certain subjects had excessive waist circumference and cholesterol levels. In addition, more than half of the subject group had hyperglycemia (either risky for or having diabetes mellitus) and smoked. Smoking is related to the occurrence of stroke as shown in a research indicating that smoking and severe psychological distress (SPD) were associated with the prevalence of stroke in young adults[22].

Nearly half of the sample group (348 subjects, 48.7%) had at least one risk factor of stroke (55.2% had one factor, 29.9% two factors, 12.0% three factors, and 2.9% four factors). This demonstrates that the sample group in the community was at high risk of stroke. Collectively, those with two or more factors were equal to 44.8%, and three or more factors 14.9%. These are less than the percentages found in other researches, which showed that, among young patients (less than 55 years old), at least 50% had 2 or more risk factors and 20-25% had 3 or more risk factors. In patients aged 55 years or older, the proportion with 2 or more risk factors was 70-80% and with 3 or more risk factors 35-45%[23]. A reason behind this may be because the present research was conducted on the general population in the community.

The present research has provided the knowledge, including the warning signs of stroke that may help the patients to see the doctor in a timely manner. A researcher revealed that 21 subjects (91%) expressed appreciation in receiving this type of information. Seventeen (74%) specified that the information on Stroke Chain of Survival was novel to

Table 5. Relationship between general data with factors

General data	1-5 factors*	No factor	OR	95% CI	p-value**
Sex (n = 714)			1.54	1.12 to 2.11	0.007
Male	132 (37.9)	104 (28.4)			
Female	216 (62.1)	262 (71.6)			
Age group (years) (n = 714)			0.38	0.28 to 0.51	<0.001
30-59	166 (47.7)	259 (70.8)			
60-89	182 (52.3)	107 (29.2)			
Education level (n = 682)					0.001
Illiterate	11 (3.3)	10 (2.9)	2.29	0.86 to 6.13	0.099
Primary	254 (76.5)	220 (62.9)	2.40	1.43 to 4.04	0.001
Secondary	43 (13.0)	70 (20.0)	1.28	0.69 to 2.37	0.434
University	24 (7.2)	50 (14.3)	1.00	-	-
Marital status (n = 712)					0.238
Single	26 (7.5)	31 (8.5)	1.00	-	-
Married	249 (71.8)	276 (75.6)	0.68	0.36 to 1.26	0.219
Widow/widower/separated	72 (20.7)	58 (15.9)	0.93	0.54 to 1.61	0.794
Geographical area (district) (n = 714)					<0.001
Lat Lum Kaeo	33 (9.5)	27 (7.4)	0.60	0.29 to 1.23	0.161
Khlong Luang	14 (4.0)	56 (15.3)	0.12	0.06 to 0.27	<0.001
Mueang Pathumthani	45 (12.9)	48 (13.1)	0.46	0.24 to 0.88	0.019
Sam Khok	44 (12.6)	60 (16.4)	0.36	0.19 to 0.68	0.002
Lum Luk Ka	84 (24.1)	75 (20.5)	0.55	0.30 to 0.99	0.048
Thunyaburi	83 (23.9)	78 (21.3)	0.52	0.29 to 0.94	0.032
Nong Suea	45 (12.9)	22 (6.0)	1.00	-	-

OR = odds ratio
* 5 factors; hypertension, smoke, diabetes mellitus, hyperlipidemia, heart diseases
** Univariate logistic regression analysis

them. The significance of the information was impulsively mentioned by 14 (61%), and additional information was requested by 4 (17%)[24,25]. The health promotion program has the potential of moderate impact on coronary heart disease and stroke mortality. The cost-effectiveness of the program, however, has yet to be established.

The sex, age group, educational background, and place of living are significantly related to the risk factors of stroke (hypertension, smoking, diabetes mellitus, heart diseases, and hyperlipidemia).

Strength is the collecting data in the community by interview, physical examination, and laboratory investigations.

Limitation is that volunteers could be selected only on the day the team visited (selection bias) and some gave wrong information (recall bias) i.e. age, etc.

As a suggestion, there should be further investigations, particularly on people with the risk factors. They may be grouped by the number of risk factors and given interventions to change their behaviors, especially in terms of the control of their disease status, the diet and increasing of the physical increasing exercise.

What is already known on this topic?

The research done previously was to study the prevalence rate and risk factors of stroke in all five regions of Thailand, starting from the year 2004 to 2006, with a total 19,997 participants between the ages of 45 and 80 years. The results showed that the crude prevalence of stroke in Thailand was 1.88%. The risk factors of stroke were sex, occupation, region, hypertension, diabetes mellitus, and hypercholesterolemia.

Research in foreign countries studied risk factors in two groups of patients with stroke: one group was younger than 55 years of age and the other group was 55 years old and older. It was found that at least 50% of the group aged less than 55 years old had two or more risk factors of stroke, and 20-25% had three or more risk factors. In the group aged 55 years and older, at least 70-80% had two or more risk factors of stroke, and 35-45% had three or more risk factors.

What this study adds?

This study discovered that the prevalence rate of stroke was 1%. Risk factor analysis revealed that almost half of the study group had risk factors of stroke. The analysis of only those with the risk factors revealed that more than half had one risk factor, and nearly one-third of those with the risk factors actually had two such factors, while the remainder had three and four risk factors. This finding can lead to more accurate behavior modification for health promotion and prevention of stroke and differs from other research in that the present research looked for a relationship between the general information and the presence or absence of the stroke risk factors. The present research conduct included physical examination, laboratory investigations and notification of results to everyone involved, as well as the relay of knowledge on the warning signals of stroke and the network telephone number in the event of warning signals so that the affected person can reach the doctor as soon as possible.

Potential conflicts of interest

None.

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ปัจจัยเสี่ยงของโรคหลอดเลือดสมอง จังหวัดปทุมธานี ประเทศไทย

ศรีเมือง พลังฤทธิ์, สมบัติ มุ่งทวีพงษา

วัตถุประสงค์: เพื่อศึกษาปัจจัยเสี่ยงของโรคหลอดเลือดสมองในจังหวัดปทุมธานี

วัสดุและวิธีการ: จังหวัดปทุมธานีมี 7 อำเภอ เลือกอำเภอละ 1 ตำบล กลุ่มตัวอย่างคือผู้ที่อายุตั้งแต่ 30 ปีขึ้นไป อบรมเจ้าหน้าที่โรงพยาบาลส่งเสริมสุขภาพตำบลเพื่อช่วยเก็บข้อมูลโดยการใช้แบบสอบถาม เจาะเลือดหาค่าน้ำตาล และค่าไขมัน โดยเจ้าหน้าที่วิเคราะห์ข้อมูลในลักษณะของภาคตัดขวาง

ผลการศึกษา: ตัวอย่าง 714 คน พบว่าส่วนใหญ่เป็นเพศหญิง 66.9% อายุเฉลี่ย 56 ปี (SD 10.7) ดัชนีมวลกายตั้งแต่ 25 กก./ม.^{2} ขึ้นไป 46.2% เส้นรอบเอวเกิน 56.4% โคเลสเตอรอลเกิน 200 มก./ดล. 60.8% ระดับน้ำตาลในเลือดตั้งแต่ 126 มก./ดล. ขึ้นไป 14.9% เป็นโรคหลอดเลือดสมอง 7 คน (1.0%) มีปัจจัยเสี่ยงคือ เป็นความดันโลหิตสูง 32.4% ไขมันในเลือดสูง 16.9% โรคเบาหวาน 13.1% สูบบุหรี่ 8.9% และโรคหัวใจ 2.0% มีปัจจัยเสี่ยงอย่างน้อยหนึ่งปัจจัย 48.7% ซึ่งมีปัจจัยเสี่ยงหนึ่ง สอง สาม สี่ และ ห้าปัจจัย เป็น 55.2%, 29.9%, 12.0%, 2.9% และ 0.0% ตามลำดับ

สรุป: อัตราความชุกของโรคหลอดเลือดสมองในจังหวัดปทุมธานีเป็น 1 ต่อผู้ที่อายุตั้งแต่ 30 ปีขึ้นไป ร้อยคน ปัจจัยเสี่ยงต่อโรคหลอดเลือดสมองที่สำคัญที่พบคือ ภาวะความดันโลหิตสูง เกือบครึ่งมีปัจจัยเสี่ยงอย่างน้อยหนึ่งปัจจัย แนวทางการปรับเปลี่ยนพฤติกรรมโดยการควบคุมภาวะโรค การบริโภคอาหาร และการออกกำลังกาย