

The epidemiology of stroke in ASEAN countries – A review

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Abstract

Stroke is a major health problem in developed countries. It is presently among the top four leading cause of death in ASEAN countries, with the crude death rate varying from 10.9/100 000 (Thailand) to 54.2/100 000 (Singapore). There is little data on stroke incidence or prevalence: incidence is 161/100 000 in Vietnam; prevalence ranges from 415/100 000 (Vietnam) to 690/100 000 (Thailand). Stroke comprises a large proportion of the clinical workload of most ASEAN neurologists. From 22 to 39% of stroke in ASEAN is hemorrhagic. Cardioembolism is an important mechanism among the young. There are interethnic differences in stroke mortality and subtype. In ASEAN countries, the frequency of hypertension in the general population ranges from 4 to 20%, while smoking among males ranges from 33 to 77%. Among stroke patients, the frequency of hypertension ranges from 49 to 72%, smoking 22 to 34%, prior cerebrovascular events 22 to 24%. Stroke carries a high mortality and morbidity, especially among hemorrhagic stroke. Rehabilitation programs may be useful. More epidemiologic data is required about stroke in ASEAN; more collaborative studies need to be done.

Key words: cerebrovascular disease, stroke, epidemiology, mortality, incidence, prevalence, risk factors, subtypes, outcome

INTRODUCTION

Stroke is a major cause of mortality and morbidity in the developed and developing world.^{1,2} The ASEAN nations of Brunei, Indonesia, Malaysia, Philippines, Singapore, Thailand and Vietnam are home to about 440 million people, comprising approximately 7% of the world population. Many of the ASEAN countries are developing countries with their own unique patterns of health-related issues. This paper reviews the published data on stroke in ASEAN countries, derived from on a MEDLINE search, and a hand-search of abstracts in *Neurology*, *Stroke*, *Cerebrovascular Diseases* and *Neurological Journal of Southeast Asia*.

STROKE MORTALITY

In developed countries with predominantly white populations, stroke is the third leading cause of death, with 10 to 12% of all deaths due to stroke,³ and a crude death rate (CDR) of 50 to 100 / 100 000.⁴ Since 1950, the mortality from stroke in industrialised countries has been declining, by 50% in some countries⁵, averaging up to 7% per annum.⁶ In some countries, the trend downward has begun to slow.⁵

Mortality data in ASEAN countries is more varied. Data from the authoritative South East Asian Medical Information Centre (SEAMIC)⁷

is illustrated in Table 1. This shows that stroke is among the top 4 leading causes of death in ASEAN countries since 1992 - number one in Indonesia, third in the Philippines and Singapore, and fourth in Brunei, Malaysia and Thailand. It was lower down the list in some countries as recently as the late 80s, especially in Thailand and Brunei where it was 7th and 8th respectively. The actual number of deaths annually from stroke varies from 74 in Brunei to 19, 112 in the Philippines. The CDR from stroke ranges from 10.9/100 000 in Thailand to 54.2/100 000 in Singapore.

Trend data suggests slightly rising CDRs in the Philippines, and no change in Singapore and Thailand from 1974 to 1993.⁷ This trend is seen in males and females. An earlier report from the Philippines showed falling rates from 1963 to 1976.⁸ An individual report from Thailand saw a rise from 3.7/100 000 in 1950 to 11.8 in 1983.⁹ Age and sex-standardised rates were static in Singapore initially¹⁰, followed by significant declines¹¹, from 99/100 000 in 1976 to 59/100 000 in 1994.¹² This decline has been attributed to falling trends in the prevalence of hypertension, smoking, hyperlipidemia and obesity in the Singapore population.^{11,12}

Inter-racial differences in mortality have been reported in Singapore, where the Malays have

TABLE 1: Stroke mortality in ASEAN countries (after SEAMIC)

Country	Brunei	Indonesia	Malaysia	Philippines	Singapore	Thailand
Position among causes of death (after 1991)	4	1	4	3*	3	4**
Position (1989/1990)	8	4***	3	3	3	7
Number of deaths annually	74	358	3,128	19,112	1,701	6,463
Crude death rate/100 000	25	NA	15.9	20.5	54.2	10.9
Crude death rate trends from 1974 to 1993	NA	NA	NA	slight increase	no change	no change

NB * Refers to diseases of the vascular system excluding heart disease

** Refers to stroke and hypertension

*** Refers to cardiovascular diseases

NA Refers to "not available"

the highest mortality compared in Chinese and Indians.^{13,14} The reasons for this are uncertain, but may be related to genetic and racial factors, risk factor differences, and the differing attitudes towards seek medical attention after onset of stroke.¹⁴

STROKE INCIDENCE

The incidence of stroke ranges from 100 to 200/100 000 in Caucasian populations⁴; this may rise to 300 to 500/100 000 in the 45 to 84 year age group.¹⁵ While there is probably little significant variation in stroke incidence among countries in Europe, Japan and the United States(US)¹⁶, some differences have been reported by others.¹⁷ Trend data among the few comparable studies show a fall in stroke incidence in Japan and Rochester, US.¹⁸

Incidence data from ASEAN countries is scanty. Data from South Vietnam shows an incidence of 161/100 000, with higher rates in

rural compared to urban areas.¹⁹ This may be related to the higher frequency of untreated or irregularly treated hypertension, smoking and alcohol intake in these areas.¹⁹

STROKE PREVALENCE

Stroke prevalence data provides the best measure of the total burden of stroke in any population. The prevalence in Caucasian populations ranges from 500 to 600/100 000.⁴

Data from ASEAN countries is shown in Table 2. The rates are not too different from reports from Caucasian populations, as they range from 415/100 in South Vietnam,¹⁹ to 690/100 000 in Bangkok, Thailand.⁹

STROKE WORKLOAD FOR NEUROLOGISTS

The clinical workload of neurologists was assessed prospectively in a number of ASEAN countries. The results are shown in Table 3.

TABLE 2: Prevalence of stroke in ASEAN countries

Country	Prevalence/100 000	Reference
Indonesia (Jakarta)	500	20
Thailand (Bangkok)	690	9
Vietnam (South)	415	19

TABLE 3: Stroke workload of neurologists in ASEAN countries

Country	Proportion of workload (%)	Type of patients	Reference
Indonesia	56.8	Inpatients	21
Malaysia	9.1	Inpatients and outpatients	22
Singapore	54.9	Inpatients	23
	17.3	Outpatients	23
Thailand	38.4	Inpatients and outpatients	24

Increasing admission rates for stroke were seen in Singapore²³ and Thailand.²⁴ Stroke comprised a large proportion of neurological inpatient and outpatient attendances, compared to practices in the United Kingdom.²⁵ The lower proportion of stroke seen by Malaysian neurologists may be related to the small number of neurologists in Malaysia; many stroke patients may be attended to by non-neurologists.²²

STROKE SUBTYPES AND MECHANISMS

Pooled data from predominantly Caucasian populations shows that 7% of stroke is due to subarachnoid hemorrhage, 12% intracerebral hemorrhage, 73% cerebral infarction, 8% ill-defined.²⁶ Data from ASEAN countries is shown in Table 4. Generally, the frequency of hemorrhagic stroke ranges from 26% seen in Singapore,²⁷ to 39% seen in Surabaya,

Indonesia.²¹ In a prospective ASEAN-wide collaborative study of 3 200 hospitalised stroke patients, 22% of all strokes were hemorrhagic.²⁸

Stroke in Malaysia, when compared to an Australian population, tended to affect small vessels (29.3% vs 18.4%), with less cardioembolism (18.5% vs 25.5%), without significant differences in intracerebral hemorrhage or large vessel infarct.²⁹ Cardioembolism and procoagulant states may be important mechanisms among young stroke patients in Singapore.³⁰ Among Thais less than 50 years old with ischemic stroke, there was more cardioembolism when compared to a Dutch population;³¹ this has been attributed to a higher frequency of rheumatic heart disease among Thais. Among a group of 68 children with stroke in Thailand, many of the 38 ischemic strokes were cardioembolic; many of the 30 hemorrhagic

TABLE 4: Stroke subtypes in ASEAN countries

Country	Type	% male	Mean age (yr)	Number of patients	SAH (%)	ICH (%)	All Hemorrhages (%)	Lac (%)	Non Lac (%)	All Infarcts (%)	III-defined (%)	Reference
Indonesia (Surabaya)	Hospital-based	54.7	NA	4 591	0.9	37.7	38.6	NA	NA	56.4	5.0	21
Singapore	Hospital-based	54.7	65.4	308	1.8	24.2	26.0	39.0	34.0	73.0	0	27
Vietnam (South)	Community-wide	NA	NA	219	NA	NA	30.0	NA	NA	70.0	0	19
ASEAN	Hospital-based	NA	59.9	3 195	2.3	20.0	22.3	15.4	NA	NA	NA	28

NB NA Refers to "not available"
 SAH Refers to subarachnoid hemorrhage
 ICH Refers to intracerebral hemorrhage
 Lac Refers to lacunar infarcts
 NonLac Refers to non-lacunar infarcts

strokes were due to arteriovenous malformations.³²

Interracial differences in clinical syndromes have also been reported among the different ethnic and tribal groups in Indonesia.³³ In Singapore, Indians have a lower frequency of hemorrhagic stroke compared to Chinese and Malays.³⁴

The well-known Siriraj Stroke Score has been shown to have a 89.3% sensitivity for cerebral hemorrhage, 93.2% sensitivity for cerebral infarction, and a predictive accuracy of 90.3%.³⁵ It was found to be reliable when applied to an Indonesian population, but almost a third had an equivocal result necessitating more definitive investigations.³⁶ A clinical diagnosis of a lacunar syndrome has been found to have a 90% sensitivity and 92% specificity for the diagnosis of lacunar infarction, with a positive predictive value of 85% and negative predictive value of 95%.³⁷

STROKE RISK FACTORS

A number of community studies have been performed to evaluate the prevalence of stroke risk factors in the community. These are shown in Table 5. From this table, it can be seen that the

frequency of hypertension, a potent but modifiable risk factor for stroke, was low in rural Thailand,⁴⁰ but ranged from 14 to 20% among other countries. Smoking, another modifiable stroke risk factor, ranged among males from 33% in Singapore³⁸ to 77% in rural Thailand;⁴⁰ almost 6% of females in Jakarta, Indonesia, smoked.²⁰

A number of stroke risk factor studies among stroke patients have been reported. This is seen in Table 6. Generally, the frequency of a history of hypertension is 50 to 70%, smoking 22 to 34%, and previous transient ischemic attacks(TIAs) or strokes 22 to 24%.

OUTCOME AFTER STROKE

The outcome post-stroke has been the subject of a number of reports.

Among 74 patients in Jakarta, Indonesia, with intracerebral hemorrhage, 20.3% died during that admission, all within 3.2 days.⁴¹ Mortality was higher if the Glasgow Coma Score was less than 9, systolic blood pressure exceeded 190 mmHg, brain scan showed midline shift, or hematoma volume exceeded 60 cc. In the ASEAN study, overall in-hospital mortality was 21% for all strokes combined.²⁸

TABLE 5: Stroke risk factors in the community in ASEAN countries

Country	Patient type	Age (yr)	Hypertension (%)	Diabetes mellitus (%)	Smoking (%)	Hyperlipidemia (%)	Obesity (%)	Reference
Indonesia (Jakarta)	Male female	25 – 64	14.9	NA	male 59.9 female 5.9	13.4#	NA	20
Singapore	Male female	18 – 69	13.6*	8.6@	male 33.0 female 3.0	19##	5.1+	38
Thailand (Urban)	Males only	35 – 64	13.0** 19.8***	9.8@@	69.1	29.5#	5.8++	39
Thailand (Rural)	Males only	35 – 64	3.7*	NA	77.0	NA	0+++	40

- NB NA Refers to “not available”
- * Refers to equal to or exceeding 160/95 mmHg
- ** Refers to exceeding 160 mmHg systolic
- *** Refers exceeding 95 mmHg diastolic
- @ Refers to based on 75g oral glucose loading test
- @@ Refers to blood sugar level exceeding 120 mg/dl
- # Refers to blood total cholesterol exceeding 6.5 mmol/l (250 mg/dl)
- ## Refers to blood total cholesterol exceeding 6.2 mmol/l
- + Refers to body mass index exceeding 31 kg/m²
- ++ Refers to body mass index exceeding 25 kg/m²
- +++ Refers to exceeding 120% of expected body weight for height

TABLE 6: History of stroke risk factors among stroke patients in ASEAN countries

Country	Hypertension (%)	Diabetes mellitus (%)	Smoking (%)	Hyperlipidemia (%)	Heart disease (%)	Prior TIA/stroke (%)	Reference
Indonesia (Surabaya)	CI 49.1 ICH 65.6	NA	NA	NA	NA	NA	21
Singapore	67.8	39.7	22.3	6.3	12.8	22.3	27
Vietnam (South)	55.0	NA	34.0	NA	9.0	12.0*	19
ASEAN	71.5	18.9	26.5	NA	20.9	23.6	28

NB NA Refers to "not available"
 * Refers to TIAs only
 CI Refers to cerebral infarction
 ICH Refers to intracerebral hemorrhage

By a month post-stroke, 46% of 35 patients in Bandung, Indonesia, had died, 11.4% had moderate disability, 20% had mild disability.⁴² In Thailand, mortality at 4 weeks post-stroke was 85% in intracerebral hemorrhage, 37% in embolism, 19.5% cerebral infarction.⁹

After rehabilitation in Singapore, 91.9% were fully or partly independent in selfcare activities.⁴³ Programs for rehabilitation in the community can be useful, with 84% of those with good and fair rehabilitation potential achieving increased independence after 12 weeks of rehabilitation at home.⁴⁴

CONCLUSIONS

Reliable epidemiologic data is required for proper planning and allocation of healthcare resources, be it for stroke or any other illness. It is clear that good epidemiologic data on many aspects of stroke is lacking in ASEAN. Inadequate case ascertainment, incomplete health screening, inaccurate diagnosis, lack of investigative equipment and technology and a low level of stroke awareness among the public may contribute to varying extents to inaccurate information about stroke mortality, morbidity, incidence, prevalence, and stroke subtypes.² This is the time to embark on ASEAN-wide collaborative studies to address these deficiencies. Protocols to those used by the World Health Organisation⁴⁵ or by MONICA investigators¹⁸ may be appropriate. Community-based data is more informative than hospital-based data, especially in countries with a large rural population that may not come to hospital

for treatment for their stroke. Happily, such efforts have been started,²⁸ and more cooperative studies can be envisaged.

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