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Prevalence of extracranial carotid stenosis in Thai ischemic stroke/TIA patients

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Abstract

Stroke is a leading cause of death and morbidity in Thailand. The purpose of this study was to look for prevalence of significant extracranial carotid stenosis (ECCS) in Thai ischemic stroke/transient ischemic attack (TIA) patients and baseline characteristics of this subgroup.

Methods: All acute/subacute ischemic stroke/TIA patients who were treated at Thammasat hospital and had carotid duplex done, during August 2006–July 2007, were included. Carotid duplex studies were performed in all clinically stable patients. The degree of stenosis was defined according to the standard velocity criteria. Stroke subtypes were classified by TOAST criteria: large-artery atherosclerosis (LAA), cardioembolism (CE), small-artery occlusion (SAO), stroke of other determined cause (OC) and stroke of undetermined cause (UND).

Results: One-hundred and eighty-four cases were included. Prevalence of significant ECCS was 9.2%. SAO subtype was the most common stroke subtype in our study (45%). Significant ECCS was found in 18.4%, 6% and 8.3% patients with LAA, SAO and CE stroke subtype, respectively.

Conclusion: Significant ECCS in Thai ischemic stroke/TIA patients is uncommon. Low prevalence of coronary artery disease and peripheral artery disease in Thai stroke patients and/or high SAO stroke subtype in our patients may explain this.

Keywords: Carotid stenosis; Stroke; Thai

1. Introduction

Stroke is the third common cause of death worldwide after ischemic heart disease and all types of cancer combined. Two-third of stroke deaths occur in less developed countries [1]. Stroke also caused 3% of the world's disability burden in 1990. By 2020, stroke mortality will have almost doubled, mainly as a result of an increase in the proportion of older people [2]. In Thailand, stroke is also a leading cause of death and morbidity. Prevalence of stroke is 690 per 100,000 adult populations. Ischemic stroke counted for 70% of all stroke [3]. One of the common causes of ischemic stroke is significant extracranial carotid stenosis (stenosis more than 50%), which is more commonly found in Caucasian patients than in Asian. The purpose of this study was to look for prevalence of significant extracranial carotid stenosis in Thai ischemic stroke/transient ischemic attack (TIA) patients and baseline characteristics of this subgroup.

2. Methods

All adult (age > 15 years old) patients, with the diagnosis of acute/subacute ischemic stroke/TIA, who were treated at Thammasat hospital and had carotid duplex done during August 2006–July 2007, were included. Computed tomography (CT) of the brain, electrocardiography (ECG), blood

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chemistry work-up, per protocol, were done in all patients. Magnetic resonance imaging/angiography (MRI/MRA) was performed in almost all patients with suspected of large-artery stenosis/occlusion and posterior circulation infarction. Echocardiogram with agitated saline injection was done in most patients, suspected of cardioembolic cause and stroke in the young. Stroke subtypes were classified by TOAST (Trial of ORG 10172 in Acute Stroke Treatment) criteria: large-artery atherosclerosis (LAA), cardioembolism (CE), small-artery occlusion (SAO), stroke of other determined cause (OC) and stroke of undetermined cause (UND). Severity of stroke was evaluated by the National Institutes of Health Stroke Scale (NIHSS).

Carotid duplex studies were performed by a certified neurologist, in all clinically stable patients, using Aloka Carotid Duplex machine, with 7.5–13 MHz, linear probe, guided by neurosonology lab protocol. Doppler information was obtained from proximal and distal common carotid artery (CCA), proximal external carotid artery (ECA), origin/proximal, mid and distal extracranial internal carotid artery (ICA) and extracranial vertebral artery (V2 segment) with 60 degree angle of insonation. For B-mode imaging data, longitudinal and transverse views were performed to obtain plaque information and residual lumen. Color flow imaging and power Doppler were done at all segments, in longitudinal and transverse views, to avoid missing site of stenosis and hypoechoic plaque. The results of carotid duplex and MRA were compared to look for reliability of the studies. The degree of stenosis of the ICA and CCA was defined according to the standard velocity criteria used in the clinical laboratory. If the systolic velocity exceeded 140 cm/s and diastolic velocity was lower than 110 cm/s, with visible plaque, it was defined as 50–75% stenosis. If the systolic velocity was >140 cm/s and diastolic velocity >110 cm/s with visible plaque, it was defined as 75–95% stenosis. In cases of subtotal occlusion (95–99% stenosis), the velocity parameters may not apply, since velocities may be high, low, or undetectable. Diagnosis of subtotal occlusion was established primarily by demonstrating a markedly narrowed lumen with color or power Doppler imaging. Total occlusion of the ICA and CCA was diagnosed when there was no identifiable patent lumen on gray-scale B-mode imaging, and no detectable flow using spectral, power, and color Doppler ultrasound [4]. If there was asymmetrical flow, with markedly decreased velocity at internal carotid artery and high-resistance spectral waveform (no diastolic flow), however patent lumen was noted at extracranial internal carotid artery, it was defined as 'probable high-grade stenosis (>75% stenosis) or occlusion beyond extracranial internal carotid artery'. MRAs of most cases in the last subgroup were sent to confirm the location and severity of the lesions.

Statistic analysis was performed using the chi-square test to identify the statistic significance of the differences between the group with significant carotid stenosis and the group without significant carotid stenosis. A value of $P<0.05$ was considered statistically significant.

3. Results

There were 194 patients during the study period. Ten patients were excluded from the study because 7 patients were clinically severe with unstable vital signs and couldn't be transferred to do carotid duplex study and 3 patients did not have carotid duplex done due to loss follow-up after being discharged. One-hundred and eighty-four patients were included in the study. Mean age of the patients was 61 years old (range from 18–91 years old). Mean NIHSS was 9 (range from 0–39). Most data was collected from admitted patients (inpatient service) (80% of patients). Baseline characteristics were presented in Table 1. Prevalence of significant carotid stenosis (more than 50% stenosis) in patients with acute/subacute ischemic stroke and TIA was 16.8% (31 patients out of 184 patients): 9.2% extracranial carotid artery lesions (17 patients), 7.6% severe stenosis or occlusion at intracranial internal carotid arteries (14 patients). Carotid duplex study results which categorized

Table 1
Baseline characteristics in Thai ischemic stroke/TIA patients

	Overall ($n=184$)		No significant carotid stenosis ($n=153$)		Significant carotid stenosis ($n=31$)		P
Characteristic	N	(%)	n	(%)	n	(%)	
Mean Age (yr)	61 (18–91)		60 (18–91)		66 (28–86)		
Mean NIHSS	9 (0–39)		8 (0–31)		13 (0–39)		
Sex							
Female	79	(43%)	66	(43%)	13	(42%)	0.9
Male	105	(57%)	87	(57%)	18	(58%)	
Family history	24	(13%)	20	(13%)	4	(13%)	0.622
Hypertension	99	(54%)	81	(54%)	18	(58%)	0.602
Diabetes mellitus	51	(28%)	43	(29%)	8	(26%)	0.794
Hyperlipidemia	65	(36%)	57	(38%)	8	(26%)	0.224
CAD	14	(8%)	11	(7%)	3	(10%)	0.607
Previous stroke							
Ischemic stroke	23	(13%)	20	(13%)	3	(10%)	0.542
Intracerebral hemorrhage	1	(0.5%)	1	(0.7%)	–	–	
Previous TIA	5	(3%)	4	(3%)	1	(3%)	0.849
PAD	–	–	–	–	–	–	
Atrial fibrillation	12	(7%)	10	(7%)	2	(7%)	0.986
Valvular heart disease	5	(3%)	4	(3%)	1	(3%)	0.849
Smoking	50	(28%)	40	(26%)	10	(32%)	0.485
Presentation							
TIA	20	(11%)	19	(12%)	1	(3%)	
Stroke subtypes							
LAA	38	(21%)	23	(15%)	15	(48%)	
SAO	83	(45%)	78	(51%)	5	(16%)	
CE	24	(13%)	19	(12%)	5	(16%)	
OC	15	(8%)	14	(10%)	1	(3%)	
UND	4	(2%)	–	–	4	(13%)	

(CAD = coronary artery disease, TIA = transient ischemic attack, PAD = peripheral artery disease, LAA = large-artery atherosclerosis, SAO = small-artery occlusion, CE = cardioembolic, OC = other determined cause, UND = stroke of undetermined cause).