

Risk of a coronary event in patients after ischemic stroke or transient ischemic attack

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ABSTRACT

Coronary artery disease (CAD) together with stroke are the leading causes of death worldwide, and together, they pre-sent a health and economic burden. Ischemic stroke survivors and patients who suffered transient ischemic attack (TIA) have a higher prevalence of coronary atherosclerosis, and they have a relatively high risk of myocardial infarction and nonstroke vascular death. Pubmed was searched for studies focused on investigating coronary atherosclerosis in ischemic stroke survivors or patients who suffered TIA and their cardiovascular risk assessment. There were coronary plaques in 48%-70% of stroke survivors without a known history of CAD, and significant stenosis of at least one coronary artery can be found in 31% of these patients. CAD is a major cause of morbidity and mortality in stroke survivors. Detection and treatment of silent CAD may improve the long-term outcome and survival of these patients.

Key words: stroke, coronary artery disease, atherosclerosis, cardiovascular risk, myocardial infarction, cerebral infarction

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Introduction

Coronary artery disease (CAD) together with stroke are the leading causes of death worldwide (1). There is a close connection between the diseases because they share common risk factors and similar pathophysiology frequently on the basis of atherosclerosis. Recent studies have shown that patients who survive an acute ischemic stroke or transient ischemic attack (TIA) have a higher prevalence of coronary atherosclerosis. Furthermore, they are prone to developing acute coronary syndrome (ACS) (2). Therefore, it is necessary to identify, control, and reduce vascular risk factors to a minimum. There is still no consensus on whether stroke survivors should undergo routine screening for CAD.

Methods

A Pubmed search was conducted in search of studies focusing on the investigation of CAD in patients after ischemic stroke.

The following keywords were used: "coronary atherosclerosis," "stroke," "cerebral infarction," and "coronary artery disease." References for each publication were checked for additional studies. A total of 10 studies were found to be relevant and were reviewed. In some of these studies [Rokey et al. (3), Love et al. (4)], we excluded all patients with previously known CAD. Then, we used simple arithmetic mean to calculate the prevalence of significant coronary stenosis among stroke survivors. A similar strategy was used in the calculation of the prevalence of coronary atherosclerosis in patients with significant carotid stenosis.

Risk factors

Common risk factors for developing atherosclerosis in coronary and intracranial arteries include high blood cholesterol, high blood pressure, diabetes mellitus, smoking, physical inactivity, and an unhealthy diet. However, there are significant differences among how these factors affect the development of these diseases. For example, a high level of low-density lipopro-

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HIGHLIGHTS

- Ischemic stroke survivors and patients who suffered transient ischemic attack have a higher risk of developing acute coronary syndrome. Significant stenosis of at least one coronary artery can be found in 31% of these patients. Detection and treatment of silent CAD may improve the long-term outcome and survival of these patients.

teins is a dominant risk factor for developing atherosclerosis in coronary arteries, whereas it is less important for the risk of stroke (5). On the contrary, disorders of heart rhythm, especially atrial fibrillation, are more relevant to ischemic stroke. Identifying and controlling these risk factors is necessary for the primary prevention of developing CAD or stroke.

Prevalence of coronary atherosclerosis among stroke survivors or patients who suffered TIA with no history of coronary heart disease

Recent studies have assessed the prevalence of CAD in stroke survivors using invasive and noninvasive techniques. Amarenco et al. (6) analyzed coronary angiography in 315 patients with no known coronary heart disease, who were admitted with nonfatal cerebral infarction. Among them, coronary plaques were found in 61.9%, and coronary stenosis >50% was found in at least one vessel in 25.7% of the patients (6). In a study of the South Korean stroke population using computed tomography angiography, 70.4% of them were found to different degrees of coronary atherosclerosis, and 33.1% of them had significant stenosis (7). In an autopsy study by Gongora-Rivera in patients with fatal stroke, significant coronary stenosis was found in 29.6% of 267 patients (8).

More studies investigating the prevalence of coronary atherosclerosis in patients with cerebral infarction are shown in Table 1. On the basis of these studies, stroke survivors with no history of CAD have coronary plaques in approximately 48%-70%, and significant stenosis (minimum of 50%) of at least one of the coronary arteries can be found in 30.9% of them (3, 4, 6-13).

The prevalence of coronary atherosclerosis is even higher in patients awaiting planned carotid artery stenting. Enomoto et al. in their studies performed coronary angiography among these patients, and significant coronary stenosis was found in 58% of them (Table 2) (14-17). However, some of these patients were neurologically asymptomatic.

Morbidity and mortality of patients after stroke

The main cause of morbidity and mortality in nonfatal stroke survivors or patients who suffered TIA is the recurrence of stroke. Nevertheless, a large group of these patients die from cardiac causes. A recent study has shown that the annual incidence of fatal myocardial infarction in stroke survivors is 2.2% (2). Amarenco et al. (18) followed up stroke survivors for five years in their study on the effects of statin treatment. Acute coronary events developed in 5.3% of the patients among which 24.2% were fatal (18). Dhamoon et al. (19) in their study also monitored patients after stroke for five years, who were living in the area of Northern Manhattan. The results of their study showed that recurrence of stroke caused death in 3.7% of the patients, whereas cardiac causes led to death in 6.4% of them (19).

Cardiovascular risk assessment after stroke and conclusion

Ischemic stroke survivors and patients who suffered TIA have a higher risk of developing ACS. It is still unclear whether these patients should undergo coronary artery examination. The American Heart Association/American Stroke Association issued a recommendation that the cardiovascular (CV) risk

Table 1. Prevalence of coronary atherosclerosis in stroke survivors and patients who suffered TIA without previously known CAD

Authors	Number of patients	Method	Coronary atherosclerosis	Significant stenosis >50%
Amarenco et al. (6)	315	Coronary angiography	195 (61.9%)	81 (25.7%)
Yoo et al. (7)	1.304	CT angiography	918 (70.4%)	431 (33.1%)
Calvet et al. (9)	274	CT angiography	133 (48.5%)	50 (18.2%)
Hoshino et al. (10)	104	CT angiography		39 (37.5%)
Seo et al. (11)	71	CT angiography		18 (25.4%)
Rokey et al. (3)	34	SPECT		14 (41.2%)
Love et al. (4)	9	Coronary angiography		4 (44.4%)
Di Pasquale et al. (12)	140	Exercise ECG->SPECT		33 (23.6%)
Gongora-Rivera et al. (8)	267	Autopsy	182 (68.2%)	79 (29.6%)
Kim et al. (13)	96	Coronary angiography before CAS		58 (60.4%)
Total	2.614			807 (30.9%)

CAD - coronary artery disease; CAS - coronary artery stenting; CT - computed tomography; ECG - electrocardiogram; SPECT - single-photon emission computerized tomography; TIA - transient ischemic attack

Table 2. Prevalence of coronary atherosclerosis in patients with significant stenosis of carotid artery

Authors	Number of patients	Method	Coronary atherosclerosis	Significant stenosis >50%
Enomoto et al. (14)	96	Coronary angiography		39 (40.6%)*
Hofmann et al. (15)	261	Coronary angiography		165 (63.2%)
Hertzer et al. (16)	200	Coronary angiography	173 (86.5%)	80 (40.0%)
Sulzenko et al. (17)	200	Coronary angiography	199 (99.5%)	155 (77.5%)
Total	757			439 (58%)

*In this study, significant stenosis was evaluated when at least one of the coronary arteries was narrowed by a minimum of 75%.

should be assessed for each patient individually and those with the highest risk should undergo a noninvasive examination of the coronary arteries (20). This examination should also be performed in patients with significant symptomatic stenosis of carotid arteries. Independently of the CV risk of all stroke survivors or patients who suffered TIA, it is necessary to focus on their risk factors and their reduction to a minimum and therefore reach maximum prevention.

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