Short Report

Prevalence of symptomatic and asymptomatic coronary artery disease in patients with stroke

KAPIL AGGARWAL, ROHIT BHATIA, GAUTAM SHARMA, CHETAN PATEL, M.V. PADMA, KAMESHWAR PRASAD, MANJARI TRIPATHI, MAMTA BHUSHAN SINGH

ABSTRACT

Background. Studies have shown that myocardial infarction is a leading cause of death in patients recovering from stroke or transient ischaemic attacks. We aimed to study the prevalence of symptomatic and asymptomatic coronary artery disease (CAD) in patients with stroke.

Methods. Eighty-six patients with stroke were evaluated for risk factors and presence of CAD. Patients without a previous diagnosis of CAD underwent stress–rest gated technetium-99m (Tc99m) tetrofosmin myocardial perfusion SPECT (MPS) scan to estimate the presence or absence of a reversible perfusion deficit.

Results. Thirty-three patients (clinically asymptomatic for CAD) did not consent for the MPS scan. Among the remaining 53 patients, 13 patients had been previously diagnosed to have CAD, 8 patients were suspected to have underlying CAD and 32 patients were asymptomatic. Among the patients with suspected CAD, 2 had abnormal MPS scans and one had triple-vessel disease on coronary angiography. Of the asymptomatic patients, 6 had CAD. The overall proportion of CAD among patients with stroke was 41.5% (22/53) and that of asymptomatic CAD 18.8% (6/32).

Conclusion. A considerable number of patients with stroke may have associated CAD. An optimal management strategy in stroke patients who have silent CAD may improve clinical outcomes.

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INTRODUCTION

Studies concerning the epidemiological characteristics and therapy for stroke show that myocardial infarction (MI) is a leading cause of death after stroke in patients who recover from cerebral infarction or transient ischaemic attack (TIA), rather than recurrent stroke or other neurological disease.[1] Few studies have looked into the relationship between stroke and coronary artery disease (CAD).[2–5] In a recent study, the incidence of in-hospital MI after acute ischaemic stroke was 2.3% and most patients died during follow-up. Several small studies have shown that patients with TIA and stroke have a high prevalence of asymptomatic CAD.[1,3,4] These studies suggest a 20%–40% prevalence of silent CAD detectable by cardiac testing in patients with stroke. The prevalence of CAD in patients with stroke has generally been studied using non-invasive cardiac testing. Studies have shown that rest and exercise radionuclide ventriculography (gated wall motion test), and stress–rest Tl-201 scintigraphy (thallium treadmill test) are more sensitive than the exercise treadmill test for detection of CAD.[1] We studied the prevalence of symptomatic and asymptomatic CAD among patients who had a stroke.

METHODS

All consecutive patients with stroke admitted from the emergency department as well as those presenting to the neurology outpatient clinic over a period of 3 years at the All India Institute of Medical Sciences (AIIMS), New Delhi were screened. The study was approved by the Institute's ethics committee. After obtaining informed consent, we included patients with TIA, and ischaemic or haemorrhagic stroke, and excluded those who had severe stroke with high morbidity and significant disability (modified Rankin score ≥5), severe associated medical illnesses making long-term survival unlikely as in those with advanced chronic renal failure, malignancy and severe congestive heart failure.

A detailed history and risk factors were recorded on a predesigned proforma. Enrolled patients underwent a detailed stroke work-up and investigations. Each patient was evaluated by a cardiologist for cardiac symptoms, and had an electrocardiogram (ECG) and an echocardiogram done. A patient was diagnosed to have CAD if she/he had:

1. A previous history of MI with corroborative raised biochemical markers and ischaemic changes in the ECG or had undergone an angiogram with or without a subsequent revascularization procedure.
2. A history suggestive of chronic stable angina, with a corroborative stress test or coronary angiogram.

Based on the history and baseline investigations, patients were divided into (i) those with a history or investigation(s) suggestive of CAD and (ii) those with no suggestion of CAD either by history or by initial investigations. Patients who had been adequately evaluated in the past for CAD did not undergo further evaluation. The rest of the patients underwent stress–rest gated technetium-99m (Tc99m) tetrofosmin myocardial perfusion SPECT (MPS) using a standardized protocol along with all the patients who had no history/investigation of CAD.

Patients who could not walk on the treadmill due to age or physical disability were evaluated by a cardiologist regarding fitness for stress testing with dobutamine infusion. The test was done under the supervision of a trained nuclear medicine expert and the final results were a consensus among two independent observers. The study was considered as normal (no perfusion defect on the stress and rest images) or abnormal (presence of perfusion defect on the stress which normalized on the rest images—reversible perfusion defect or presence of perfusion

All India Institute of Medical Sciences, Ansari Nagar, New Delhi, India

KAPIL AGGARWAL, ROHIT BHATIA, M.V. PADMA, KAMESHWAR PRASAD, MANJARI TRIPATHI, MAMTA BHUSHAN SINGH Department of Neurology

GAUTAM SHARMA Department of Cardiology

CHETAN PATEL Department of Nuclear Medicine

Correspondence to ROHIT BHATIA; *rohitbhatia71@yahoo.com*

defect on the stress which remain unchanged on the rest images—fixed perfusion defect). Further testing by coronary angiography was decided by the cardiologist depending upon the need and patient's willingness for the procedure.

RESULTS

Eighty-six patients with either ischaemic or haemorrhagic strokes were studied (Fig. 1). The mean (SD) age of the patients was 55 (10.4) years (range 27–78 years), and there were 65 men and 21 women. Ischaemic strokes occurred in 73 of the 86 patients (84.9%; Table I). First ever strokes were seen in 79.7% of patients and 20.3% had a previous history of stroke. The risk factors among the groups with and without CAD are shown in Table II.

Patients with CAD (n=21)

Patients with previously diagnosed CAD. Thirteen patients were already diagnosed with CAD. Of these, 4 patients had undergone a revascularization procedure, 4 patients had undergone coronary angiography alone in the past and the remaining 5 were on medical therapy.

Patients with suggestion of CAD based on clinical history or laboratory findings. Eight patients had a history suggestive of CAD. One patient underwent coronary angiography in view of notable symptoms and was subsequently successfully treated with coronary artery bypass graft (CABG). The remaining patients (*n*=7) underwent MPS of which 2 patients had evidence of CAD. In one patient with a right bundle branch block on ECG, the MPS suggested dilated cardiomyopathy without any regional stress-induced reversible ischaemia consistent with a diagnosis of non-ischaemic dilated cardiomyopathy. This patient was finally classified among the cardio-embolic strokes without CAD.

TABLE I. Risk factor profile and stroke subtype in the study population

Risk factor	Patients (%)
Age >60 years	34 (39.5)
Smoking	53 (61.2)
Alcohol	43 (50)
Hypertension	63 (73.2)
Dyslipidaemia	58 (67.5)
Diabetes	12 (13.9)
Peripheral vascular disease	1 (1.2)
Family history of stroke	21 (24.4)
Stroke subtype	
Haemorrhagic	6 (6.9)
Ischaemic	73 (84.9)
Large artery	45 (61.6)
Small vessel disease	23 (31.5)
Cardio-embolic	5 (6.9)
Transient ischaemic attack	7 ((8.2)

TABLE II. Comparison of risk factors in those with and without coronary artery disease (CAD)

Risk factors	CAD		p value	Newly diagnosed CAD (*n*=9)	p value†
	Absent (*n*=31)	Present (*n*=22)*			
Mean (SD) age (years)	49.5 (10.2)	56.7 (9.1)	0.87	48.9 (7.03)	0.87
Current smokers	19 (61.3)	14 (63.6)	0.86	6 (66.7)	1.00
Alcohol	15 (48.4)	13 (59.1)	0.44	5 (55.6)	1.0
Hypertension	18 (58.1)	16 (72.7)	0.27	6 (66.7)	0.72
Diabetes mellitus	3 (9.6)	7 (31.8)	0.04	2 (22.2)	0.31
Hypercholesterolaemia (total cholesterol >200 mg/dl)	15 (48.4)	10 (45.5)	0.8	6 (66.7)	0.33
Past history					
Stroke	6 (19.3)	6 (27.3)	0.42	2 (22.2)	1.0
Transient ischaemic attack	2 (6.4)	4 (18.2)	0.2	2 (22.2)	0.21

Figures in parentheses are percentages unless specified * includes the 9 newly diagnosed patients with CAD † comparison with those who did not have CAD (*n*=31)

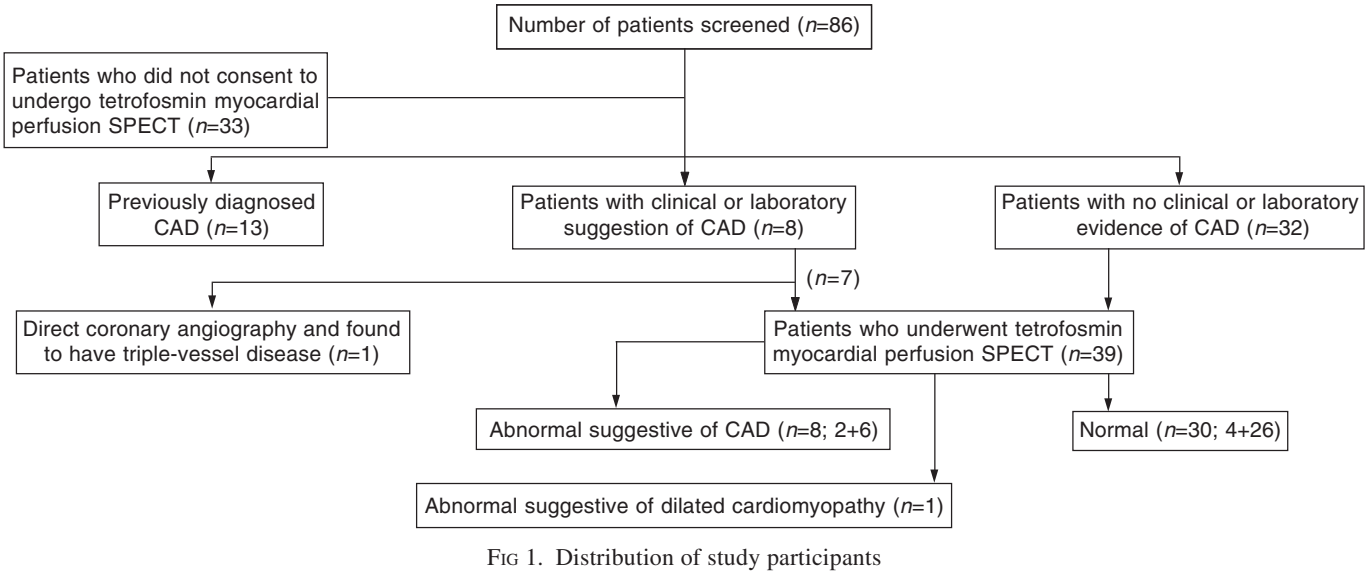

FIG 1. Distribution of study participants
CAD coronary artery disease

TABLE III. Clinical and investigation profile of patients with asymptomatic coronary artery disease

Patient	DOE (NYHA)	ECG	Echo	CT head/MRI brain
1	Class 2	Abnormal	Normal	Left internal capsule infarct
2	Normal	Normal	Left ventricular hypertrophy	Left MCA infarct
3	Normal	Normal	Normal	Left periventricular lacunar infarct
4	Class 3	Abnormal	Dilated left ventricle	Right MCA infarct
5	Normal	Normal	Normal	Left parietal infarct
6	Normal	Normal	Normal	Right MCA infarct
7	Normal	Normal	Normal	Left MCA infarct
8	Normal	Normal	Normal	Left MCA infarct
9	Class 3	Normal	Normal	Left cerebellar infarct

DOE dyspnoea on exertion NYHA New York Heart Association ECG electrocardiogram MCA middle cerebral artery

Patients without CAD (n=32)

Among the 32 patients, 6 (18.8%) were detected to have a reversible ischaemic defect suggestive of CAD (Table III). Overall, 9 (22.5%) patients were found to have asymptomatic CAD (8 on MPS and 1 on angiogram; Table III).

DISCUSSION

Many population studies have shown that following a cerebral ischaemic episode, a fatal coronary event is the major cause of death in the short- and long-term.[6–8] In a recent estimate, the risk of MI following a TIA in patients without known CAD was estimated to be double than that in the general population and was higher in patients younger than 60 years at the time of the index event.[9] Studies have also shown that 25%–70% of patients with carotid disease and no symptoms of CAD have abnormal provocative test results for myocardial ischaemia or angiographic evidence of severe CAD.[1,10,11] In a study of 469 patients with acute ischaemic stroke, 274 patients who had no history of CAD and had undergone dual source CT were analysed for predictors of CAD (≥50% stenosis) or complicated aortic plaque (CAP) based on vascular risk factors, Framingham risk score (FRS) and stroke subtype.[12] Asymptomatic CAD (≥50% stenosis) was found in 61 (22.3%) and CAP in 58 (21.2%). The authors concluded that a comprehensive evaluation for CAD and aortic atherosclerosis may be useful in patients with acute ischaemic stroke, especially in those with higher FRS or specific stroke subtypes.

We found an overall prevalence of CAD in 41.5% of our patients. Previous estimates of CAD prevalence in strokes varied from 20% to 50%. Some studies have reported the prevalence of CAD to be as high as 58%.[11] In another study of 342 patients with no known CAD undergoing coronary angiography, the prevalence of any coronary plaque was seen in 61.9% of patients (95% CI 56.5–67.3) and coronary stenoses ≥50% was found in 25.7% (95% CI 20.9–30.5).[5] The diagnosis of CAD in patients with stroke is usually based on a history of angina, MI and resting ECG changes. Since no standardized cardiac investigation is done in patients with stroke with an aim to detect CAD, a silent CAD goes undetected. A screening based on coronary angiography in stroke patients not only has poor patient acceptability owing to its invasive nature, but also has unfavourable cost-effectiveness. A non-invasive evaluation consisting of exercise ECG testing and radionuclide myocardial scintigraphy should be considered as a reliable alternative to detect silent CAD. Radionuclide myocardial perfusion scintigraphy scanning has 93% sensitivity to detect CAD and predictive value for subsequent coronary events.[11] Although coronary angiography is considered the 'gold standard', studies have shown that angiographic characterization of coronary obstruction may not provide information about future coronary events.[13] In addition, studies have shown that radionuclide scans predict and prognosticate the occurrence of coronary events.[14]

Our study has limitations. The number of patients studied was small. A large, population-based sample will be required to estimate the true prevalence of CAD. We do not have angiogram data to ascertain the true sensitivity and specificity of the MPS scan. None of our patients with haemorrhagic stroke underwent a myocardial stress scintigraphy as a chance occurrence because of lack of consent.

The optimal management of CAD in stroke patients, especially those with previously unrecognized CAD, may help improve patient outcomes.

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