

Original Research Article**An echocardiographic study in patients with non haemorrhagic cerebral infarction to find cardiac abnormalities**Bansal M¹, Singh J², Singh TP³, Kaur A⁴

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ABSTRACT

Background: Strokes are a major cause of morbidity and mortality worldwide. Majority are due to ischemic cerebral infarction. Ischemia may result from occlusion of blood vessels due to a disease process intrinsic to carotid and intracranial vessels or may relate to coexisting heart diseases, predisposing to embolic phenomenon.

Objective: Echocardiographic study in patients with cerebrovascular accident, confirmed to be of non hemorrhagic nature on CT scan/MRI, for evidence of potential cardiac abnormalities as a predisposing cause for the vascular event.

Material and Methods: An observational study was conducted in department of medicine, GNDH, Amritsar. 50 patients of ischemic stroke were taken and 2D transthoracic echocardiography was done to find potential cardioembolic abnormalities.

Results: 76% of patients had echocardiographic abnormalities and 42% had potential cardioembolic abnormalities, out of which most common were ventricular wall hypokinesia, calcific aortic valve, rheumatic heart disease and dilated cardiomyopathy. The prevalence was almost similar in different age groups and both the sexes.

Conclusion: Prevalence of potential cardioembolic abnormalities is high (42%) in ischemic stroke patients and 2D

echocardiography is therefore recommended in the management and secondary prevention of cardioembolic stroke, which has a higher mortality and more chances of recurrence than atherothrombotic type of ischemic stroke.

Key Words: Stroke, echocardiography, potential cardioembolic abnormalities, cardioembolic stroke

Introduction

Stroke is defined as an episode of acute neurological dysfunction presumed to be caused by ischemia or haemorrhage, persisting ≥ 24 hours or until death. CNS infarction is defined as brain, spinal cord, or retinal cell death attributable to ischemia, based on pathological, imaging, or other objective evidence of cerebral, spinal cord, or retinal focal ischemic injury in a defined vascular distribution; or clinical evidence of cerebral, spinal cord, or retinal focal ischemic injury based on symptoms persisting ≥ 24 hours or until death, and other etiologies excluded. [1] Strokes are a major cause of morbidity

and mortality worldwide. [2] They may result from brain infarction or haemorrhage. Majority are due to ischemic cerebral infarction. [3] Ischemia may result from occlusion of blood vessels due to a disease process intrinsic to carotid and intracranial vessels or may relate to coexisting heart diseases, predisposing to embolic phenomenon. [4]

There is no doubt that emboli arising from the heart or passing through it from the venous system, can reach the brain to cause ischemic stroke or TIA. In developed countries, about 20% of ischemic stroke and TIAs are probably due to embolism from the heart. The most

common cause being non-rheumatic atria fibrillation. Emboli vary in their composition from mostly fibrin to mostly platelets to calcium, tumour or infected vegetations. The emboli also vary in size. Emboli mainly occlude distal arterial branches within the brain, resulting in surface infarcts that appear triangular in shape with the base of the triangle at the brain's surface and the apex pointing inward.^[5]

Stroke is the leading cause of disability and the second most common cause of death worldwide.^[6,7] Cardio embolic cerebral infarction accounts approximately for one quarter of all cerebral infarcts.^[8] In most cases, recurrence of cardio embolism can be prevented by oral anticoagulants. Therefore, for a patient with a cerebral infarct, early confirmation of a diagnosis of cardio embolic cerebral infarction is extremely important in order to initiate anticoagulation therapy for an adequate secondary prevention.^[9] The present study was conducted for finding the prevalence of cardioembolic abnormalities in patients of non haemorrhagic stroke.

Material and methods

The study was conducted in Department of Medicine, at Guru Nanak Dev Hospital, Amritsar after taking approval from institutional thesis and ethical committee. 50 patients diagnosed as cerebrovascular accident, confirmed to be of non haemorrhagic nature on CT scan/MRI were taken. All patients were subjected to detailed history after taking consent and detailed systemic examination and investigations were performed. Patients diagnosed as cerebrovascular accident, confirmed to be of non haemorrhagic on CT scan/MRI were included in the study and those having intracranial hemorrhage

and venous infarctions were excluded. This was a cross sectional single centre type of echocardiographic study of 50 patients with ischemic stroke undertaken to investigate the potential cardiac abnormalities as cause for ischemic stroke. A Trans Thoracic Echocardiography (TTE) examination was performed in all subjects using available portable Colour Doppler Echocardiography (CDE) machine with an adult transducer of 2.5M Hz (Sonosite USA). Parasternal long-and short-axis, apical 4 chamber and two chamber views were obtained. All the measurements were done according to the American Society of Echocardiography guidelines and all the abnormalities were diagnosed according to the standard guidelines. All the significant cardiac findings on echocardiography were noted. Following are the potential cardioembolic abnormalities considered with their salient echocardiography features:

- Rheumatic heart disease: Echocardiographic criteria for individuals aged >20years to diagnose definite RHD (either of these):
 - Pathological MR and at least two morphological features of RHD of the MV
 - MS mean gradient ≥ 4 mmHg
 - Pathological AR and at least two morphological features of RHD of the AV, only in individuals aged
 - Pathological AR and at least two morphological features of RHD of the MV
- Dilated cardiomyopathy: All the four cardiac chambers are dilated particularly the left ventricle and there is global hypokinesia.
- Mitral annular calcification: There is bright and reflective echodensity in the posterior segment of the mitral valve annulus.
- Mitral valve prolapse: Systolic bowing movement of part of either or both

leaflets above the plane of the mitral valve annulus.

- Atrial fibrillation: Absence of 'A' wave on colour doppler.
- Infective/non infective endocarditis: Mobile, irregular echo-reflective masses attached to a valve cusp or a cardiac lesion and prolapsing into one of the chambers.
- Patent foramen ovale: A small 'flame' of colour signal seen in the middle region of the atrial septum on colour doppler imaging.
- Hypokinesia/akinesia of ventricular wall: Global or segmental hypokinesia or akinesia of the ventricles.
- Calcific aortic valve: An echo-dense lesion.
- LA/LV thrombus: LA thrombus appears as a bright well defined rounded mass arising from the posterior atrial wall or floating freely while a LV thrombus appears as a bright well defined rounded mass, which protrudes into the ventricular cavity.
- Cardiac myxoma: LA myxoma is pedunculated mass attached to the margin of foramen ovale on the inter-atrial septum, centre of myxoma is echolucent and periphery echodense.
- Prosthetic valve
- Atrial septal aneurysm
- Paradoxical embolism and congenital heart disease

The data was collected and analysed Chi square test was used to compare the group of patients who had positive evidence of cardiac disease on ECG with the other group who had no positive evidence of cardiac disease on ECG for potential cardioembolic abnormalities.

Results

This is a Cross sectional single centre type of echocardiographic study of 50 patients

with non hemorrhagic cerebral infarction undertaken to investigate the potential cardiac abnormalities as cause for ischemic stroke. 50 patients diagnosed as cerebrovascular accident, confirmed to be of non haemorrhagic nature on CT scan/MRI were taken. Following observations were made the youngest patient was 29 years old and oldest 80 year old. The mean age of the patients was 58.42 with SD of 12.32. (Table:1) Maximum incidence was in 45-65 year age group. Both males and females were almost equally represented in the study. Males constituted 44% (22) of the cases while females were 56% (28) of the cases.

Table 1: Age distribution of cases

Age Group in years	No. of cases	%age
25-45	7	14.00
46-65	26	52.00
66-85	17	34.00
Total	50	100.00
M± SD	58.42 ± 12.32	

Table 2: Risk factors present

Risk factor	Positive	%age
Diabetes Mellitus – 2	11	22.00
Hypertension	25	50.00
Smoking	4	8.00
Dyslipidemia	9	18.00

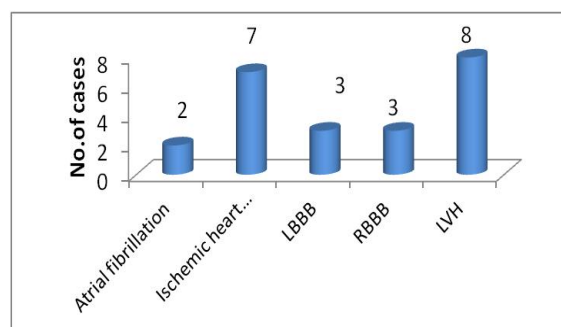


Fig.1 ECG findings

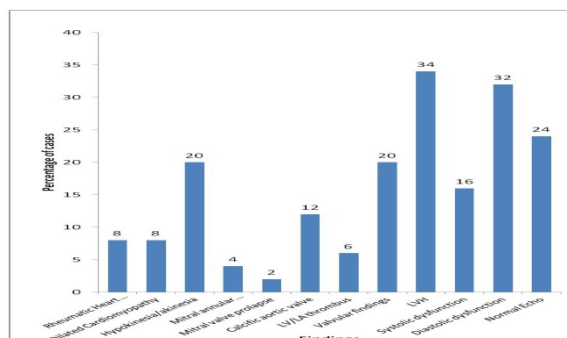


Fig.2 Echocardiographic findings

Table: 3 Potential cardioembolic cases on echocardiography

Findings	Positive	Negative	Total
Potential cardioembolic source on echocardiography	21 (42%)	29 (58%)	50

Table: 4 Comparison of potential cardioembolic cases according to evidence of cardiac disease on ECG

Potential cardioembolic abnormality	Positive evidence of cardiac disease on ECG		No positive evidence of cardiac disease on ECG	
	No.of cases	%age	No.of cases	%age
Present	11	52.38	10	34.82
Absent	10	47.61	19	65.18
Total	21	100.00	29	100.00

$\chi^2 = 1.60 (P > 0.05)$; Non Significant

Discussion

This study was an observational single centre type of echocardiographic study. The objective of the study was to find potential cardioembolic abnormalities in 50 diagnosed cases of stroke confirmed to be non hemorrhagic on CT/MRI scan.

In this study, an echocardiographic evaluation was done for all 50 patients included in the study. 12 (24%) patients had normal echocardiographic data, while 38 (76%) patients had some abnormal finding on echocardiography. Potential cardioembolic abnormality, identified by trans-thoracic echocardiography was found in 42% of the cases.

Maximum number of ischemic stroke patients in our study was found in 45-64 year age group (52%). It is quite similar to a study by Wadwhani et al^[10], which showed maximum incidence in age group of 51-60 years comprising 23 percent and with Aiyar et al^[11] it was 34% of total patients in age group of 51- 60 years. While incidence of stroke increases

with age but it is more in 45-64 year age group in our study may be due to more population in this age group in comparison to above 64 year age group. The mean age in the study was 58.42 years which is closely related to study by Naik M, et al^[12] who found a mean age of 58.27 years. 14% of patients were in the younger age group of < 45 years compared to a study by Gauri et al^[13] which had 19 percent of cases as young stroke. Stroke incidence rates are generally relatively higher in males than females. In this study females constituted 56% of cases and males 44% of cases, the difference may be due to small sample size.

Mean systolic and mean diastolic blood pressures were raised at presentation in our study. In a study by Qureshi et al^[14] elevated blood pressure was found in over 60% of patients. In the present study hypertension was found to be a present in 50% of the cases which is comparable to The Oxfordshire

community stroke project by Sandercock P et al^[15] in which prevalence of hypertension was found in 52% of cases of cerebral infarction. In another study by kaur et al^[16] hypertension was found in 32.69% of cerebral infarction patients. In the present study diabetes mellitus as a risk factor was present in 22% of the patients. In the study by Sandercock P et al^[15] diabetes mellitus was present in 10% of the cases. In the study by Gauri et al^[13] diabetes was found to be present in 9% of cases. In our study smoking was found to be present in 8 % of all the cases as compared to 21 % in study by Kaur et al^[16] in patients of non hemorrhagic infarct. Dyslipidemia as a risk factor was found to be present in 18 % cases i.e. 9 patients out of 50 patients which is comparable to study done by Khan et al^[17] in which it was seen in 19% of cases.

In our study ECG was found to be abnormal in 42 % cases. LVH was found to be the most common abnormality in 16% cases on ECG which is quite comparable to a study by Goldstein et al^[18] in which LVH was found in 21.5 % cases. Atrial fibrillation was found in 13% of cases in that study compared to 4% in our study. Bundle branch blocks i.e. LBBB and RBBB were found to be in 6 % cases each as compared to 2 and 7 % in that same study. In this study most common abnormalities found were left ventricular hypertrophy (34%), followed by diastolic dysfunction (32%), hypokinesia/akinesia of ventricles in 20% cases, valvular findings in 20% cases and systolic dysfunction in 16% of cases. Potential cardioembolic abnormalities were present in 42% cases as compared to a study done by N. Uma et al^[19] at Lady Hardinge Medical College and Associated Smt. Sucheta Kriplani and Dr. Ram Manohar Lohia Hospitals, New Delhi where potential cardioembolic source was found in 27 (54%) patients.

Most common abnormalities found were left ventricular wall hypokinesia in 13 (26%) followed by mitral regurgitation in 9 (18%) and aortic valve calcification in 7 (14%) patients. This difference may be due to small sample size (50 cases) in both the studies. Zenkers et al.^[20] also reported a similar result and found a potential cardioembolic source in 50% patients evaluated by transthoracic echocardiography.

Infarction secondary to cerebral embolism was diagnosed in 127 (23.5%) of 540 patients in the Michael Reese Stroke Registry.^[21] Coronary artery disease, atrial fibrillation, valvular heart disease, mitral annulus calcification, and cardiomyopathy were the commonest etiologies. Echocardiography documented a potential embolic source in 7 patients without previously known heart disease and clarified the cardiac pathology in many of the patients with known heart disease. In a study by Sandercock P et al^[15] 244 patients of cerebral infarction were studied. Potential cardioembolic sources were found in 31% of patients.

Gagliardi et al^[22] studied frequency of echocardiographic abnormalities in patients with ischemia of the carotid territory. Eighty-eight consecutive patients referred to a neurosurgical Department (63 men and 25 women) aged from 14 to 68 years, with cerebral ischemia in the carotid territory were taken. Only 5 (18%) of the 27 patients with abnormal angiograms had a potential cardiac source of emboli while 24 (39%) out of the remaining 61 patients had a potential cardiac source demonstrated at echocardiography.

Wang D et al^[23] studied 1638 cases of acute ischemic stroke in a hospitalized population and found rheumatic heart disease in 130 patients (7.9%), which is similar to the results in our study in

rheumatic heart disease was present in 8% of cases. In present study left ventricular hypertrophy was found in 17 (34%) patients on echocardiography. This is comparable to study done by Marco R et al.^[24] Lower figures were reported by N.Uma et al. (12%),^[19] which may be due to small sample size. LVH is independently associated with stroke risk. In our study the Left ventricular ejection fraction was compared in patients with a potential cardioembolic abnormality and those without a potential cardio embolic abnormality. Ejection fraction was found to be significantly lower ($p < 0.05$) in the group with potential cardio embolic abnormalities (56.06 %) than the group without potential cardio embolic abnormalities (41.14 %). Low EF was a risk factor for stroke in the multiethnic North Manhattan (NOMASS) population cohort, independently of age, sex and ethnicity; however, risk of stroke was not related to severity of EF reduction.^[25]

Strokes are a major cause of morbidity and mortality. More than 40% of ischemic stroke patients have potential cardioembolic abnormalities. Cardioembolic stroke has higher mortality and recurrence rates. 2D echocardiography is the main stay in diagnosing cardiac source of embolus. Many patients with no apparent clinical or ECG evidence of cardiac disease can be identified with echocardiography. 2D ECHO is recommended in every ischemic stroke patient to find potential cardioembolic abnormalities which will guide in the management of stroke, use of anticoagulants and secondary prevention of stroke.

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