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Research Paper: Prevalence of Heart Failure in Patients With Ischemic Stroke: A Descriptive Study

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ABSTRACT

Background: Cerebrovascular Accident (CVA) is the second cause of death and disability in the world. Heart failure can co-occur with CVA and increases the risk of death and disability in patients.

Objectives: This study aimed to evaluate the prevalence of heart failure in patients with ischemic stroke.

Materials & Methods: In this cross-sectional study, the information of patients with ischemic stroke was collected in 2016 from their files. They were referred to the Emergency Department of Poursina Hospital. Statistical analysis of data was performed by using descriptive statistical methods. Estimation of mean and frequency was done by SPSS v. 22.

Results: A total of 291 patients were recruited in the study. Also, 157 patients (54%) were male, and 134 (46%) were female. The Mean±SD age of patients was 61.68 (12.98) years. Systolic heart failure prevalence was 59.8%, and diastolic heart failure was 65.7%.

Conclusion: Based on the findings, more than half of the patients with ischemic stroke also develop heart failure. Therefore, it is recommended that the patient be evaluated and treated for heart failure when faced with ischemic stroke.

Keywords: Prevalence, Heart failure, Stroke

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Highlights

- More than half of patients with ischemic stroke have heart failure, too.
- Their simultaneous occurrence endangers the health and life of the patient.

Introduction

Cerebrovascular Accident (CVA) is one of the most important reasons for death and disability worldwide and Iran [1]. In 2013, there were 3725085 cases of ischemic stroke and 7258216 cases of hemorrhagic stroke in the world. Ischemic stroke prevalence was 90.3 per 100000, and hemorrhagic stroke prevalence was 176 per 100000. There were 1483707 deaths due to stroke globally in those aged 20–64 years [2]. Besides the high mortality rate, diagnosis and treatment for these people cost highly every year. Risk factors of ischemic stroke are systolic or diastolic heart failure, Hypertension (HTN), Diabetes Mellitus (DM), hyperlipidemia, and lack of movement. On the other hand, the most common disease related to Heart Failure (HF) is HTN, and it is more common in aged women [3, 4].

Heart failure is a complicated clinical syndrome that can be caused by any structural or functional heart dysfunction, which reduces ventricular function in filling or emptying blood. This syndrome is classified into diastolic HF (with preserved ejection fraction) and systolic HF (with reduced ejection fraction) based on Ejection Fraction (EF) [5]. HF prevalence is more than 5.8 million people in the USA and more than 23 million people worldwide [6]. The differences in the prevalence rates of the causes of HF can be due to the difference in studied societies, definitions, time of research (Framingham research on the heart was started in 1948). Also, the etiology of HF cannot be determined precisely by non-invasive ways [7].

The estimated rate of ischemic stroke incidence caused by heart disease is about 20%–35%, and most of the cerebral lesions with cardiac origin refer to embolism. In some studies, the most common myocardial disorder combined with stroke is myocardial infarction [8]. Another study has shown that the risk of stroke increases by 18% for every 5% drop in heart EF [9]. Abnormal heart rhythm, abnormal ECG (like inverted T wave), and pulmonary edema can be seen in patients with cerebral lesions, and these symptoms are more common in acute brain injuries [10, 11].

Because of the adverse outcome of ischemic stroke and heart failure, including disability and death, the simultaneous occurrence of these diseases can increase the severity of the outcomes. As a result, paying attention to the simultaneous occurrence of these two diseases and their early diagnosis is of particular importance. Knowing the prevalence of co-occurrence of these diseases can help decide on using more diagnostic methods for them. Based on what was discussed, this study aimed to investigate the prevalence of heart failure in patients with ischemic stroke.

Materials and Methods

In this cross-sectional study, we investigated the patients who came to the Emergency Department of Poursina Hospital with ischemic stroke diagnoses from March 2015 to March 2016, and their data were recorded in the hospital's archive system. In this study, 291 patients with ischemic stroke were studied.

The inclusion criteria included all patients with ischemic stroke diagnosis in their files who came to Poursina Hospital in Rasht City from March 2015 to March 2016. The exclusion criteria were incomplete Electrocardiogram (ECG) findings, unchecked EF, and incomplete medical records. The checklist included questions like age; sex; underlying diseases, including Diabetes Mellitus (DM), Hypertension (HTN), Hyperlipidemia (HLP), history of heart disease; and death during hospitalization completed based on patients' records.

The patients' ECG records during hospitalization were checked, and their EF and Diastolic Left Ventricular Dysfunction (DLVD) were recorded as criteria for systolic heart failure and diastolic heart failure, respectively. EF is subdivided as follows [12]: normal, more than 55%; mildly abnormal, 45%-54%; moderately abnormal, 30%-44%; and severely abnormal, less than 30%. Diastolic dysfunction in echocardiography is also subdivided into four groups: grade 0 (normal), grade 1 (dilatation disorder), grade 2 (pseudo normalization), grade 3 (reversible or irreversible restrictive disorder) [1].

Systolic heart failure is defined as a condition in which the heart fails to discharge its contents adequately. Diastolic heart failure is a clinical syndrome characterized by the symptoms and signs of heart failure, a preserved EF, and abnormal diastolic function [13]. The collected data were entered into SPSS v. 22 (IBM Corp., Armonk, NY, USA) for statistical analysis. The data were analyzed using descriptive statistical methods, estimating mean and frequency, and the Chi-square test for analytical analysis. We considered a P-value below 0.05 as significant.

Results

In this study, we investigated 291 patients' files. Of them, 157 cases (54%) were male, and 134 cases (46%) were female, and their mean age was 61.68 years. Also, 253 cases had the underlying diseases (87.2%), which the most common were HTN (70.4%), and DM (31.1%). The others had HLP and stroke (26.5%) and a history of heart disease (20.3%).

Systolic heart failure

Systolic heart failure prevalence was 59.8%. Severely abnormal systolic heart function was seen in 28 cases (9.6%), 45 cases with moderately abnormal systolic heart function (15.5%), 101 cases with mildly systolic heart function (40.2%), and 101 healthy cases (40.2%) (Table 1).

Diastolic heart failure

In the study of diastolic HF prevalence, we found that 44.3% of cases (129 patients) had no diastolic HF, and 55.6% had diastolic HF. In the study of diastolic HF prevalence with respect to gender, the normal findings were observed in 71 men (45%) and 58 women (43.3%). Regarding the prevalence of diastolic HF with respect to the underlying diseases, diastolic HF was observed in 148 patients (58.5%) with underlying disease and 14 patients (37.8%) without underlying disease. Concerning the prevalence of diastolic HF with respect to mortality, it was observed in 36 patients who passed away during hospitalization (Table 2). Grade 0: Normal, Grade 1: Dilatation disorder, Grade 2: pseudo normalization, Grade 3: reversible or irreversible restrictive disorder.

Discussion

In the present study, the prevalence of heart failure in acute ischemic stroke patients was studied. Based on the findings, the average age of the study patients was 61.68 years. In this study, 54% of patients were male and 46% female. Although gender distribution does not matter in ischemic stroke prognosis, based on geographical locations and influential environmental risk factors, the gender distribution is different in various studies.

Among all of the stroke patients in our study, 65.7% had HF with preserved Ejection Fraction (HFpEF), and 59.8% had HF with reduced Ejection Fraction (HFrEF) (based on patients' EF). Golipour et al. investigated echocardiography findings in patients with acute cerebrovascular damages. They found that 14% of patients had systolic dysfunction, and 18% had diastolic dysfunction. About 17% of patients had less than 40% EF [14] which in our study, 25.1% of patients had EF less than 45% in systolic HF. This difference could be because of a different definition of abnormal EF percentage. So that in our study, the prevalence of HF in patients with

Table 1. Frequency of systolic heart failure in patients with ischemic CVA

Variables		EF Classification, No. (%)				
		Severely Abnormal (≤30%)	Moderately Abnormal (30-44%)	Mildly Abnormal (45-54%)	Normal (≥55%)	P
Gender	Male	21 (13.4)	24 (15.3)	45 (28.7)	67 (42.7)	0.03
	Female	7 (5.2)	21 (15.7)	56 (41.8)	50 (37.3)	
Underlying disease	Yes	24 (9.5)	42 (16.6)	92 (36.4)	95 (37.5)	0.01
	No	4 (10.8)	3 (8.1)	9 (24.3)	21 (56.8)	
Death during hospitalization	Yes	5 (13.9)	9 (25)	14 (38.9)	8 (22.2)	0.01
	No	23 (9)	36 (14.1)	87 (34.1)	109 (42.7)	
Total		28 (9.6)	45 (15.5)	101 (34.7)	117 (40.2)	-

Table 2. Frequency of diastolic heart failure in patients with ischemic CVA

Variables		Left Ventricular Diastolic HF, No. (%)				
		Grade 0	Grade 1	Grade 2	Grade 3	P
Gender	Male	71 (45.2)	78 (49.7)	4 (3)	2 (1.3)	0.8
	Female	58 (43.2)	72 (53.7)	6 (3.8)	0 (0)	
Underlying disease	Yes	105 (41.5)	136 (53.8)	0 (0)	2 (0.8)	0.04
	No	23 (62.2)	14 (37.8)	10 (4)	0 (0)	
Death during hospitalization	Yes	26 (72.2)	8 (22.2)	2 (5.6)	0 (0)	0.01
	No	103 (40.4)	142 (55.7)	8 (3.1)	2 (0.8)	
Total		129 (44.3)	150 (51.5)	10 (3.4)	2 (0.7)	-

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ischemic stroke is more compared to similar studies. We consider EF less than 55% as an abnormal EF. But, in similar studies such as in Golipour et al. study, an abnormal EF was considered below 40%.

Also, similar studies showed that almost 10% to 24% of stroke patients have HF, and it seems that HF is the cause of stroke in 9% of patients [15, 16]. Based on the Framingham study, the risk of ischemic stroke in patients with HF is 2-3 times more than in patients without HF [17]. Lip et al. in a large and real-world group study, found that the ischemic stroke prevalence was high 30 days after HF diagnosis [18].

Also, in our study, most of the HFrEF prevalence is related to EF 45%-54%, and EF less than 30% is less common (9.6%). Patrick et al. showed that EF less than 50% increases the risk of stroke. However, this is not shown in all studied groups frequently. The decrease in EF in any degree could be a substitute for atherosclerotic cerebrovascular. In these patients, the common vascular risk factors may be more critical than EF. There is no evidence to support that EF less than 33% is a severe stroke risk factor [19].

According to our results, among men, 57.3% had HFrEF, and 54.8% had HFpEF, and among women, 62.7% had HFrEF, and 56.7% had HFpEF. So in our study, the prevalence of HF was a little more in women with ischemic stroke. Similar studies showed more HFrEF in men and more HFpEF in women [3]. In Dries et al.'s study, the risk of ischemic stroke with HF was a little more in men than women [20]. However, the left ventricular dysfunction may be a more dangerous risk factor for stroke in women [20].

In our study, the most common underlying diseases were HTN (70.6%), DM (31.1%), HLP, and history of stroke (26.5%). About 62.4% of patients had HFrEF, and 58% of patients had HFpEF with underlying diseases. This result confirmed different studies which showed HTN, heart disease, atherosclerosis, DM, HLP, and past history of stroke are risk factors for ischemic stroke [21-23]. The high prevalence of these underlying diseases in patients with HF also could show the incidence of these diseases together to cause a stroke.

Studies show that HTN is the cause of 60% of strokes [8, 24] which confirms the high prevalence of HTN in our study as a serious risk factor. Among the studied patients, 36 cases (12.4%) passed away during hospitalization. Of these 36 patients, 28 cases (77%) had HF. Also, among 255 patients who survived, 146 cases (57.2%) had HF, which shows that HF in patients with ischemic stroke will raise the mortality rate. Of course, this rate is not statistically significant. This finding might be because so many patients were removed from the study as they were critically ill, and no echocardiography was performed for them (because of our exclusion criteria). The mortality rate during hospitalization in the two groups with and without diastolic dysfunction was significant.

Conclusion

Based on the findings, more than half of the patients with ischemic stroke also have heart failure, and their simultaneous occurrence can endanger the patient's life. Therefore, it is recommended that the patient be evaluated and treated for heart failure when faced with an ischemic stroke.

Ethical Considerations

Compliance with ethical guidelines

This study was approved by Guilan University of Medical Sciences (Code: IR.GUMS.REC.1395.44). All study procedures were done in compliance with the ethical guidelines of the Declaration of Helsinki, 2013.

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Authors' contributions

Conceptualization: Seyyed Mahdi Zia Ziabari; Methodology: Seyyed Aboozar Fakhr Mousavi; Investigation, writing the original draft, review, and editing: Seyyedd Mahdi Zia Ziabari and Maryam Naser Alavi; Resources: Rasoul Tabari-Khomeiran, Maryam Ghasemi, and Zahra Shokri Bafrajard; Supervision: Amir Noyani.

Conflict of interest

The authors declared no conflict of interest.

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