

Association between left atrial enlargement and the incidence of stroke in patient with non-valvular atrial fibrillation

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Abstract

Objective: Increased left atrial diameter (LAD) is associated with the risk of thromboembolism in non-valvular atrial fibrillation (NVAf) patients. The present study was done to evaluate the correlation between LAD enlargement and stroke in NVAf patients.

Materials and Methods: This was a hospital based prospective observational study conducted among 120 atrial fibrillation patients. The patients were divided into two groups; Cases (n=60), NVAf patients with stroke and Controls (n=60) NVAf patients without stroke.

Results: There was no significant difference in the age, sex, BMI, alcohol intake and smoking among the cases and controls. Majority of the patients were in the age range between 71-80 years. Further, M mode anteroposterior dimension of the left atrium, left Atrial dimension in anteroposterior diameter by parasternal approach was significantly higher in cases as compared to control ($p < 0.05$). Based on the cut-off points, in M-mode, 86% of patients in case showed increased left atrial anteroposterior diameter as compared to control only 20% showed increased LAD ($p < 0.05$).

Conclusion: Thus increased LAD is a significant predictor of thromboembolic events in patients with non valvular atrial fibrillation.

Keywords: non valvular atrial fibrillation, left atrium diameter, stroke, cardiovascular disease

Introduction

Atrial fibrillation (AF) is the most frequently encountered arrhythmia in clinical practice [1]. The incidence and prevalence of AF are increasing globally. Based on data from the FHS (Framingham Heart Study), the prevalence of AF increased 3-fold over the last 50 years [2]. The Global Burden of Disease project estimated a worldwide prevalence of AF around 46.3 million individuals in 2016 [3]. The left atrium is a predilection site for cardiac thrombosis. Left atrial enlargement (LAE) is suggested to be closely associated with left atrial thrombosis in research of patients with AF [4]. Previous studies shows that AF elevates the risk of thromboembolism conditions like stroke and systemic embolism, but this risk is not solely depend on AF but might be also due to various stroke risk factors [5]. Further, these clinical risk factors are used to formulate clinical risk stratification schemes, such as CHADS₂ and CHA₂DS₂-VASc scores [6, 7]. Mounting studies reveals that there is a marked correlation between LAE and ischemic stroke [8, 9]. Earlier reports shows that mild LAE is associated with atherosclerotic stroke and strong LAE increases the risk of cardioembolic stroke (Shaikh, *et al.*, 2013). Many recent studies show that there is a significant association between recurrent ischemic stroke and LAE [10, 11]. Globally, transthoracic echocardiography is the widely used technique for the evaluation of left atrial structure and function as well as the left atrial diameter. In this backdrop, the present study was carried to evaluate to compare the diameter of Left Atrium in AF patients with and without thromboembolic events. Further, the correlation between left atrial size and

thromboembolic events in patients with AF of non valvular origin was also evaluated.

Materials and Methods

This was a hospital based prospective observational study conducted among 120 Atrial fibrillation patients diagnosed on ECG, categorized as valvular (Mitral Stenosis and Prosthetic valve) or non valvular origin with help of 2D Echocardiography. Patients of non valvular atrial fibrillation with thromboembolic events were designated as case group and without thromboembolic events were designated as controls. The study was conducted for a period of 18 months.

Inclusion criteria

Patients of age above 18 years, diagnosed with atrial fibrillation on ECG. Categorized as valvular (Mitral Stenosis and Prosthetic Valve) or non valvular origin with help of Echocardiography. Patients of non valvular Atrial Fibrillation with Thromboembolic events in case group. Patients of non valvular Atrial Fibrillation without Thromboembolic events in control group.

Exclusion criteria

Patients with age < 18 years, diagnosed with other causes of arrhythmias, having valvular Atrial fibrillation, pregnant females and patients with dementia were excluded from the study. ECG and 2D Tran-Thoracic Echocardiography was done in both the group to evaluate the left Atrial size (Anterior-Posterior diameter of Left Atrium in M-Mode and

2 chamber view of 2D Echo, 4 chamber view with Superior-Inferior and Transverse diameter). Size (Dimensions) of Left atrium were evaluated and compared in both the groups.

CHADS2-VASc scoring was done to assess the risk of developing thromboembolic events in AF patients. Thromboembolic events were defined as patients having stroke and vascular ischemic diseases which was confirmed by MRI or CT scan of brain.

Correlation of thromboembolic events and left atrial enlargement was done in patients of AF.

Results

The present study was conducted to evaluate the correlation of left atrial size and thromboembolic events in patients with non valvular atrial fibrillation. The atrial fibrillation patients with thromboembolic events were designated as cases and without thromboembolic events were designated as controls. In this study male preponderance was observed, with 66.7% in cases and 75% in controls and found to non-significant. Majority of the patients in cases (29.8%) and controls (33.4%) were in the age range between 71-80 years. The age distribution between the cases and controls was found to be non-significant. The BMI was normal in most of the patients in cases and controls (50% and 60%; $p>0.05$). The most

common clinical finding in this study was congestive heart failure 28.3% vs 23.3%, cardiomyopathy 18.3% vs 11.7%, pulmonary disease 6.7% vs 5% among the cases and control and found to be non-significant. The incidence of recent myocardial infarction was high in cases (1.7%) as compared to controls (0%). Regarding echocardiographic findings, mitral valve calcification (20% vs 15%), left ventricular hypertrophy (18.3% vs. 11.7%) and left ventricular aneurysm (3.3% vs. 1.7%) was higher in cases as compared to the controls ($p>0.05$). Meanwhile, aortic valve sclerosis (40% vs. 46.7%), left ventricular dilatation (16.7% vs. 21.7%), diffuse hypokinesia (6.7% vs. 10%) and mitral valve prolapse (0% vs. 1.7%) was higher in controls as compared to the cases ($p>0.05$). The M mode anteroposterior dimension of the left atrium (50.32±9.77 vs. 43.48±8.50mm) and left atrial dimension in anteroposterior diameter by parasternal approach (48.45±9.99 vs. 35.72±9.26mm) was significantly ($p<0.05$) higher in cases as compared to the control. Further, superoinferior (base-to-roof) dimension in the apical four-chamber view (52.77±9.48 vs. 44.70±9.59mm) and the transverse dimension in the apical fourchamber view (50.32±9.77 vs. 43.48±8.50mm) were significantly higher in cases as compared to the controls. The results were shown in table 1.

Table 1: Echocardiographic measurements of AF patients with and without stroke

Echocardiographic Measurements	Cases (n=60) Mean±SD	Controls (n=60) Mean±SD	P value
AP (M-mode)	50.32 ±9.77	43.48± 8.50	$P<0.05$
AP (parasternal)	48.45 ±9.99	35.72± 9.26	
SI (four-chamber)	52.77 ±9.48	44.70± 9.59	
Transverse (four chamber)	46.55± 10.69	33.35 ±8.86	

In this study, there was a strong association between the M-mode anteroposterior diameter of the left atrium and the left atrium diameter as measured bytwo-dimensional

echocardiography in all three views. The results were shown in table 2.

Table 2: Inter-correlations between Left Atrial

Echocardiographic Measurements	AP (M mode)	AP (parasternal)	SI (four chamber)	Transverse (four chamber)
AP (M-mode)	99.13	-	-	-
AP (parasternal)	65.67	99.13	-	-
SI (four-chamber)	63.14	61.17	99.13	-
Transverse (four chamber)	61.17	85.57	62.18	99.13

Echocardiographic measurements of patient

The increased left atrial diameters among the cases and controls were shown in table 3. The cut points for increased diameters are as follows: AP (M-mode) >40mm; AP (parasternal) >38mm; SI (four-chamber) >53mm; transverse (four-chamber) >46mm. In the M-mode, 86% of patients in cases and 24% in controls displayed increased anteroposterior diameter of the left atrium and it was found to be significant ($p<0.05$).

Table 3: Increased Left Atrial Diameters among the cases and control

Echocardiographic Measurements	Cases (%)	Controls (%)	P value
AP (M-mode)	86	24	$p<0.05$
AP (parasternal)	89	18	$p<0.05$
SI (four-chamber)	56	18	$p<0.05$
Transverse (four-chamber)	52	12	$p<0.05$

Discussion

The present study correlates the left atrial size and the incidence thromboembolic events of in patients diagnosed with non valvular atrial fibrillation. Earlier studies showed the significant association between LAD enlargement and AF progression, recurrence and mortality events [12].It is contrary, whether LAD enlargement increases the risk of thrombosis in AF patients. In a study done by Olshansky *et al.* [13] and Broughton *et al.* [14] there is no significant association between LAD enlargement in AF patients and the subsequent risk of thromboembolism. So, in this study we have evaluated the correlation between LAD enlargement in non valvular AF and stroke.

In our study, non valvular AF patients are classified as with and without thromboembolic events and considered as cases and controls respectively. In both cases and control majority of the patients are in age group between 71-80 years. Similar to the present study, Ogata *et al.* [15] reported that, in non-valvular AF patients with a long-term risk of stroke

recurrence the mean age of the patients is 77.8 ± 10.2 years. In our study, there is no significant gender wise variation among the cases and controls which is line with the study conducted by Hamatani *et al.* [16].

We reported no significant variation in the BMI, smoking and alcohol intake among the cases and controls. In contrast to our study, Tiwari *et al.* [17] reported that stroke patients had hypertension, incidence of CHD, diabetes, high BMI as well as renal dysfunction. Further, in our study, AF stroke patients showed higher incidence of congestive heart failure, cardiomyopathy, pulmonary disease and recent myocardial infarction as compared to AF patients without stroke. This is accordance to the study done by Leung *et al.* [18] where the stroke patients displayed higher prevalence of hyperlipidaemia, hypertension, and coronary heart disease as that of the patients without stroke.

In the current study AF stroke patients displayed high incidence of mitral valve calcification, left ventricular hypertrophy and left ventricular aneurysm as compared to the AF patients without stroke which is similar to the Leung *et al.* study [18]. In our study, the M mode anteroposterior dimension of the left atrium (50.32 ± 9.77 vs. 43.48 ± 8.50 mm) and left Atrial dimension in anteroposterior diameter by parasternal approach (48.45 ± 9.99 vs. 35.72 ± 9.26 mm) was significantly ($p < 0.05$) higher in cases as compared to the control. Further, the superoinferior (base-to-roof) dimension in the apical fourchamber view (52.77 ± 9.48 vs. 44.70 ± 9.59 mm) and the transverse dimension in the apical four-chamber view (50.32 ± 9.77 vs. 43.48 ± 8.50 mm) was significantly ($p < 0.05$) higher in cases as compared to the control. Similar to our report, Mostafa *et al.* [19] study showed that based on 2D Echo atrial diameter is enlarged in AF stroke patients (40.2 ± 2.5 mm Vs 35.1 ± 3.6 mm) as compared to AF patients without stroke.

In the M-mode, 86% patients of in case and 24% patients in control, the patient's had an enhanced diameter in the anteroposterior of the left atrium and it was found to be significant ($p < 0.05$). Our study is in line with the study done by Ogata *et al.* where LAD displayed significant accuracy in the prediction of repeated stroke in prospective cohort trials, even though the CHA2DS2-VASc score indicators (i.e., age, ethnicity, asthma, chronic heart failure, diabetes mellitus, and vascular diseases) were used in the baseline model.

Conclusion

Thus the outcome of the present shows that, non valvular atrial fibrillation (NVAf) with thromboembolic events as compared to patients of NVAf without thromboembolic events had a larger left atrium diameter (LAD). Hence LAD enlargement can be taken as an independent marker for assessing the risk of thromboembolic events in patients of NVAf. Therefore, it is recommended that patients of NVAf with anteroposterior (AP) diameter greater than 40 mm in M-Mode and 38 mm in parasternal view of 2D Echo should be started on prophylactic anticoagulation therapy for prevention of thromboembolic events.

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