

Predisposing Factors of Atrial Fibrillation and Its Association with Left Atrial Dimension: A Cross-sectional Study

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Abstract

Background: Atrial fibrillation (AF) is defined as nonstandard heart rhythm characterized by speedy and asymmetrical beating. Rheumatic heart disease is considered as the foremost reason of AF. Electrocardiography (ECG) and echocardiography (ECHO) are precious noninvasive techniques for quantitatively deciding the size of the left atrium.

Materials and Methods: A cross-sectional study was done on 100 patients, who presented with AF. Chest X-ray, ECG, and ECHO of the patients were done and the findings were evaluated.

Results: AF was common in patients with mean age of 59.6 years. The male and female ratio in the study was 2:3. The most common etiology of AF was found to be rheumatic heart disease (36%), followed by hypertension (25%), and coronary artery disease (19%). In ECG, 85% of patients with AF showed absent P wave which was the most common finding followed by a variation in R-R interval (72%). Coarse fibrillatory waves (58%) were common than fine (44%). Stage I (41-50 mm) left atrial (LA) dilatation was most common found in AF followed by Stage II (51-60 mm). Stage III was least common presentation.

Conclusion: Rheumatic heart disease is the most common underlying etiology of AF in India, and Stage I and Stage II LA dilatation are more prone to develop fibrillation.

Key words: Atrial fibrillation, Echocardiography, Electrocardiography, Left atrial dilatation

INTRODUCTION

Atrial fibrillation (AF) is defined as nonstandard heart rhythm characterized by speedy and asymmetrical beating. Most of the patients are symptomless, but some have complaints of palpitations, dyspnea, chest discomfort, and episodes of fainting. The most common risk factors associated with AF are hypertension, coronary artery disease, valvular heart disease, congenital heart disease, and many others. In developing countries like India, rheumatic fever is usually linked to AF.¹

AF is a commonly affected heart rhythm and hazardous too. In developed countries such as North America and Europe, the incidence of disease has increased from 0.4-1% in 2005 to 2-3% in 2014. Whereas in developing countries like India about 0.6% males and 0.4% females are affected by this disease. Some studies suggest that incidence of disease also depends on the age group of the patients (0.12% in <50 years age, 5% in 60-70 years of age, and 15% in >80 years of age).^{2,3}

The association of AF with a genetic cause has also been established. Four types of mutations in the genes, which leads to disease have been reported. Familial AF is a monogenic disease.^{1,4}

AF is also common after cardiac surgeries and in post-myocardial infarction settings but is mostly of limited duration. It is also linked with some non-cardiac circumstances leading to reversible short duration AF such as hyperthyroidism, alcohol consumption, major surgery,

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pulmonary conditions causing hypercapnia. Different studies advocate that condition, which mainly leads to AF, are rheumatic heart disease, coronary artery disease, and hypertension.⁴⁻⁶

Most studies favor that rheumatic heart disease is the foremost reason of AF. Some suggest that AF occurs due to the involvement of left atrium by rheumatic fever. Whereas other studies noted that the patients with AF develops left atrium dilatation.¹⁻⁸

Age is also considered as an important feature leading to the progress of AF. Echocardiography (ECHO) is a precious noninvasive technique for quantitatively deciding the size of left atrium.⁵

The current study is done to weigh up the relationship between left atrial (LA) dilatation and presence of AF in patients suffering from different diseases.

MATERIALS AND METHODS

A cross-sectional study was done on hundred patients who presented with AF from March 2012 to April 2015. Informed consent was taken from all the patients. A detailed history of patients was taken and thorough general and systemic examination was done. Basic investigations, such as hemogram, serum electrolytes, renal function tests, and chest X-ray, were done. All the patients underwent electrocardiography and ECHO.

Chest X-ray: X-ray images are used to diagnose the conditions of heart and lung. The PA view of chest was done, and following features were noted:

1. Cardiomegaly
2. LA enlargement
3. Pulmonary congestion.

Electrocardiogram (ECG): A 12 lead standard ECG was used in all the patients and features of AF were observed and recorded. If ECG showed irregular baseline, missing P-waves, R-R interval variation and existence of fibrillatory "F" waves were recorded.

ECHO: All the patients underwent ECHO. As per the recommendations of American Society of ECHO 2D echo-guided M-mode was used to measure the atrial size. LA enlargement is defined as the measurement of LA dimension more than 40 mm. It also helps in understanding the reason of AF (Table 5).

We graded the LA size according to following criteria:

- Normal (LA dimension <40 mm)
- Stage I (LA dimension 41-50 mm)

- Stage II (LA size 51-60 mm)
- Stage III (LA size >60 mm).

RESULTS

In this study, the range of age of patients taken under evaluation was 10-90 years with the mean age of 59.6 years. Male and female ratio in the study was 2:3 (males 40, females 60) (Table 1).

Most common etiology of AF in our study was found to be rheumatic heart disease (36%), followed by hypertension (25%), and coronary artery disease (19%). Less common etiological factors for AF were noncardiac (10%) and congenital disorders (7%) (Table 2).

In ECG, 85% of patients with AF showed absent P wave, which was the most common finding followed by a variation in R-R interval (72%). Coarse fibrillatory waves (58%) were common than fine (44%). The more patients showed left ventricular hypertrophy (23%) as compared to left one (21%). Infarction, ischemic changes and axis deviation were also present (Table 3).

In this study, 19% of patients showed no significant findings in chest X-ray. The most common finding was cardiomegaly (72%) and followed by enlarged left atrium (59%) (Table 4).

Stage I (41-50 mm) LA dilatation was most common found in AF followed by Stage II (51-60 mm). Stage III was least common presentation (Figure 1).

Table 1: Distribution of cases according to age and sex

Age of patients (years)	n (%)		
	Male patients	Female patients	Total patients
<20	2 (5)	5 (8.3)	7 (7)
20-40	8 (20)	11 (18.3)	19 (19)
40-60	14 (35)	20 (33.3)	34 (34)
60-80	12 (30)	19 (31.6)	31 (31)
>80	4 (10)	5 (8.3)	9 (9)
Total	40 (100)	60 (100)	100 (100)

Table 2: Diseases associated with AF

Associated disease	Percentage
Rheumatic heart disease	36
Hypertension	25
Coronary artery disease	19
Congenital heart disease	7
Noncardiac etiology	10
Others	3

AF: Atrial fibrillation

Table 3: Findings of ECG in patients of AF

ECG presentation	Percentage
Absent P wave	85
R-R interval variation	72
Fibrillatory waves (coarse)	58
Fibrillatory waves (fine)	44
Left ventricular hypertrophy	23
Right ventricular hypertrophy	21
Infarction changes	9
Ischaemic changes	8
Left axis deviation	9
Right axis deviation	10

ECG: Electrocardiography, AF: Atrial fibrillation

Table 4: Findings of chest X-ray in patients of AF

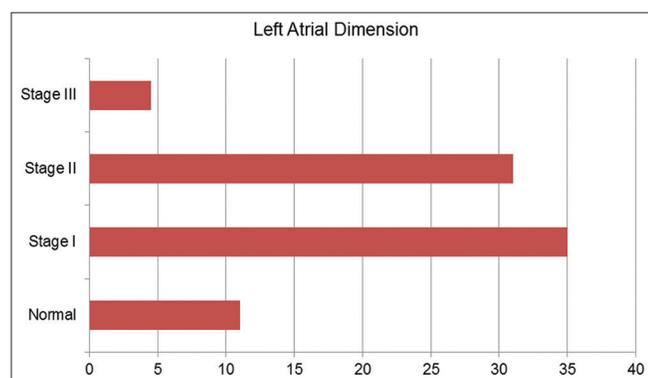
Chest X-ray findings	Percentage
No significant finding	19
Cardiomegaly	72
Enlarged left atrium	59

AF: Atrial fibrillation

Table 5: Findings of ECHO in patients of AF

ECHO measurement of left atrium	Percentage
Normal	11
Stage I	35
Stage II	31
Stage III	23

AF: Atrial fibrillation, ECHO: Echocardiography

**Figure 1: Percentage of different dimensions of left atrial enlargement in atrial fibrillation**

DISCUSSION

According to many studies, the incidence AF was found to be frequent in >45 years of age group. In another study by Arthur *et al.* also supported that AF is more prevalent (89%) in patients >40 years of age. In our study, the mean age of 100 patients who were diagnosed AF was 59.6 years. Supporting many other researches disease was more common in females as compared to males (M: F ratio 2:3).¹

Regarding etiology of AF, a study by Lévy *et al.* suggested that hypertension (56.4%) is generally the cause of AF.

After that rheumatic heart disease (31%), coronary artery diseases (26.6%), hypertrophic cardiomyopathy (18.5%) were considered as the cause of this disease.⁶ Another study advocated that rheumatic heart disease was responsible for AF in 25% of female and 8% of male patients admitted. However in contrast to these researches, rheumatic heart disease (36%) was considered as mainly accountable for AF in our study. Hypertension (25%) was found to be second most common etiology of this disease.⁹

Some studies suggested that the occurrence of AF depends on the size of the left atrium. Cardiac patients with LA dimension below 40 mm were not at risk of AF but those in which the measurements exceeded 40 mm, 54% of patients developed AF.¹⁰ Kulkarni *et al.* recommended that 97.14% rheumatic heart disease patients with LA size of >40 mm developed AF.⁷ Similarly, Lévy *et al.* also supported our finding that patients with mean LA size of 45.8 ± 8.6 mm developed AF.⁶ Thus, we conclude that there is a strong co-relation between incidence of atrial fibrillation and LA dilatation. If LA size exceeds 40 mm then it is an alarming feature for the patient. Currently, a study conducted by Kulkarni *et al.* in India found that 96.55% patients with LA size of >40 mm (mean = 55.58 mm) progress to develop fibrillation.⁷

Most of the studies support that in ECG (absent P wave and R-R interval variation) and in ECHO (cardiomegaly and enlarged left atrium) are the features which are mostly present in patients with AF.¹¹⁻¹⁶ The findings of our study are comparable to these results.

CONCLUSION

AF was frequent in >59 years of age group and is mostly associated with LA enlargement. The most common underlying reason for LA enlargement was rheumatic heart disease, hypertension, coronary artery disease, congenital heart disease. For diagnosis purpose absence of P waves, variation in R-R interval, fine and coarse fibrillatory waves are common findings and in ECHO cardiomegaly and LA dilatation are common features.

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