

ECG and Echo Measures of AF – An Review

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Keywords

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Abstract

RHD accounts for between 35% - 45% of all cardiac incidents in India. It's the leading cause of atrial fibrillation in the first place. One of the most prevalent persistent arrhythmia, atrial fibrillation (AF) is a leading cause of death, hospitalizations, and overall healthcare costs. There are an estimated 2.3 million Americans with AF right now, and that number is projected to more than double, to 5.6 million, by the year 2050. Prevalence estimates range from around 1% in those aged 60-65 to between 8% and 10% in those aged 80 and more. Six percent to ten percent of patients over the age of 70 have it. The incidence is likewise greater among whites than among blacks, and among males than among women. It is also linked to a 2x increased risk of death from any cause and a 5x increased risk of stroke. It's characterized by a fast and/or irregular heartbeat. Individuals may have a wide range of AF symptoms. While some individuals with AF have symptoms, many others experience none at all. Anxiety and irregular fluttering are other frequent symptoms of intermittent AF, in addition to the most noticeable sign, palpitations. Exercise intolerance and dyspnea may occur in people with an unregulated

ventricular response, and are often associated with congestive heart failure (CHF). The riskiest consequence of atrial fibrillation is thromboembolism.

1. Introduction

Lone atrial fibrillation occurs when the heart's electrical system is abnormal but the heart's structure is otherwise normal. Nevertheless, atrial fibrillation is more common when other risk factors, such as cardiovascular disease, are present. Rheumatic mitral stenosis stands out as the most common cause. In the industrialized world, the leading causes of death are hypertension (HTN) and coronary artery disease (CAD). Diseases of the heart's valves, such as diabetes mellitus, congestive heart failure, and myocardial infarction, are further causes for concern (MI). There is a weak association between clinical hyperthyroidism and new-onset atrial fibrillation. Rheumatic heart disease, high blood pressure, and congenital heart disease (CHD) are all significant contributors in third world nations. If an electrocardiogram (ECG) is taken at the time of the arrhythmia, it may be sufficient for a diagnosis of AF. Nevertheless, since AF is typically intermittent, a single normal ECG reading does not rule out the possibility of the diagnosis. When AF is suspected but an initial ECG is normal, more monitoring is required.

Echocardiography should be performed in all patients with AF. Echocardiography has an important role in the risk stratification and management of AF. It helps in patient selection, assessing candidates for ablation by providing anatomic and hemodynamic information, intraprocedural guidance, detection and monitoring of complications. The transthoracic echocardiography (TTE) helps in rapid assessment of anatomy and function. The transesophageal echocardiography (TEE) helps in identifying a thrombus or risk associated with it. Intracardiac echocardiography is mostly useful during the ablation procedure.

This research was carried out to evaluate the symptoms and underlying potential factors (cardiac & non-cardiac) of AF since the risk of severe or life-threatening complications is small if AF is recognized and treated early.

2. Objectives

a) To determine how common cardiac issues are among those who have been diagnosed with atrial fibrillation.

- b) Examine the many ways in which atrial fibrillation manifests clinically.
- c) Examining ECG and echocardiographic data from people diagnosed with atrial fibrillation.

3. Review of Literature

Disorganized, fast, and irregular atrial activation, lack of atrial contraction, and a ventricular rate governed by AV nodal conduction are the hallmarks of atrial fibrillation (AF). Mortality, hospitalizations, and overall healthcare costs all rise dramatically when AF is present. Prevalence estimates range from around 1% in those aged 60–65 to between 8% and 10% in those aged 80 and more. The incidence is likewise greater among whites than among blacks, and among males than among women. It is also linked to a 2x increased risk of death from any cause and a 5x increased risk of stroke.

Individuals may have a wide range of AF symptoms. While some individuals with AF have symptoms, many others experience none at all. Anxiety or irregular fluttering are also frequent symptoms of intermittent AF, in addition to the most noticeable sign, palpitations.

Prominent symptoms of AF are:

- Palpitations
- Breath shortness
- Intolerance of Exercise
- Pain in Chest

In younger patients: Chest pain and palpitations
Elderly patients experience fatigue and shortness of breath
Many patients often have no symptoms (silent AF), especially the elderly. It comes to light during routine follow ups.

4. Material and Methods

This research is purely observational and makes no attempts to change anything. The research was done between October 2018 and March 2020 at the inpatient department of the tertiary care, teaching institution at Krishna Institute of Medical Sciences and Research Center in Karad's Department of General Medicine.

Total patients Enrolled:

A total of one hundred thirty (130) patients consulted in Medicine OPD and admitted in wards of the tertiary care hospital were enrolled in the study.

Inclusion criteria:

- a) All consenting patients more than 18 years of age.
- b) Diagnosis of atrial fibrillation confirmed with 12-lead ECG.

Exclusion criteria:

- a) Patients less than 18 years of age.
- b) Non-consenting patients.

All enrolled patients for study underwent following investigations:

a) Haematology

- 1. Automatic three-part cell analyzer for hemoglobin.
- 2. Completely automated three-part cell analyzer for determining total leukocyte count
- 3. Counting platelets using a fully automated 3-part cell analyzer. Nihon Kohden's automated 3 part analyser was used to measure all CBC parameters. (It's the MEK 6420P)
- 4. Stago analyser prothrombin time (PT/INR) (Model number- BT3305B301)

Biochemistry

- 1. Evaluation of Urea in Blood Using the Urease-GLDH Method
- 2. Modified JAFFE's Method for Measuring Creatinine in Serum
- 3. Measurement of Sodium in Serum using an Ion Selective Electrode
- 4. Measurement of Potassium in Blood Serum using an Ion Selective Electrode
- 5. Hexokinase-mediated reaction at random in the blood
- 6. Arsenazo calcium in serum
- 7. Xylidyl blue technique for measuring magnesium in serum
- 8. Measurement of Phosphorus in Blood Using the UV Molybdate Technique

- 9. Calorimetry 10 Serum T3, T4, and TSH via immune-enzymometric assay (automated) on a TOSOH machine for testing of liver function.
- 10. Transasia's EM 360 biochemistry analyzer was used to measure all variables.

Echocardiographic Examination:

Resting transthoracic 2-dimensional echocardiography and Doppler imaging were used to evaluate diastolic function of the left ventricle in all patients. The echocardiographers were kept in the dark about the research to prevent any potential bias in the results. Harmonic imaging mode on an echocardiography machine with a multi-frequency probe (ranging from 5 to 1 MHz) was used to carry out the procedure. Throughout the period of three consecutive cardiac cycles, an investigator who was blind to any other factors took all of the echocardiographic readings.

5. Results and Discussions

This observational study was conducted on one hundred thirty patients of atrial fibrillation.

Frequency distribution according to age

Table-1: Age distribution of the study participants (n=130)

Agedistribution(years)	Number	Percent
20-40	12	9.2
41-60	30	23.1
61-80	75	57.7
>81	13	10.0
Total	130	100.0

Degree of freedom=8

Patients' ages ranged from 14.66 to 64.42 years on average in our research (Range 21-95 years). Patients between the ages of 61 and 80 made up the largest demographic, with 75 cases observed (56.7%), followed by those aged 41 to 60 (30 cases, 23.1%), those aged 81 and more (13 cases, 10%), and those aged 20 to 40 (12 cases, 9.2%).

Frequency distribution according to Gender

Table-2: Gender distribution of the study participants (n=130)

Gender distribution	Number	Percent
Male	72	55.4
Female	58	44.6
Total	130	100.0

“Majority of the participants were males (55.4%) and rest were females (44.6%). The male: female ratio was 1.2:1”

Comparative frequency distribution according to Age and Gender

Table-3: Age and Gender distribution of the study participants (n=130)

Age distribution (years)	Male		Female	
	Num-ber	Per-cent	Num-ber	Per-cent
20-40	2	2.8	10	17.2
41-60	16	22.2	14	24.1
61-80	47	65.3	28	48.3
>81	7	9.7	6	10.3
Total	72	100.0	58	100.0

Majority, 47 (65.3%) , of the 72 male patients , belong to the 61 to 80 years age group and least being , 2 (2.8%) from the 20 to 40 years age group. While ,28 (48.3%), of the 58 female patients belong to 61 to 80 years age group and least being ,6 (10.3%) from the age group more than 81 years age.

Frequency distribution of participants according to presenting symptoms

Table-4: Presenting symptoms in study participants (n=130)

Presenting symptoms	Number	Percent
Palpitations	80	61.5
Dyspnoea	127	97.7
Chest Pain	79	60.8
Pedal edema	84	64.6

Cough	17	13.1
Hemoptysis	3	2.3
Abdominal Pain	2	1.5
Syncopal attacks	1	0.8
Hepatomegaly	5	3.8

The majority of patients presented with dyspnea (97%), followed with pedal oedema (64.6%), palpitations (61.5%), chest discomfort (60.8%), coughing (13.1%), hepatomegaly (3.8%), haemoptysis (2.3%), stomach pain (1.5%), and syncopal episodes (0.8%).

Electrocardiograph

Twelve-lead electrocardiogram was performed. Heart rates ranged from 74 to 180 beats per minute, with 45 percent of patients having a rate of 90 to 110 bpm. All patients had a very erratic heartbeat. All patients lacked P-waves. Normal QRS complexes were inconsistent in timing and amplitude, however.

6. Discussion

Patients' mean ages were 64.42 14.66 years old in our research (Range 21-95 years). These findings are consistent with those of earlier Indian research, which found that the majority of patients were seen between the ages of 61 and 80 (75 patients, 57.7%), followed by those aged 41 to 60 (23.1%), then those aged >81 (10%), and finally those aged 20 to 40 (9.6%). Patients in a research by Vivek GC et al. had a mean age of 54.84 17.49 years (Range 30-80), with a third of them falling in the 60-79 age bracket. Sharma et al. and Gurpal Singh et al. found similar results, with a mean age of 40.0 7.0 years and 57.33 years, respectively. The Framingham heart study is the greatest evidence for chronic AF and shows that the incidence increases with age, as described by Kulkarni et al. Among those aged 50–59, the frequency of AF was 0.5%, but it increased to 8.8% in those aged 80–89. All of the patients in a study of AF caused by CAD were above the age of 50, as reported by Prakash SK and Chugh SK. A greater prevalence of AF was also identified in older age groups in the few studies conducted in western nations, where high blood pressure and coronary artery disease are key cardiac antecedents of AF. RHD is a key cardiac risk factor for AF in the Indian population.

Males made up 55.4% of the sample, while females made up 44.6%. The ratio of men to women was 0.80 to

1. According to the research conducted by Vivek GC et al., 48% of the participants were male and 52% were female. No sex-based differences in AF prevalence were discovered in the Framingham heart study. The prevalence of AF was 43% in males and 57% in women in a different research by Manyari et al. Gurpal Singh et al. found that although AF was more common in women (55%) than in males (45%), the symptoms might be different for each individual. While some individuals with AF have symptoms, many others experience none at all. Anxiety and irregular fluttering are other frequent symptoms of intermittent AF, in addition to the most noticeable sign, palpitations. Topping the list of presenting symptoms in our research was dyspnea (97.7%), followed by pedal edema (64.6%), palpitations (61.5%), chest pain (60.8%), cough (13.1%), hepatomegaly (3.8%), haemoptysis (2.3%), stomach discomfort (1.5%), and syncopal episodes (0.8%). Similarly, Vivek GC et al. found that 82% of patients had dyspnea, followed by 78% experiencing palpitations, 66% experiencing edema, 36% experiencing chest pain, 18% experiencing stomach pain, 10% experiencing hemoptysis, and 4% experiencing syncopal episodes. Gurpal Singh et al. have noticed similar signs.

While AF may occur in a heart with no structural abnormalities (lone AF), it more often occurs with other risk factors, such as cardiovascular disease. RHD accounts for between 35% - 45% of all cardiac incidents in India. It's the leading cause of atrial fibrillation in the first place.

Most of the participants in our research had a history of IHD (40.76%) or RHD (33.84%), MS (33.84%), or high blood pressure (31.53%). ADD/ADHD, PHT, TR, and AS all account for 1.5% each, while AR and COPD each account for 0.8% of cases. There was no statistically significant variation in the distribution of causes between the sexes. According to research by Vivek GC et al., RHD accounts for 50% of all occurrences of AF. Other prevalent causes include IHD and HTN (12%), HTN alone (12%), ASD (4%), cardiomyopathy (8%), COPD (6%), and thyrotoxicosis (2%). Gurpal Singh et al. found that RHD accounted for 26% of AF cases, DCM for 23%, hypertension for 14.06%, mitral valve prolapse and thyrotoxicosis for 9.37% each, IHD for 3.1%, ASD for 1.5%, digitalis toxicity for 1.5%, and lone fibrillation for 1.5%. Prakash SK, Chugh SK, et al. found a similar pattern, reporting that 91.61 percent of AF was owing to chronic

RHD and 5.94 percent to CAD. According to the Framingham Heart Study, RHD and cardiac failure are the strongest predictors of AF. In their analysis of 704 instances of AF, Davidson et al. found that atherosclerotic CVD, which includes MI, hypertensive heart disease, and CAD, accounted for 55% of the cases. Other heart conditions included chronic rheumatic heart disease (22.8%), chronic obstructive pulmonary disease (2.8%), WPW syndrome (2.6%), thyrotoxicosis (2.6%), cardiomyopathy (0.9%), MVP (0.9%), sick sinus syndrome (0.7%), myocarditis (0.6%), pulmonary embolism (0.3%), and atrial septal defect (0.3%). RHD is present in roughly 20-23% of AF patients, and ASD is the most frequent congenital heart condition documented to induce AF, according to two investigations by Levy S et al. One person with thyrotoxicosis was also mentioned. According to the Framingham Heart Study, high blood pressure is the leading cause of heart problems that might lead to atrial fibrillation.

In 90 patients, CCF was the most prevalent consequence (69.3%). One patient had DCM and 3.07% of those who were diagnosed with it died. Just 29.2% had no problems, although Vivek GC et al. said that 80% of their patients had CCF. Levy et al. found CCF in 38% of their ALFA research participants, while Sharma et al. found it in 30% of their patients. Stroke, cor-pulmonale, and superior mesenteric ischemia were among the additional problems described by a small number of other researches.

Echocardiography should be performed in all patients with AF. It helps in patient selection, assessing candidates for ablation by providing anatomic and hemodynamic information, intraprocedural guidance, detection and monitoring of complications.

Long standing HTN can lead to increase LA pressure and dilatation. This can cause AF. In this study the mean LA size was 4.50 ± 0.48 cm (Range 3.5-5.8). Most of them had LA size between 4-5 cm (71.5%), followed by >5 cm (13.8%), 3.7-4 cm (10%) and 6 (4.6%). The most common finding on ECHO was Left atrial enlargement (93.84%), followed by mitral stenosis (83.84%), LVH (47.69%), MR (22.30%), RAE (6.15%), TR (4.61%), RHD (2.30%), RVH (1.5%) DCM, AS and AR (0.8% each). ECHO was normal in 1.5% patients. **Vivek GC et al.** found that, LAE was present in 66%, chronic valvular RHD was present in 48%. The mean LA size in cases of AF was 4.122 ± 0.456 cm (Range 3cm - 5.6cm). Results from the Framingham

study showed that, with each 5 mm increment in LA dimension, increased the AF risk by 39%, 5% decrement in LV fractional shortening increased the risk by 34%, 4 mm increment in LV wall thickness increased the AF risk by 28%. Those with ≥ 2 echocardiographic abnormalities had a four-fold greater risk than those with no changes.

Henry et al in their study on patients with MVP/ Aortic valve disease/septal hypertrophy reported that, AF was rare when LA size was <44 mm(3%) and common when > 50 mm (54%). They concluded that , LA size is an important factor in the development of AF and in determining the long term result of cardioversion. **Tsang et al**, reported that, 30% increase in LA volume led to 43% increased risk of AF. **Keren et al** , also found similar results with stepwise increase in LA size causing transient and chronic AF.**Dahlöf et al** in their LIFE study on 941 hypertensive patients reported that ,enlarged LA diameter was present in 56% of women and 38% of men. Patients with enlarged LA had higher prevalence of MR , AF, LVH. They also had higher age, SBP, pulse pressure, weight, BMI, LV internal chamber dimension, strokevolume, and mass and lower relative wall thickness and EF (allP <0.05). **Kulkarni et al**, studied RHDin 65 cases found that LA size > 40 mm was present in 86.15% cases and13.86% had LA less than 40 mm. **Manyari et al**, studied atrial arrhythmias and LA size and found a significant correlation between the two.

7. Conclusion

The most prevalent type of arrhythmia seen in routine clinical practice is atrial fibrillation. Dyspnea and palpitations were the conditions most often seen presenting complaints in this research. The gender distribution of patients showed no discernible trend. The most common causes were coronary artery disease or rheumatic heart disease. Ischemic heart disease was the most prevalent finding in the individuals' electrocardiographic examination. Left atrial hypertrophy and mitral stenosis were detected during an echocardiographic examination.

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