

A Review of the Evaluation of Atrial Fibrillation through Electrocardiography and Echocardiography

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Abstract

While isolated AF may occur in a heart with no structural abnormalities, the condition is more often linked to risk factors such as hypertension or coronary artery disease. Rheumatic mitral stenosis stands out as the most common cause. In the industrialized world, the leading causes of death are hypertension (HTN) or coronary artery disease (CAD). Diabetes mellitus, congestive heart failure, valvular heart disease, and prior myocardial infarction are additional risk factors (MI). Low-incidence clinical hyperthyroidism has also been linked to new-onset atrial fibrillation. Rheumatic heart disease, high blood pressure, and congenital heart defects (CHD) are major contributors in third world nations.

1. Introduction

AF is one of the most frequent problems that arise. MS caused by rheumatic fever has been linked to AF for quite some time. With RHD, the prevalence of AF is

close to 40%. Researchers Deverail et al. found a strong correlation between age and AF occurrence. Most people had AF after the age of 40, however it was relatively rare in younger patients.

The incidence of RHD among AF patients treated by William Kannel et al. was 10.2% in males and 26.5% in women. AdellCullel et al. found that 19% of their AF patients also had RHD. Eleven percent of AF patients had RHD, according to Aberg et al. [19] Ten percent of AF patients had RHD, according to research by Eugene Rich et al. According to research by T.K. Srinivasan, RHD is quite common in India.

2. Echocardiography in AF

All patients experiencing AF should get an echocardiogram. It is useful for assessing AF risk and managing the condition. Intra-procedural guiding, complication identification and monitoring, patient selection, and hemodynamic and anatomic assessment of ablation candidates are all aided by this technology.. Some instances are:

- a) Structurally normal heart- patients more likely to have spontaneous conversion to sinus rhythm
- b) Structurally normal heart, young age, absence of clinical risk factors- relatively low risk of embolic complications.
- c) Detection of previously unsuspected cardiomyopathy or MS- less chance of spontaneous restoration of sinus rhythm and an increased chance of cardio embolic 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. 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 other frequent symptoms of intermittent AF, in addition to the most noticeable sign, palpitations. Exercise intolerance and dyspnea are symptoms of congestive heart failure that may occur in people with an unregulated ventricular response. In such cases, the ECHO may exhibit symptoms of a DCM.

AF influences systolic and diastolic function of the heart. In this study, we found that, majority of our patients had moderate LVSD (48.5%) followed by mild (40.8%) and severe (2.3%). In 11 patients (8.5%) the LV systolic function was good. Also, majority of the patients had Grade 1 DD (54.6%) followed by Grade 2 DD (36.2%) and Grade 3 DD (4.6%). No diastolic dysfunction was seen in 6 (4.6%). The mean LA size increased with severity of systolic and diastolic

dysfunction ($p= 0.001$). The data on proportion of systolic dysfunction is limited. But, many studies have shown improvement in systolic function too after ablation for AF indicating the relationship between the two. In a study by **Kosiuk et al**, they found the prevalence of LVDD as 37% in patients of AF. This is lower than our study. In another study by **Hogg et al** , the prevalence of LVDD was 30%.

3. Classification of AF

AF can be classified based on etiology or temporal pattern. It can be first ever episode or recurrent episode. The temporal classification is given below.^[13]In paroxysmal atrial fibrillation (PAF) , episodes terminate without intervention in less than 7 days (often within 24hours). Atrial fibrillation that lasts longer over 7 days or requires treatment, including such cardioversion, to return the heart to normal rhythm is considered persistent. Atrial fibrillation that has not stopped for more than 12 months is considered long term persistent atrial fibrillation. If you have been diagnosed with permanent atrial fibrillation, it implies that your arrhythmia has persisted despite your best efforts to correct it.

Heart disease

AF is one of the most frequent problems that arise. MS caused by rheumatic fever has been linked to AF for quite some time. With RHD, the prevalence of AF is close to 40%. According to Deverailletal, the occurrence of AF increases steadily with age. AF was rare in younger people but became more prevalent with each passing decade, becoming the norm for individuals in their 40s and beyond.

Among their AF patients, William Kannel et al. found an incidence rate of 10.2% for RHD in males and 26.5% in women. Adell Cullel et al. found that 19% of their AF patients also had RHD. Abergetal found that 11% of AF patients also had RHD. Ten percent of AF patients had RHD, according to research by Eugene Rich et al. In India, RHD is quite common. In 58% of AF patients examined by T.K. Ramanetal's team, RHD was present.

Ischemic Heart Disease

AF occurs in 10-15% of patients with acute MI. Kobayashi et al, reported 17.6% of AF in the acute phase of MI in the study of 381 consecutive acute MI patients in their Institute. According to research by William Kannei et al., transitory atrial fibrillation (AF) is strongly linked to coronary heart disease, particularly MI, in both sexes. Compared to males, women had a weaker association between chronic AF and preexisting

coronary HD. Nevertheless, the research found that the chance of developing persistent AF was increased for males with coronary HD. They also found a weaker correlation between angina pectoris and any kind of AF than they did with MI. Studies on the antecedent causes of atrial fibrillation have reported variable results. Abergetal, reported highest incidence rate of 43% cases of IHD in their series of atrial fibrillation patients. Koskinen. P. et al, reported an incidence rate of 21% for IHD among their patients with AF. William Kannel et al, observed IHD in 16.3% of patients with AF. Adell Cullelet al, noted 14% IHD among their AF patients. Eugene Rich et al, reported an incidence rate of 13.6% for IHD among their AF patients.

Hypertensive Heart Disease:

Individuals with hypertension with evidence of LVH on electrocardiogram (ECG), cardiac enlargement on x-ray (XR), elevated LV mass index (>131g/m² in males and >110g/m² in women), or cardiac failure are classified as having LVH. The chronicity, severity, and accompanying consequences of HTN all have a role in how often fibrillation occurs in those with hypertension. Researchers have shown that hypertensive cardiac disease is the most prevalent risk factor for atrial fibrillation. Hypertensive HD was responsible for 45.7% of male and 51.2% female AF cases, according to research by William Kannel et al. In a study of individuals with atrial fibrillation, de Carvalho Filho et al. found that 51% also had hypertensive HD.

Cardio-myopathies

Both dilated and hypertrophic cardio myopathies are associated with AF. Ohkawa et al, have reported AF in 71% of patients with DCM. Roberts et al, reported AF in 25 cases among 101 cases of DCM i.e. incidence of 25%. Haissaguerre et al, in their study on auricular arrhythmias in DCM in 236 patients observed AF in 27% of cases.

Congenital Heart Disease

With CHD, ASD is the only risk factor for AF. In a study including 32 individuals with substantial ASD, the prevalence of AF was found to be 19% by Gerasim Tikoff et al. Age and the presence of high LA pressure and LAE are two variables linked to the development of AF in patients with ASD.

Hyperthyroidism

Hyper thyroidism may trigger AF sometimes. It is estimated that approximately 10 % of thyrotoxicos is patients are in AF. De Carval ho Filho et al, reported an incidence of 14.3 % in their study of chronic AF among 49 patients with hyper thyroidism. Siebers M.J et al, in

their study reported that no subject had a suppressed TSH level among 50 consecutive cases of AF. Fagerberg B, et al, reported that on measurement of TSH levels in 110 ambulatory patients with AF none were hyperthyroid.

Frost et al. conducted a research in which they tracked all individuals diagnosed with new-onset hyperthyroidism for 30 days to look for the emergence of atrial fibrillation (AF) or an atrial flutter.

4. Determination of Size

M-mode echocardiography performed via a parasternal window is used to measure the heart's size. Towards the conclusion of systole, immediately before to the opening of the mitral valve, a linear dimension matching the anteroposterior plane was measured. The plane is standardized by having its center of gravity located inside the aortic valve. This allows for a consistent and reliable assessment of left atrial volume. Sometimes the stagnant blood can cause the hazy and amorphous echoes to be seen while viewing the posterior wall of the left atrium, it can be cleared with help of the change in gain or adjusting the angle of the transducer. To minimize the error in measuring the left atrial size multiple view assessment is done.

Study was done on GE WIPRO (Wipro GE – 95, Wipro GE Vivid S6) echocardiography machine with facilities of M mode, Doppler and 2D- echocardiography.

Patients were examined for structural, valvular heart disease, left ventricular filling and left atrial size.

Left atrial size is commonly assessed by M mode in the parasternal long axis view.

Scan was performed to obtain four chamber, two chamber, parasternal long axis view, short axis view.

5. Statistical Analysis

Data entry was done using SPSS version 21.0 (trial version) for Windows. “Descriptive statistics included measures like mean, standard deviation, range, and proportions. The results were represented in tabular and graphical formats Data were expressed as mean values ± standard deviations (SD), percentage for continuous variables. Frequency and proportions were reported for categorical variables. The ‘p’ value of < 0.05 was considered statistically significant.”

Table-1: ECG changes in addition to AF in study participants (n=130)

ECGchanges	Number	Percent
Only AF	33	25.4
AF + IHD	47	36.2

AF + LVH	41	31.5
AF + IHD + LVH	9	6.9
Total	130	100.0

Apart from AF, ECG in 47 (36.2%) patients showed features of IHD, 41 (31.5%) showed features of LVH and 9 (6.9%) showed features of both IHD and LVH.

6. Echocardiogram

Table-2: Echocardiographic changes in study participants (n=130)

Echocardiographic changes	Number	Percent
Normal	2	1.5
LAE	122	93.84
RAE	8	6.15
LVH	62	47.69
RVH	2	1.5
DCM	1	0.8
MS	109	83.84
MR	29	22.30
TR	6	4.61
AS	1	0.8
AR	1	0.8
RHD	3	2.30

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.

7. Summary and Conclusions

Our patients had a mean age of 64.42 14.66 years old (Range 21-95 years). Patients between the ages of 61 and 80 made up the largest demographic (75 people, or 57.7%), followed by those aged 1 to 60 (23.1%), then those aged 81 and over (10 people, or 10%), and finally those aged 20 to 40 (9 people, or 9.2%). Males accounted for 55.4% of the total, while females made up 44.6%. Male to female patients with atrial fibrillation ratio was 1 to 0.80. The most common precursory cause was ischemic heart disease (40.76%), followed by rheumatic heart disease (33.84%), MS (33.84%), and hypertension (31.53%). Hyperthyroidism (3.84%) , ASD, PHT, TR (all 1.5%) , AS, AR and COPD (0.8%). There was no statistically significant difference in the distribution of causes between the sexes (chi square = 33.575, p = 0.117). Patients often complained of shortness of breath (97.1%) but also sometimes presented with other symptoms such as pedal edema (64.6 percent), palpitations (61.5 percent), chest

discomfort (60.8 percent), cough (13.0 percent), hepatomegaly (3.8 percent), haemoptysis (2.3 percent), stomach ache (1.5 percent), or syncopal episodes (0.8%). Every single patient's pulse was completely erratic. The typical heart rate was 119.34 17.54 beats per minute. The heart rates varied between 66 and 168 beats per minute. Most patients' pulse rates were over 110 beats per minute (67.7%), next between 90 and 110 (26.2%), and finally below 90 beats per minute (6.2%). An average deficit of 12.08 2.33 pulses was recorded. Sixteen was the lowest and sixteen was the highest.

67.1% of the patients had a pulse deficit of 10 or more, whereas 33.1% had a deficit of 10 or less. SBP averaged 142.38 17.38 mmHg (Range 90-170). 86.46 10.11 mm Hg was the average DBP (Range 60-110). "RBS averaged 149.83 51.09 mg/dl (Range 74-364). Average uric acid levels were 37.00 18.84 mg/dl (Range 14-142). Creatinine concentrations averaged 1.26 0.57 mg/dl (Range 0.6-4.5). Sodium concentrations averaged 139.08 5.55 mEq/l (Range 123.0-149.0). The average potassium concentration was 4.09 0.45 mEq/l (Range 3-5). Eighty (61.5% of) individuals had elevated JVP. In 71 (54.6%) individuals, chest X-rays were negative." Fifty-eight individuals (44.6%) were diagnosed with cardiomegaly. The symptoms of COPD were seen in one patient (0.8%). Twelve-lead electrocardiogram was performed. The range ranged from 74 to 180 beats per minute, with 45 percent of patients having a heart rate between 90 and 110. All patients had a rhythm that was very erratic. All patients lacked P-waves. The QRS complexes were regular, but their timing and amplitude were erratic. In addition to AF, the ECG exhibited characteristics of IHD in 47 (36.2%), LVH in 41 (31.5%), and both in 9 (6.7%) individuals.

References

- [1] Koskinen PE, Kupari MA, Leinonen HA, Luomanmäki K. Alcohol and new onset atrial fibrillation: a case-control study of a current series. *Heart*. 1987 May 1;57(5):468-73.
- [2] De EC, Miotta ST, Alves AT, Curiati JA, De YA. Chronic atrial fibrillation in the elderly. *Arquivos brasileiros de cardiologia*. 1991 Aug;57(2):109-14.
- [3] Leclercq JF, Attuel P. Paroxysmal atrial fibrillation. *1993.43(12).1515- 21*
- [4] Ohkawa S, Inoue J, Sugiura M. A clinicopathologic study of dilated cardiomyopathy in the aged. *J Cardiogr Suppl*. 1986.9.35-47

- [5] Roberts WC, Siegel RJ, McManus BM. Idiopathic dilated cardiomyopathy: analysis of 152 necropsy patients. *Am J Cardiol.* 1987.60(16).12.1340-55.
- [6] Ingerslev J, Bjerregaard P. Prevalence and prognostic significance of cardiac arrhythmias detected by ambulatory electrocardiography in subjects 85 years of age. *Eur Heart J.* 1986 .7.7.570-5
- [7] Samukawa M, Hasegawa K, Harada Y, Nakao M, Tadaoka S, Yoneda M et al. Clinical features and significance of hypertrophic cardiomyopathy with atrial fibrillation. *J Cardiol.* 1987.17.9.465-74.
- [8] Blake GE, Lakkireddy D. Atrial Septal Defect and Atrial Fibrillation: The Known and Unknown. *J Atr Fibrillation.* 2008.1.3.9.45.
- [9] Melmed S, Kenneth P, P. Reed L, Henry K. Williams Textbook of Endocrinolog.2011.12.5.1-1920.
- [10] Siebers MJ, Drinka PJ, Vergauwen C. Hyperthyroidism as a cause of atrial fibrillation in long-term care. *Archives of internal medicine.* 1992 Oct 1;152(10):2063-4.
- [11] Fagerberg B, Lindstedt G, Strömblad SO, Darpö B, Nyström E, Sjöström L, Lundberg PA, Olsson SB. Thyrotoxic atrial fibrillation: an underdiagnosed or overdiagnosed condition?. *Clinical chemistry.* 1990 Apr 1;36(4):620-7.
- [12] Frost L, Vestergaard P, Mosekilde L. Hyperthyroidism and risk of atrial fibrillation or flutter: a population-based study. *Archives of internal medicine.* 2004 Aug 9;164(15):1675-8.