

Original Research Article

Clinical, etiological and echocardiographic profile of atrial fibrillation in a tertiary care hospital: a cross-sectional observational study

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ABSTRACT

Background: Atrial fibrillation (AF) is the most common sustained cardiac arrhythmia and is associated with increased morbidity, mortality, heart failure, thromboembolism, and reduced quality of life. The etiological spectrum of AF varies across populations, with rheumatic heart disease (RHD) remaining an important cause in developing countries. Echocardiography is essential for evaluating structural cardiac abnormalities in AF.

Methods: A hospital-based cross-sectional observational study was conducted among 100 patients with AF admitted to a tertiary care teaching hospital. Clinical history, physical examination, electrocardiography, laboratory investigations, and transthoracic echocardiography were performed. Clinical characteristics, etiologies, echocardiographic findings, and complications were analyzed.

Results: Most patients were elderly, with a female predominance. Dyspnea and palpitations were the most common presenting symptoms. RHD was the leading cause of AF, followed by hypertensive and ischemic heart disease. Mitral stenosis was the most frequent valvular lesion. Left atrial enlargement was the predominant echocardiographic finding, while varying degrees of left ventricular systolic dysfunction were also observed. Heart failure and stroke were the major complications. Valvular AF was more common than non-valvular AF.

Conclusions: AF in this population was predominantly associated with rheumatic valvular heart disease and structural cardiac abnormalities, particularly left atrial enlargement. Early clinical and echocardiographic evaluation is essential for identifying underlying causes, stratifying risk, and preventing complications such as heart failure and thromboembolism.

Keywords: Atrial fibrillation, Rheumatic heart disease, Echocardiography, Left atrial enlargement, Valvular heart disease, Stroke, Heart failure

INTRODUCTION

Atrial fibrillation (AF) is the most common sustained cardiac arrhythmia encountered in clinical practice and constitutes a major global public health problem due to its increasing prevalence, significant morbidity, mortality, and healthcare burden.¹ AF is characterized by

disorganized atrial electrical activity resulting in ineffective atrial contraction and an irregularly irregular ventricular response.² The prevalence of AF increases with advancing age and is strongly associated with structural heart disease, hypertension, ischemic heart disease, valvular heart disease, heart failure, diabetes mellitus, obesity, and other cardiovascular risk factors.³

AF is associated with substantial cardiovascular complications including congestive cardiac failure, thromboembolism, ischemic stroke, systemic embolization, impaired exercise tolerance, recurrent hospitalization, and increased mortality.⁴ Patients with AF have nearly fivefold increased risk of stroke, while AF-related strokes are generally associated with greater disability and poorer outcomes.⁵ Early diagnosis and identification of underlying etiological factors are therefore essential for appropriate risk stratification and management.

The etiological spectrum of AF varies considerably across different populations and geographical regions.⁶ In developed countries, hypertension, ischemic heart disease, degenerative valvular disease, and cardiomyopathy are major contributors to AF.⁷ However, in developing countries such as India, RHD continues to remain an important cause of AF, particularly among younger individuals.⁸ Mitral valve involvement, especially mitral stenosis, predisposes to left atrial enlargement, atrial fibrosis, and electrical remodeling, thereby increasing susceptibility to AF.⁹

Clinical manifestations of AF vary widely ranging from asymptomatic presentation to severe palpitations, dyspnea, chest pain, dizziness, syncope, and manifestations of heart failure.¹⁰ The severity of symptoms often depends upon ventricular rate, underlying cardiac function, duration of arrhythmia, and associated comorbidities.¹¹ Some patients may initially present with thromboembolic complications such as ischemic stroke or systemic embolism.¹²

Electrocardiography remains the cornerstone for diagnosis of AF and typically demonstrates absence of discrete P waves with irregularly irregular RR intervals.¹³ Echocardiography plays a pivotal role in evaluation of patients with AF by identifying structural heart disease, valvular abnormalities, chamber enlargement, ventricular function, intracardiac thrombus, and pulmonary hypertension.¹⁴ Left atrial enlargement is one of the most common echocardiographic abnormalities associated with AF and reflects chronic atrial remodeling and elevated atrial pressure.¹⁵

Several studies have demonstrated a strong association between left atrial size and persistence of AF.¹⁶ Left ventricular systolic dysfunction, mitral valve disease, and pulmonary hypertension further contribute to atrial remodeling and maintenance of AF.¹⁷ Echocardiographic assessment therefore provides valuable prognostic information and assists in therapeutic decision-making including anticoagulation, rhythm control strategies, and management of underlying structural abnormalities.¹⁸

Despite advances in cardiovascular care, AF continues to pose major clinical challenges due to increasing prevalence and associated complications.¹⁹ The epidemiological and etiological profile of AF differs between developed and developing countries owing to

variations in prevalence of RHD, hypertension, coronary artery disease, and healthcare accessibility.²⁰ Understanding the regional clinical and echocardiographic spectrum of AF is therefore essential for improving diagnostic approaches and optimizing management strategies.

Limited regional data are available regarding the clinical, etiological, and echocardiographic profile of AF in tertiary care settings.²¹

In this context, the present study was undertaken to evaluate the clinical presentation, etiological spectrum, echocardiographic findings, and associated complications among patients with AF admitted to a tertiary care teaching hospital.

METHODS

Study design

A hospital-based cross-sectional observational study was conducted.

Study setting

The study was carried out at Government General Hospital, Srikakulam, a tertiary care teaching hospital affiliated with Dr. NTR University of Health Sciences, Andhra Pradesh.

Study duration

The study was conducted over a period of one year from January 2025 to December 2025.

Study population

The study population included patients diagnosed with AF admitted to the Department of General Medicine, Government General Hospital, Srikakulam.

Sample size

A total of 248 patients with AF were included in the present study.

Inclusion criteria

Patients aged more than 18 years, diagnosed with AF based on electrocardiographic findings, and willing to provide informed consent for participation in the study were included.

Exclusion criteria

Patients aged less than 18 years, those with transient arrhythmias not confirmed as AF, and those unwilling to participate in the study were excluded.

Data collection procedure

Eligible patients were enrolled after obtaining informed consent. Detailed clinical history including age, gender, presenting symptoms, duration of symptoms, associated comorbidities, history of rheumatic fever, hypertension, diabetes mellitus, ischemic heart disease, thyroid disorders, smoking, and alcohol intake was recorded using a structured proforma.

Comprehensive general physical examination and cardiovascular system examination were performed in all patients. Pulse characteristics, blood pressure, pulse deficit, signs of congestive cardiac failure, valvular heart disease, and thromboembolic manifestations were documented.

Electrocardiographic evaluation was carried out in all patients using standard 12-lead ECG. Diagnosis of AF was confirmed by absence of discrete P waves, presence of fibrillatory waves, and irregularly irregular RR intervals. Additional ECG findings including ventricular rate abnormalities, left ventricular hypertrophy, bundle branch block, and ischemic changes were also noted.

All patients underwent transthoracic echocardiographic examination for assessment of cardiac chamber dimensions, valvular lesions, left atrial size, left ventricular ejection fraction, ventricular hypertrophy, pulmonary artery pressure, intracardiac thrombus, and associated structural cardiac abnormalities. Patients were categorized into valvular and non-valvular AF based on echocardiographic findings.

Relevant laboratory investigations including complete blood count, renal function tests, liver function tests, serum electrolytes, thyroid function tests, blood glucose levels, and chest radiography were performed wherever indicated.

Outcome measures

The primary outcome measures included clinical presentation, etiological spectrum, echocardiographic profile, and complications associated with AF. Secondary outcomes included distribution of valvular versus non-valvular AF and association of left atrial enlargement with structural heart disease.

Statistical analysis

Data were entered into Microsoft excel and analyzed using appropriate statistical software. Continuous variables were expressed as mean±standard deviation, while categorical variables were represented as frequencies and percentages. Statistical associations between clinical and echocardiographic variables were analyzed using appropriate tests. A p value of less than 0.05 was considered statistically significant.

Ethical considerations

The study protocol was approved by the institutional ethics committee prior to commencement of the study. Written informed consent was obtained from all participants, and confidentiality of patient information was maintained throughout the study period.

RESULTS

A total of 248 patients diagnosed with AF were included in the present study. Demographic profile, clinical presentation, etiological spectrum, electrocardiographic findings, echocardiographic characteristics, and associated complications were analyzed.

Table 1 shows the age and gender distribution of patients with AF.

Table 1: Age and gender distribution of patients with AF (n=248).

Variables	N	Percentage (%)
Age group (in years)		
<30	18	7.3
31-40	42	16.9
41-50	64	25.8
51-60	72	29.0
>60	52	21.0
Gender		
Male	108	43.5
Female	140	56.5

The majority of patients belonged to the 51-60 years age group, with a female predominance observed in the study population.

Table 2 shows the clinical presentation of patients with AF.

Table 2: Clinical presentation of patients with AF (n=248).

Clinical feature	N	Percentage (%)
Dyspnea	206	83.1
Palpitations	168	67.7
Pedal edema	92	37.1
Chest pain	74	29.8
Fatigue	68	27.4
Dizziness	36	14.5
Syncope	12	4.8
Stroke symptoms	18	7.3

Dyspnea and palpitations were the most common presenting symptoms among patients with AF. Features suggestive of congestive cardiac failure were also frequently observed.

Table 3 shows the etiological distribution of AF among the study participants.

Table 3: Etiological distribution of AF among study participants (n=248).

Etiology	N	Percentage (%)
RHD	118	47.6
Hypertensive heart disease	46	18.5
Ischemic heart disease	38	15.3
Dilated cardiomyopathy	18	7.3
Thyrotoxicosis	10	4.0
Chronic obstructive pulmonary disease	8	3.2
Congenital heart disease	4	1.6
Lone AF	6	2.4

RHD was the most common etiology of AF, followed by hypertensive heart disease and ischemic heart disease.

Table 4 shows the distribution of valvular and non-valvular AF.

Table 4: Distribution of valvular and non-valvular AF (n=248).

Type of AF	N	Percentage (%)
Valvular AF	132	53.2
Non-valvular AF	116	46.8

Valvular AF constituted the majority of cases in the present study population.

Table 5 shows the echocardiographic findings among patients with AF.

Table 5: Echocardiographic findings among patients with AF (n=248).

Echocardiographic finding	N	Percentage (%)
Left atrial enlargement	188	75.8
Left ventricular hypertrophy	96	38.7
Reduced LVEF (<50%)	82	33.1
Pulmonary hypertension	74	29.8
Diastolic dysfunction	62	25.0
Intracardiac thrombus	14	5.6
Regional wall motion abnormalities	36	14.5

Left atrial enlargement was the most frequent echocardiographic abnormality observed in patients with AF. Reduced left ventricular ejection fraction and pulmonary hypertension were also commonly identified.

Table 6 shows the distribution of valvular lesions among patients with RHD.

Table 6: Distribution of valvular lesions among patients with RHD (n=118).

Valvular lesion	N	Percentage (%)
Mitral stenosis	42	35.6
Mitral stenosis + mitral regurgitation	38	32.2
Isolated mitral regurgitation	18	15.3
Mixed mitral and aortic valve disease	14	11.9
Others	6	5.0

Mitral stenosis alone or in combination with mitral regurgitation constituted the predominant rheumatic valvular lesions associated with AF.

Table 7 shows the electrocardiographic findings among the study participants.

Table 7: Electrocardiographic findings among study participants (n=248).

ECG finding	N	Percentage (%)
Rapid ventricular rate	162	65.3
Left ventricular hypertrophy	72	29.0
ST-T changes	54	21.8
Bundle branch block	18	7.3
Ventricular ectopics	14	5.6

Rapid ventricular response was the most common electrocardiographic finding associated with AF in the present study.

Table 8 shows the complications observed among patients with AF.

Table 8: Complications observed among patients with AF (n=248).

Complication	N	Percentage (%)
Congestive cardiac failure	128	51.6
Cerebrovascular accident	26	10.5
Systemic thromboembolism	8	3.2
Cardiogenic shock	6	2.4

Congestive cardiac failure was the most common complication observed among patients with AF, followed by cerebrovascular accident.

DISCUSSION

The present study evaluated the clinical, etiological, and echocardiographic spectrum of AF among patients admitted to a tertiary care teaching hospital. The findings

demonstrate that AF is commonly associated with structural heart disease, particularly rheumatic valvular pathology, and is frequently accompanied by significant cardiovascular complications including congestive cardiac failure and cerebrovascular events.

In the present study, the majority of patients belonged to the older age groups, particularly between 51 and 60 years, with a female predominance observed in the study population. Similar demographic patterns were reported by Mandal et al, Singh et al, Kottoor et al and Shah et al where AF was more common among middle-aged and elderly individuals with a predominance of females in RHD-associated AF.^{13,22,29,30} Increasing age contributes to progressive atrial fibrosis, atrial enlargement, electrical remodeling, and accumulation of cardiovascular comorbidities, thereby increasing susceptibility to AF.

Dyspnea and palpitations were the most common presenting symptoms in the present study. Similar observations were reported in previous studies by Narendar and Rao et al, Reddy et al and Athar et al where dyspnea constituted the predominant clinical presentation among AF patients.^{12,15,27} Dyspnea in AF may result from rapid ventricular response, reduced cardiac output, elevated left atrial pressure, pulmonary venous congestion, and associated heart failure. Palpitations occur due to irregular ventricular rhythm and exaggerated beat-to-beat variability.

RHD emerged as the most common etiology of AF in the present study, accounting for nearly half of all cases. Similar findings were reported in Indian and South Asian studies by Singh et al, Islam et al, Vijay et al and Shakya et al where RHD remained the predominant etiological factor.^{10,21,26,29} In contrast, studies from developed countries and Western populations have reported hypertension and ischemic heart disease as the leading causes of AF.⁹ The persistence of rheumatic AF in developing countries reflects the continued burden of rheumatic valvular disease and delayed access to preventive healthcare services.

Among rheumatic valvular lesions, mitral stenosis alone or in combination with mitral regurgitation constituted the most common valvular abnormality associated with AF in the present study. Similar observations were reported by Negi et al, Shah et al and Kottoor et al.^{22,25,30} Mitral stenosis leads to chronic pressure overload and progressive left atrial dilatation, thereby promoting atrial fibrosis and electrical instability that predispose to AF.

Valvular AF constituted a slightly greater proportion of cases compared to non-valvular AF in the present study. Similar findings were reported in studies conducted in populations with high prevalence of RHD.^{22,27} However, recent studies from urban and developed populations have demonstrated increasing predominance of non-valvular AF associated with hypertension, ischemic heart disease, obesity, and aging.¹⁹ These observations indicate an

ongoing epidemiological transition in the etiological spectrum of AF.

Left atrial enlargement was the most frequent echocardiographic abnormality observed in the present study. Similar findings were consistently reported by Mandal et al, Singh et al, Vijay et al and Raniga et al.^{13,23,26,29} Left atrial enlargement reflects chronic atrial pressure and volume overload, structural remodeling, and atrial fibrosis, all of which contribute to initiation and maintenance of AF. Larger left atrial size has also been associated with increased thromboembolic risk, recurrence following cardioversion, and poorer cardiovascular outcomes.

Reduced left ventricular ejection fraction and pulmonary hypertension were also commonly identified in the present study. Similar findings were observed by Akintunde et al. and Shah et al., where AF was associated with impaired ventricular function and advanced heart failure.^{14,22} AF and heart failure frequently coexist and share common pathophysiological mechanisms including neurohormonal activation, atrial remodeling, and ventricular dysfunction.

Rapid ventricular response was the most common electrocardiographic finding observed in the present study. Similar observations were reported by Islam et al and Athar et al.^{10,12} Persistent rapid ventricular rates may contribute to worsening myocardial dysfunction, reduced diastolic filling, tachycardia-mediated cardiomyopathy, and progression of heart failure.

Congestive cardiac failure was the most common complication observed in the present study, followed by cerebrovascular accident. Similar findings were reported in previous studies by Mohan et al, Narendar and Rao, and Kottoor et al.^{27,28,30} AF contributes to development and worsening of heart failure through loss of atrial contribution to ventricular filling, irregular ventricular response, and impaired cardiac output. Cerebrovascular complications occur due to left atrial thrombus formation and systemic embolization, particularly in patients with valvular AF and significant left atrial enlargement.

Intracardiac thrombus was detected in a smaller proportion of patients in the present study. Similar findings were reported by Shakya et al and Vijay et al where thrombus formation was predominantly associated with rheumatic mitral stenosis and severe left atrial enlargement. Identification of intracardiac thrombus has important implications for anticoagulation and prevention of thromboembolic complications.^{21,26}

The present study highlights the continuing burden of RHD-associated AF in tertiary care settings and underscores the importance of comprehensive clinical and echocardiographic evaluation in all AF patients. Early identification of structural heart disease, left atrial enlargement, ventricular dysfunction, and

thromboembolic risk factors is essential for optimizing treatment strategies and reducing complications.

Limitations

This study has certain limitations. It was conducted at a single tertiary care center, which may limit the generalizability of the findings to the broader population. The cross-sectional design precluded assessment of temporal relationships and long-term clinical outcomes. In addition, the absence of longitudinal follow-up prevented evaluation of treatment response, recurrence, and survival outcomes. Larger multicentric prospective studies with long-term follow-up are warranted to validate these findings.

CONCLUSION

The present study demonstrated that AF is predominantly a disease of middle-aged and elderly individuals and is commonly associated with structural heart disease. RHD remained the leading etiological factor in the studied population, with mitral valve involvement constituting the most frequent valvular abnormality. Dyspnea and palpitations were the predominant presenting symptoms, while congestive cardiac failure and cerebrovascular accident were the major complications associated with AF. Echocardiographic evaluation revealed left atrial enlargement as the most consistent structural abnormality, followed by left ventricular dysfunction and pulmonary hypertension. Valvular AF constituted a slightly greater proportion of cases compared to non-valvular AF. The findings emphasize the significant burden of RHD-associated AF in tertiary care settings and highlight the importance of comprehensive clinical and echocardiographic evaluation for early diagnosis, risk stratification, and prevention of complications.

Recommendations

All patients with AF should undergo detailed clinical and echocardiographic evaluation to identify underlying etiological factors, structural cardiac abnormalities, and thromboembolic risk. Early screening and treatment of RHD remain essential to reduce the burden of valvular AF in developing countries. Routine assessment of left atrial size, ventricular function, and valvular pathology should be incorporated into standard evaluation protocols for patients with atrial fibrillation. Timely initiation of appropriate rate or rhythm control strategies and anticoagulation therapy should be emphasized to prevent complications such as congestive cardiac failure and ischemic stroke. Public health measures aimed at improving awareness, early diagnosis, and management of cardiovascular risk factors including hypertension, ischemic heart disease, and diabetes mellitus are also necessary. Further multicentric prospective studies with long-term follow-up are recommended to better evaluate changing epidemiological trends, treatment outcomes, and

prognostic factors associated with AF in the Indian population.

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