Section: General Medicine

Original Research Article

CLINICO-ETIOLOGICAL PROFILE OF ATRIAL FIBRILLATION IN ELDERLY PATIENTS ATTENDING A TERTIARY CARE CENTRE IN UTTARAKHAND: A HOSPITAL-BASED CROSS-SECTIONAL OBSERVATIONAL STUDY

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ABSTRACT

Background: Atrial fibrillation (AF) is the most common sustained cardiac arrhythmia and its prevalence rises steeply with age, making elderly patients disproportionately affected by its clinical and thromboembolic consequences. Regional data on the clinico-etiological profile of AF in elderly patients from hilly and sub-Himalayan populations of India remain limited.

Materials and Methods: This hospital-based cross-sectional observational study was conducted over 12 months in the Department of General Medicine, Government Medical College, Haldwani, and its associated Dr. Sushila Tiwari Government Hospital, Uttarakhand. A total of 130 consecutively recruited patients aged ≥65 years with AF confirmed on electrocardiography were evaluated for demographic, lifestyle, clinical, laboratory, electrocardiographic, radiological, and echocardiographic parameters. Thromboembolic and bleeding risk were assessed using the CHA_2DS_2-VASc and HAS-BLED scores, respectively. Categorical variables were compared using the Chi-square/Fisher's exact test, with $p<0.05$ considered significant.

Results: The cohort had a slight female predominance (53.1%) and was concentrated in the 65–70-year age band (49.2%). Systemic hypertension (52.3%), coronary artery disease (38.5%), diabetes mellitus (29.2%), and chronic obstructive pulmonary disease (25.4%) were the leading comorbidities. Shortness of breath (71.5%) and exertional dyspnea (62.3%) were the dominant presenting symptoms, and AF with fast ventricular rate was seen in 54.6% of patients. Echocardiography showed left atrial enlargement in 83.8% and mitral regurgitation in 58.5% of patients; hypertensive and rheumatic heart disease were the leading final etiological diagnoses. Heart failure (36.9%) and ischemic stroke (24.6%) were the most frequent complications.

Conclusion: AF in elderly patients at this tertiary centre is predominantly a disease of structural heart disease and cardiovascular comorbidity rather than an isolated rhythm disturbance. Systematic risk stratification, aggressive comorbidity control, and structured anticoagulation decision-making are needed to reduce the substantial burden of heart failure and stroke observed in this population.

Keywords: atrial fibrillation; elderly; clinico-etiological profile; CHA_2DS_2-VASc; HAS-BLED; echocardiography; tertiary care; Uttarakhand.

INTRODUCTION

Atrial fibrillation (AF) is the most frequently encountered sustained cardiac arrhythmia in clinical practice and a major contributor to cardiovascular morbidity and mortality worldwide. It is characterized by rapid, disorganized atrial electrical activity that abolishes effective atrial contraction and produces an irregularly irregular ventricular rhythm, with well-recognized links to heart failure, thromboembolism, hospitalization, and impaired quality of life.[1]

Understanding of AF has evolved from early clinical descriptions of an irregular pulse to a detailed electrophysiological and structural characterization enabled by electrocardiography and cardiac imaging.[2,3] It is now recognized as a progressive syndrome driven by cumulative atrial electrical and structural remodeling—atrial dilatation, interstitial fibrosis, myocyte loss, and shortened refractory periods—that create a substrate favoring re-entry and self-perpetuation of the arrhythmia.[3]

The burden of AF rises steeply with age: while uncommon in younger adults, its prevalence increases markedly after the sixth decade of life, so that elderly patients account for a disproportionate share of AF-related hospitalizations, complications, and deaths.[1] Age-related atrial remodeling combines with a high burden of comorbid hypertension, coronary artery disease, valvular disease, heart failure, diabetes, chronic kidney disease and thyroid dysfunction to create a particularly vulnerable substrate in older adults.[4]

Beyond rhythm disturbance, AF has direct hemodynamic consequences—loss of atrial contraction reduces ventricular filling and produces beat-to-beat variability in stroke volume, manifesting clinically as fatigue, dyspnea, and worsening heart failure, particularly in elderly patients with limited cardiovascular reserve.[5] AF is also a leading preventable cause of ischemic stroke: disorganized atrial contraction promotes stasis and thrombus formation, particularly within the left atrial appendage, and AF-related strokes tend to be more severe and disabling than strokes of other etiologies.[6]

Given rising life expectancy and improving cardiovascular survival, the global and Indian burden of AF is projected to continue increasing, with demographic transition and a growing burden of hypertension and diabetes contributing to more elderly patients presenting with AF and its complications in developing countries.[4] Despite this, data specifically characterizing the clinico-etiological profile of AF among elderly patients from hilly and sub-Himalayan regions of India, where healthcare access and risk-factor patterns differ from urban plains populations, remain limited. This study was undertaken to evaluate the demographic, clinical, etiological, and complication profile of AF in elderly patients attending a tertiary care hospital in Uttarakhand, and to characterize their thromboembolic and bleeding risk using validated scoring systems.

1.1 Aim and objectives

Aim: To evaluate the clinical, etiological, epidemiological, and complication profile of atrial fibrillation in elderly patients attending a tertiary care hospital.

Objectives

- To study the clinico-etiological profile of atrial fibrillation in elderly patients.
- To study the epidemiological profile of atrial fibrillation in elderly patients.
- To study the complications associated with atrial fibrillation in elderly patients.

MATERIALS AND METHODS

2.1 Study design and setting

This was a hospital-based, cross-sectional, observational study conducted in the Department of General Medicine, Government Medical College, Haldwani, and its associated Dr. Sushila Tiwari Government Hospital, Haldwani, Uttarakhand, over a period of 12 months following approval from the Institutional Ethics Committee.

2.2 Study population and sampling

The study population comprised elderly patients diagnosed with AF attending the Department of General Medicine. A consecutive sampling technique was used: all eligible patients presenting during the study period and satisfying the inclusion criteria were recruited after written informed consent. A total of 130 patients were enrolled.

Inclusion criteria: (i) age ≥65 years; (ii) AF confirmed on electrocardiography; (iii) willingness to provide written informed consent.

Exclusion criteria: (i) age <65 years; (ii) paroxysmal AF; (iii) post-operative AF; (iv) unwillingness to participate.

2.3 Study procedure and variables

A predesigned proforma was used to record demographic data (age, sex, residence, education, occupation, marital status, dietary habits), lifestyle factors (smoking, alcohol use, tobacco use), and comorbidities. Clinical evaluation documented presenting symptoms (dyspnea, palpitations, chest pain, fatigue, cough, syncope, orthopnea, paroxysmal nocturnal dyspnea, bilateral pedal edema), New York Heart Association (NYHA) functional class, and vital parameters (pulse rate, blood pressure, peripheral oxygen saturation, Glasgow Coma Scale [GCS] score).

Electrocardiography confirmed the diagnosis of AF and classified ventricular response as fast (FVR) or controlled (CVR). Routine investigations included complete blood count, packed cell volume, platelet count, international normalized ratio (INR), liver and renal function tests, serum electrolytes, fasting glucose, HbA1c, lipid profile, thyroid function tests, and cardiac biomarkers (CPK-MB, troponin-T).

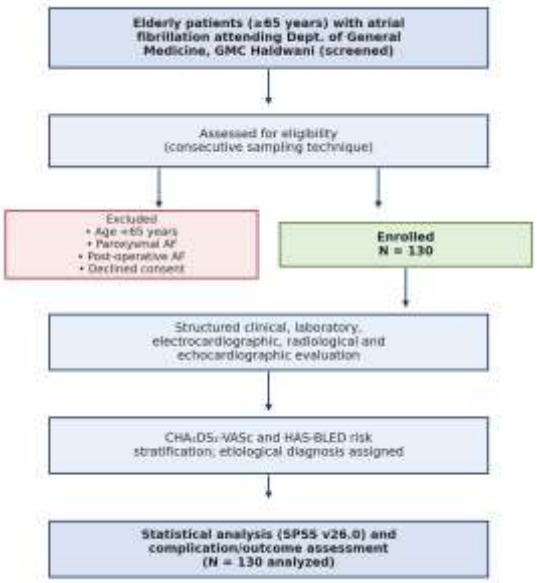
Radiological evaluation comprised chest radiography (postero-anterior view) and two-dimensional transthoracic echocardiography, assessing atrial enlargement, valvular disease, ventricular function, pulmonary arterial hypertension, and pericardial effusion. The underlying etiological diagnosis was established by integrating clinical, electrocardiographic, echocardiographic, and laboratory findings.

Thromboembolic risk was assessed using the CHA_2DS_2-VASc score and bleeding risk using the HAS-BLED score. Complications recorded during evaluation included heart failure, ischemic stroke, systemic embolism, myocardial ischemia, hypotension/syncope, tachycardia-induced cardiomyopathy, reduced cardiac output, progression to AF, vascular dementia, reduced quality of life, and mortality.

2.4 Ethical considerations

Ethical clearance was obtained from the Institutional Ethics Committee of Government Medical College, Haldwani, prior to commencement of the study. Written informed consent was obtained from all participants, confidentiality was maintained throughout, and participation was voluntary.

Figure 1. Study flow diagram



2.5 Statistical analysis

Data were entered in Microsoft Excel and analyzed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Categorical variables were expressed as frequencies and percentages and continuous variables as mean ± standard deviation or median (interquartile range), depending on distribution. The Chi-square test or Fisher's exact test was used to compare categorical variables, with $p<0.05$ considered statistically significant.

RESULTS

A total of 130 elderly patients with AF fulfilling the inclusion criteria were evaluated. Findings are summarized below by domain, with selected data presented in tabular form.

3.1 Demographic and socio-economic profile

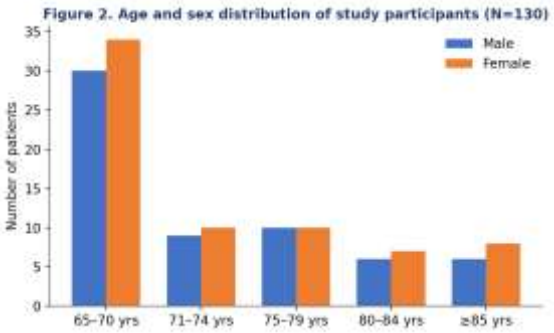
The cohort showed a slight female predominance (69, 53.1% vs. 61 male, 46.9%; p=0.620). Nearly half of the participants (64, 49.2%) belonged to the 65–70-year age band, with progressively fewer patients in older age categories (71–74 years: 14.6%; 75–79 years: 15.3%; 80–84 years: 10.0%; ≥85 years: 10.7%) (p=0.020). Most participants resided in non-hilly areas (72.4%), nearly half were illiterate (48.5%), all were married, and housewives constituted the largest single occupational group (49.2%), reflecting the higher proportion of elderly women in the cohort.

Table 1: Age, sex, and socio-demographic distribution of study participants (N = 130)

Variable	Category	n (%)	p-value
Age group (years)	65–70	64 (49.2)	0.020*
	71–74	19 (14.6)	
	75–79	20 (15.3)	
	80–84	13 (10.0)	
	≥85	14 (10.7)	
Sex	Male	61 (46.9)	0.620
	Female	69 (53.1)	
Residence	Non-hilly	94 (72.4)	0.042*
	Hilly	36 (27.6)	
Education	Illiterate	63 (48.5)	0.108
	Primary	44 (33.8)	

	Secondary	10 (7.7)	
	Graduate & above	13 (10.0)	
Marital status	Married	130 (100)	0.093
Occupation	Housewife	64 (49.2)	0.002*
	Business/skilled/labour/service (combined)	66 (50.8)	

**Statistically significant ($p<0.05$).*



3.2 Lifestyle risk factors

Smoking was the most common addiction (53, 40.8%), followed by alcohol consumption (30, 23.1%) and tobacco chewing (22, 16.9%). Smoking and alcohol use were significantly more common among males (30.7% and 21.5%, respectively) than females (10.7% and 1.5%), whereas tobacco chewing was relatively more frequent among females (all $p<0.05$; Table 2).

Table 2: Lifestyle risk factors by sex (N = 130)

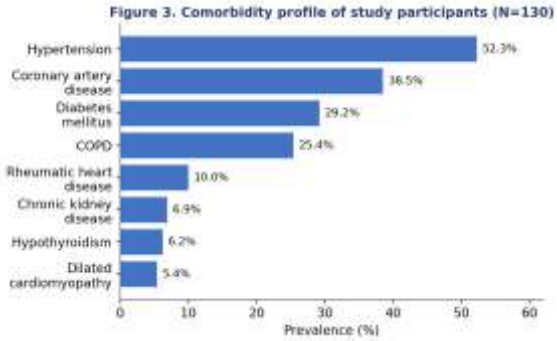
Risk factor	Male, n (%)	Female, n (%)	p-value
Alcohol use	28 (21.5)	2 (1.5)	0.020*
Smoking	40 (30.7)	14 (10.7)	0.010*
Tobacco chewing	10 (7.7)	12 (9.2)	0.001*

3.3 Comorbidity profile

Systemic hypertension was the most common comorbidity (68, 52.3%), followed by coronary artery disease (50, 38.5%), diabetes mellitus (38, 29.2%), chronic obstructive pulmonary disease (33, 25.4%), rheumatic heart disease (13, 10.0%), chronic kidney disease (9, 6.9%), hypothyroidism (8, 6.2%), and dilated cardiomyopathy (7, 5.4%). Hypertension and rheumatic heart disease were relatively more common in females, whereas coronary artery disease and COPD predominated in males (Table 3).

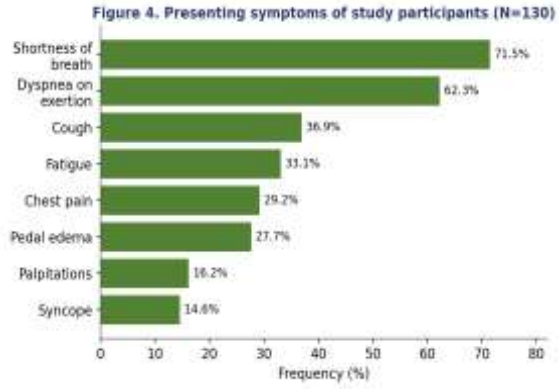
Table 3: Distribution of associated comorbidities (N = 130)

Comorbidity	Male, n (%)	Female, n (%)	Total, n (%)	p-value
Systemic hypertension	30 (49.2)	38 (55.1)	68 (52.3)	0.002*
Coronary artery disease	28 (45.9)	22 (31.9)	50 (38.5)	0.021*
Diabetes mellitus	19 (31.1)	19 (27.5)	38 (29.2)	<0.001*
COPD	20 (32.8)	13 (18.8)	33 (25.4)	<0.001*
Rheumatic heart disease	4 (6.6)	9 (13.0)	13 (10.0)	0.090
Chronic kidney disease	5 (8.2)	4 (5.8)	9 (6.9)	<0.001*
Hypothyroidism	1 (1.6)	7 (10.1)	8 (6.2)	0.003*
Dilated cardiomyopathy	4 (6.6)	3 (4.3)	7 (5.4)	0.040*



3.4 Clinical presentation and examination

Shortness of breath (93, 71.5%) and dyspnea on ordinary exertion (81, 62.3%) were the predominant presenting symptoms, followed by cough (36.9%), fatigue (33.1%), chest pain (29.2%), bilateral pedal edema (27.7%), palpitations (16.2%), and syncope (14.6%). Nearly half of patients were in NYHA class II (49.2%) and 39.2% were in NYHA class IV. On examination, pedal edema (35.4%), basal crepitations (33.1%), and raised jugular venous pressure (24.6%) were the commonest findings, and pansystolic murmur was the most frequent auscultatory finding (57.7%). Mean systolic and diastolic blood pressures were 131.0 ± 22.9 mmHg and 80.0 ± 11.7 mmHg; mean pulse rate was 117.3 ± 25.0 beats/min and mean SpO_2 was 94.4 ± 2.6%, reflecting the tachycardic ventricular response typical of AF.

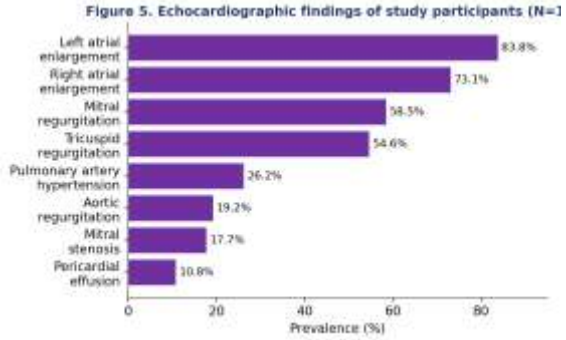


3.5 Electrocardiographic, laboratory, and radiological findings

AF with fast ventricular rate (FVR) was present in 71 patients (54.6%) and AF with controlled ventricular rate (CVR) in 59 (45.4%) ($p<0.001$). Laboratory evaluation showed mild anemia in a proportion of patients (mean hemoglobin 12.9 g/dL, median 11.5 g/dL), preserved coagulation in most patients (mean INR 1.23 ± 0.50), suboptimal glycemic control in a subset (mean HbA1c 7.0%, median 6.2%), and generally preserved renal function with a right-skewed distribution (median creatinine 1.1 mg/dL, interquartile range 0.9–1.4 mg/dL) indicating a minority with significant renal impairment. Cardiac biomarkers (CPK-MB, troponin-T) were within normal limits in the large majority of patients, arguing against acute myocardial injury as the precipitant of AF in most cases. On chest radiography, cardiomegaly was seen in 35.4%, pulmonary edema in 6.9%, and pleural effusion in 3.1% of patients.

3.6 Echocardiographic and etiological profile

Two-dimensional echocardiography demonstrated left atrial enlargement in 109 patients (83.8%), the single most common structural abnormality, followed by right atrial enlargement (73.1%), mitral regurgitation (58.5%), tricuspid regurgitation (54.6%), pulmonary arterial hypertension (26.2%), aortic regurgitation (19.2%), mitral stenosis (17.7%), and pericardial effusion (10.8%). Based on integrated clinical and echocardiographic assessment, hypertensive heart disease and rheumatic heart disease were the two leading final etiological diagnoses (18 patients each, 13.8%), followed by ischemic heart disease and dilated cardiomyopathy (8 patients each, 6.2%), degenerative valvular heart disease (6, 4.6%), and heart failure with reduced ejection fraction (3, 2.3%); congenital heart disease, hypertrophic and restrictive cardiomyopathy, and a normal study were each identified in only one patient.



3.7 Thromboembolic and bleeding risk

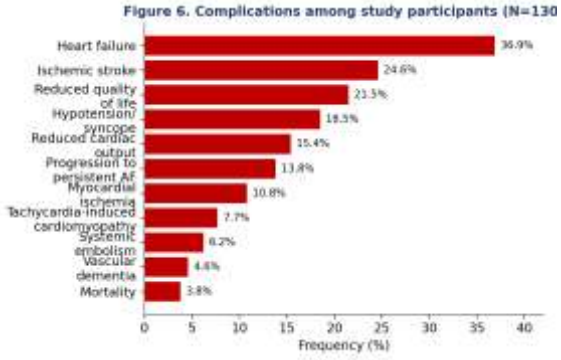
Assessment of individual CHA_2DS_2-VASc components showed that female sex (53.1%) and hypertension (52.3%) were the most prevalent contributors, followed by age ≥75 years (30.0%), diabetes mellitus (29.2%), vascular disease (23.1%), prior stroke/TIA/thromboembolism (19.2%), and congestive heart failure (18.5%), indicating that most patients carried multiple risk factors for thromboembolism. For HAS-BLED, advanced age (>65 years) was present in nearly all patients (97.7%) by definition, followed by abnormal liver/kidney function (66.9%), hypertension (51.5%), drug/alcohol use (33.8%), prior stroke (19.2%), bleeding history/predisposition (15.4%), and labile INR (13.1%), indicating a substantial concurrent bleeding-risk burden requiring individualized anticoagulation decisions.

3.8 Complications

Heart failure was the most frequent complication (48, 36.9%), followed by ischemic stroke (32, 24.6%), reduced quality of life (28, 21.5%), hypotension/syncope (24, 18.5%), reduced cardiac output (20, 15.4%), progression to persistent AF (18, 13.8%), myocardial ischemia (14, 10.8%), tachycardia-induced cardiomyopathy (10, 7.7%), systemic embolism (8, 6.2%), vascular dementia (6, 4.6%), and mortality (5, 3.8%). [Table 4]

Table 4: Complications among study participants (N = 130)

Complication	Male, n (%)	Female, n (%)	Total, n (%)
Heart failure	22 (36.1)	26 (37.7)	48 (36.9)
Ischemic stroke	16 (26.2)	16 (23.2)	32 (24.6)
Reduced quality of life	12 (19.7)	16 (23.2)	28 (21.5)
Hypotension/syncope	10 (16.4)	14 (20.3)	24 (18.5)
Reduced cardiac output	9 (14.8)	11 (15.9)	20 (15.4)
Progression to persistent AF	8 (13.1)	10 (14.5)	18 (13.8)
Myocardial ischemia	8 (13.1)	6 (8.7)	14 (10.8)
Tachycardia-induced cardiomyopathy	6 (9.8)	4 (5.8)	10 (7.7)
Systemic embolism	4 (6.6)	4 (5.8)	8 (6.2)
Vascular dementia	2 (3.3)	4 (5.8)	6 (4.6)
Mortality	3 (4.9)	2 (2.9)	5 (3.8)



DISCUSSION

This study characterized 130 elderly patients with AF at a tertiary care centre in Uttarakhand and found a disease profile dominated by structural heart disease, multiple cardiovascular comorbidities, and a substantial burden of heart failure and stroke, rather than an isolated rhythm disturbance.

Nearly half of the participants belonged to the youngest elderly stratum (65–70 years), consistent with the well-established rise in AF prevalence with advancing age described by Go et al. in the ATRIA study,[7] and by Kannel et al. in the Framingham Heart Study,[8] as well as with Benjamin et al.'s identification of age as the strongest independent predictor of incident AF in a population-based cohort.[9] The slight female predominance observed here (53.1%) mirrors the pattern described by Go et al,[7] and Schnabel et al,[10] who noted that although AF incidence is higher in men, women's greater longevity results in a growing absolute burden of AF among elderly women.

Smoking was the most prevalent modifiable risk factor (40.8%), consistent with Chamberlain et al.'s finding in the Atherosclerosis Risk in Communities (ARIC) cohort that both current and former smokers carry a significantly higher risk of AF,[11] and with Aune et al.'s dose-response meta-analysis linking smoking intensity and duration to AF risk.[12] Alcohol use, reported in 23.1% of patients and markedly more common in men, aligns with the "Holiday Heart" phenomenon first described by Ettinger et al,[13] and the dose-dependent relationship demonstrated by Larsson et al,[14] the lower prevalence relative to Western cohorts likely reflects sociocultural patterns of alcohol use among elderly Indian women and possible under-reporting.

Hypertension was the leading comorbidity (52.3%), consistent with its recognition as the commonest AF-associated risk factor in Indian real-world registry data,[15] and with Benjamin et al.'s Framingham findings that long-standing hypertension substantially increases AF risk through left ventricular hypertrophy, diastolic dysfunction, and left atrial remodelling.[9] Coronary artery disease (38.5%) and diabetes mellitus (29.2%) were the next most common comorbidities, in keeping with the Euro Heart Survey,[16] and with Huxley et al.'s meta-analysis showing diabetes independently increases AF risk by approximately 30–40%.[17] COPD (25.4%), more common among men, is consistent with Konecny et al.'s demonstration that chronic hypoxia, pulmonary hypertension, and systemic inflammation associated with COPD promote AF,[18] the higher smoking prevalence among male participants in this cohort likely contributed to this pattern. Rheumatic heart disease remained an important etiology (10.0%), reflecting its continuing, if declining, contribution to AF in Indian populations as documented in community AF-screening studies from India,[19,20] in contrast to Western cohorts where ischemic and hypertensive etiologies now predominate.[8]

Breathlessness rather than palpitation was the dominant presenting complaint (71.5% shortness of breath; 62.3% exertional dyspnea), consistent with observations from the Euro Heart Survey,[16] and the Indian Heart Rhythm Society AF registry,[21] that elderly AF patients typically present with heart-failure symptoms rather than isolated palpitation, an impression reinforced by the frequent findings of pedal edema, raised jugular venous pressure, and basal crepitations on examination in the present cohort. AF with fast ventricular rate was the predominant electrocardiographic pattern (54.6%), in line with Zoni-Berisso et al.'s epidemiological description of AF presentation in elderly patients with cardiovascular disease.[22]

Echocardiography identified left atrial enlargement as the most frequent structural abnormality (83.8%), consistent with Vaziri et al.'s Framingham data identifying left atrial size as an independent echocardiographic predictor of AF,[23] and with Tsang et al.'s demonstration that left atrial volume is a key risk marker for incident AF in older adults.[24] The high prevalence of mitral and tricuspid regurgitation likely reflects secondary annular dilatation from long-standing atrial and ventricular remodeling rather than primary valvular pathology alone. Hypertensive and rheumatic heart disease were the leading final etiological diagnoses, paralleling findings from Indian AF cohorts describing a mixed hypertensive-valvular etiological pattern distinct from the predominantly ischemic pattern reported in Western series.[8]

Assessment of thromboembolic risk showed that most patients carried multiple CHA_2DS_2-VASc risk factors—chiefly female sex, hypertension, advanced age, and diabetes—consistent with the original validation of the score by Lip et al,[25] and its subsequent nationwide validation by Olesen et al., who demonstrated that accumulating risk factors are associated with a substantially higher incidence of thromboembolic events.[26] Parallel HAS-BLED assessment showed a high prevalence of advanced age, renal/hepatic dysfunction, and hypertension, mirroring the original derivation cohort described by Pisters et al.[27] As emphasized by Pisters et al., an elevated HAS-BLED score should prompt identification and correction of modifiable bleeding

risk factors and closer monitoring rather than withholding indicated anticoagulation, since most patients in this cohort simultaneously carried a high thromboembolic risk.

Heart failure and ischemic stroke were the leading complications in this cohort, consistent with Wolf et al.'s classical demonstration that AF increases stroke risk approximately five-fold relative to sinus rhythm,[6] and with Stewart et al.'s 20-year Renfrew/Paisley cohort data identifying heart failure and thromboembolism as the principal causes of AF-related morbidity.[28] The substantial complication burden observed here likely reflects the advanced age of participants combined with the high prevalence of hypertension, coronary disease, diabetes, and structural heart disease, and underscores the importance of early diagnosis, systematic risk stratification, and comorbidity-directed management, consistent with the integrated management approach recommended in contemporary AF guidelines.[4,29]

4.1 Strengths and limitations

This study provides a comprehensive, multi-domain clinico-etiological characterization of elderly AF patients—spanning demographic, lifestyle, laboratory, electrocardiographic, echocardiographic, and risk-scoring data—from a tertiary care centre in Uttarakhand, a sub-Himalayan region where such data are scarce. However, several limitations should be noted. The study was conducted at a single tertiary centre, which may limit generalizability and introduces potential referral bias toward more severe disease. The sample size (n=130) was relatively modest, and the cross-sectional design precludes assessment of long-term outcomes, treatment response, or causal relationships. Long-term follow-up data on recurrence, anticoagulation adherence, and stroke or mortality outcomes were not available. A small number of laboratory values showed extreme dispersion suggestive of possible data-entry or unit inconsistencies and should be interpreted with caution.

CONCLUSION

Atrial fibrillation in elderly patients at this tertiary care centre was predominantly associated with advanced structural heart disease and a high burden of cardiovascular comorbidity—chiefly hypertension, coronary artery disease, diabetes mellitus, COPD, and rheumatic heart disease—rather than occurring as an isolated arrhythmia, with smoking as the leading modifiable lifestyle risk factor. Patients most often presented with breathlessness and other heart-failure symptoms rather than classical palpitations, often reflecting delayed presentation and advanced disease. Left atrial enlargement and valvular regurgitation were the dominant echocardiographic abnormalities, and hypertensive and rheumatic heart disease were the leading etiological diagnoses. Most patients carried a high combined thromboembolic and bleeding risk burden, and heart failure and ischemic stroke were the principal complications observed. These findings support systematic electrocardiographic screening of symptomatic elderly patients, routine CHA_2DS_2-VASc/HAS-BLED-based risk stratification, comprehensive echocardiographic evaluation, aggressive comorbidity and lifestyle-risk-factor control, and timely anticoagulation in eligible patients as integral components of AF management in this population. Larger, multicentric, prospective studies with long-term follow-up are recommended to further define treatment outcomes and prognosis of AF among elderly patients in Uttarakhand and comparable regions of India.

Ethics statement

The study was approved by the Institutional Ethics Committee of Government Medical College, Haldwani. Written informed consent was obtained from all participants.

Conflict of interest

None declared.

Funding

None declared.

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