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Original article

Clinical Characteristics and Hospital Case Distribution of Atrial Fibrillation at the National Cardiac Center, Benghazi, Libya: A Retrospective Study

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Abstract

Atrial fibrillation (AF) is the most common sustained cardiac arrhythmia and a major contributor to stroke and heart failure. Data on AF from Libya remain limited. To describe the demographic and clinical characteristics of AF patients diagnosed at the National Cardiac Center of Benghazi between 2022 and 2024. Retrospective descriptive review of records of 467 patients diagnosed with AF at a single tertiary cardiac center. Data on age, sex, hypertension, diabetes, myocardial infarction, heart failure, smoking, and hypothyroidism were extracted and analysed descriptively; sex-based differences were assessed using chi-square/Fisher's exact tests. Mean age at diagnosis was 63.5 ± 13.0 years, with the highest proportion (30.0%) aged 60–68 years. Of 467 patients, 51.8% were female, and 48.2% were male. Hypertension (62.1%), diabetes (45.0%), and hypothyroidism (13.1%) were common, and each differed significantly by sex (all $p<0.05$, higher in females). Myocardial infarction (5.1%) and heart failure (16.3%) showed no significant sex difference. Diagnoses peaked in July–August and were lowest in November. AF cases at this center were concentrated among older adults, with a nearly balanced sex distribution and significant sex differences in several comorbidities. These findings provide descriptive baseline data on AF from a Libyan tertiary center; findings should not be interpreted as population prevalence or as evidence of causal risk factors given the retrospective, single-center, uncontrolled design.

Keywords. Hospital Case, Atrial Fibrillation, National Cardiac Center, Benghazi, Libya.

Introduction

Atrial fibrillation (AF) is the most common cardiac rhythm disturbance, characterized by irregular atrial activity resulting from disrupted sinus node control and sporadic depolarization of atrial myocytes [1]. Globally, AF has doubled in incidence and prevalence over the past 50 years, affecting approximately 46.3 million individuals in 2016, with projections indicating further increases across the US, Europe, and Asia [2,3]. The incidence rises sharply with age, ranging from 3.1 cases per 1000 person-years in men aged 55–64 to 38.0 cases in men aged 85–94. Despite improved awareness and detection, AF remains under-recognized, posing a major health burden due to its association with severe complications such as stroke and heart failure. AF increases stroke risk fivefold, with AF-related strokes often fatal or disabling [4]. AF does not occur in isolation but is influenced by multiple risk factors. These can be categorized into non-modifiable (age, family history, ethnicity) and modifiable (hypertension, coronary artery disease, diabetes, obesity, thyroid disorders, chronic kidney disease, and lifestyle factors such as smoking and alcohol use) [5,6].

Hypertension is the most significant cardiovascular risk factor, while diabetes and obesity contribute through vascular damage and inflammatory stress. Thyroid dysfunction, particularly hypothyroidism, also plays a role, with higher prevalence among females. Other contributors include sleep apnea, chronic inflammation, and postoperative states. Lifestyle triggers such as excessive alcohol intake (Holiday Heart Syndrome), caffeine, nicotine, and recreational drugs further exacerbate AF risk [6–8]. Pathophysiologically, AF arises from ectopic discharges in pulmonary veins and autonomic ganglionated plexi, premature atrial contractions, electrolyte imbalances, and abnormal ion channel activity [7–9]. Structural remodeling, fibrosis, atrial dilation, and autonomic nervous system dysfunction perpetuate AF episodes, leading to persistent or permanent forms resistant to treatment [10,11]. Clinically, AF presents with heterogeneous symptoms ranging from palpitations, dyspnea, and fatigue to asymptomatic cases [12–14]. Diagnosis relies on pulse examination and confirmation by 12-lead ECG, while complications include stroke, myocardial infarction, and heart failure [15–17].

Although the global epidemiology of atrial fibrillation is well documented, hospital-based clinical data on AF patients from Libya and the broader North African region remain scarce, and to our knowledge, no such data have previously been published from a Libyan cardiac center. Understanding the demographic profile and comorbidity burden of AF patients in this population is a necessary first step toward improving local screening practices, comorbidity management, and future prospective research. Therefore, this study aims to describe the age and sex distribution of AF patients diagnosed at the National Cardiac Center of Benghazi between 2022 and 2024, to describe the frequency of hypertension, diabetes, smoking, and hypothyroidism among these patients and their distribution by sex, and to describe the annual and monthly distribution of recorded AF diagnoses over the study period. To describe the clinical characteristics and hospital-based case distribution of atrial fibrillation among adults diagnosed at the National Cardiac Center of Benghazi (2022–2024).

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Methodology

Study Design and Setting

This study was designed as a retrospective descriptive study conducted at the National Cardiac Center of Benghazi, Libya, using consecutively identified atrial fibrillation cases diagnosed between January 2022 and December 2024. Data collection and analysis were performed in 2025.

Data Collection

Patient files diagnosed with atrial fibrillation (AF) were retrieved from the statistical and analytical unit of the cardiology department. All diagnoses were confirmed by qualified cardiologists. Incomplete patient files, defined as any file missing age, sex, or date-of-diagnosis data required for the primary analysis, were excluded. The available records did not specify the electrocardiographic diagnostic criteria used for AF confirmation, whether newly diagnosed and previously known AF cases were both included, whether repeated admissions of the same patient were counted more than once, the total number of incomplete/excluded records, or AF type (paroxysmal, persistent, or permanent). These details were therefore not available for the present analysis. Data were systematically entered into Microsoft Excel (version 16.96).

Variables

The collected data included patients' age, sex, associated medical conditions (hypertension, diabetes mellitus, prior myocardial infarction, heart failure, smoking, hypothyroidism), and date of diagnosis.

Statistical Analysis

Data were preliminarily processed in Microsoft Excel and subsequently analysed using the Statistical Package for Social Sciences (SPSS, version 22). Descriptive statistics were generated for all variables. Associations between sex and categorical clinical characteristics were assessed using the Pearson chi-square test; Fisher's exact test was used instead when the expected count in any cell was less than 5. Chi-square and Fisher's exact analyses reported in this study examine differences in the distribution of clinical characteristics between male and female patients within the AF cohort and should not be interpreted as demonstrating that these characteristics caused or predicted the development of AF. A p-value < 0.05 was considered statistically significant.

Ethical Approval

The study protocol was approved by the regional ethics committee of the Libyan International Medical University and conducted in accordance with the guidelines of the Faculty of Applied Medical Sciences.

Results

Age Distribution

The age distribution of atrial fibrillation (AF) cases at the National Cardiac Center of Benghazi was divided into six age groups: ≤50 (n=78, 16.7%), 51–59 (n=78, 16.7%), 60–68 (n=140, 30.0%), 69–78 (n=106, 22.7%), 79–87 (n=56, 12.0%), and ≥88 years (n=9, 1.9%), with a total sample size of 467 patients (Figure 1). The mean age at diagnosis was 63.54 ± 13.04 years (range, ≤50–≥88 years). The 60–68-year age group represented the largest proportion of AF cases, followed by the 69–78-year group, while patients aged ≥88 years represented the smallest group.

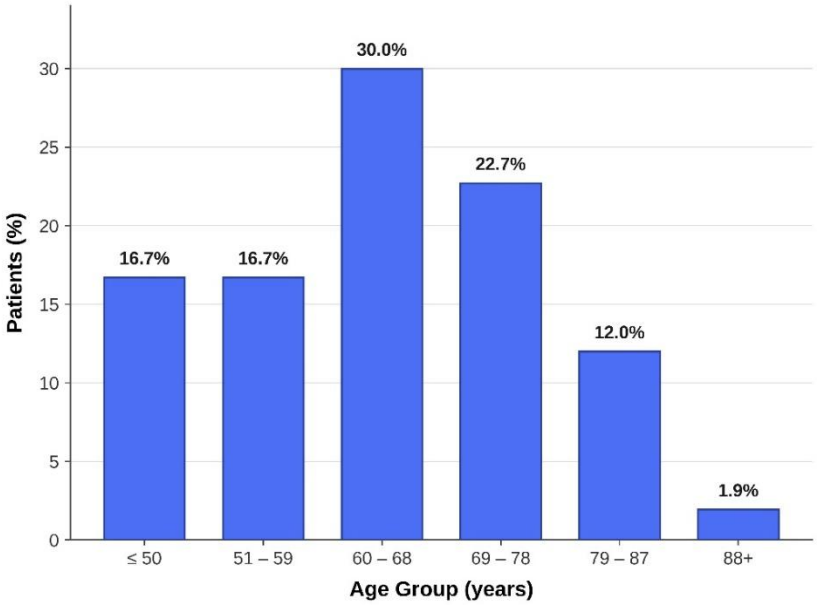

Figure 1. Age distribution of patients diagnosed with atrial fibrillation

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Gender distribution

Among the 467 patients diagnosed with atrial fibrillation (AF), 242 (51.8%) were female and 225 (48.2%) were male, indicating a slight female predominance in the study population (Figure 2). These percentages represent the sex distribution of AF cases. They should not be interpreted as evidence of a higher prevalence of AF among females because the sex distribution of the underlying hospital population was not available.

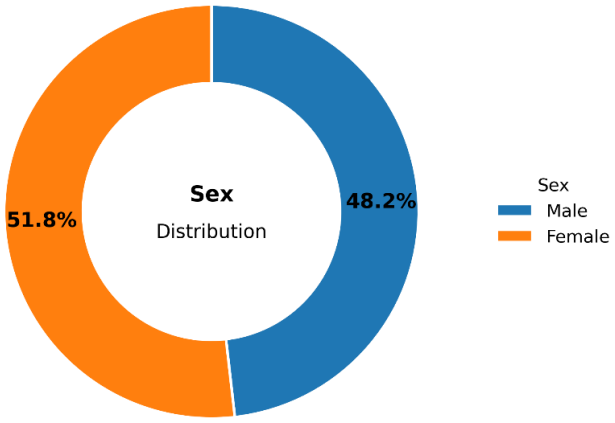

Figure 2. Sex distribution of patients diagnosed with atrial fibrillation

Common risk factors

A descriptive and inferential analysis was conducted to examine clinical characteristics observed among patients diagnosed with atrial fibrillation (AF) in the study population (N = 467). The characteristics examined included hypertension, myocardial infarction, heart failure, smoking, diabetes, and hypothyroidism. These conditions were also categorized by sex to explore potential sex-based differences. Out of 467 patients, 290 (62.1%) were diagnosed with hypertension. Among the 225 male patients, 123 (54.7%) had hypertension, while 102 (45.3%) did not. In contrast, among 242 female patients, 167 (69.0%) were diagnosed with hypertension, while 75 (31.0%) were not (Figure 3, Table 1). Hypertension was numerically more common among female than male AF patients in this study population. A chi-square test was conducted to determine the association between sex and hypertension. The results showed a statistically significant association, $\chi^2(1, N = 467) = 10.189$, $p = 0.001$, indicating that hypertension was significantly more common among female than male patients within this study population.

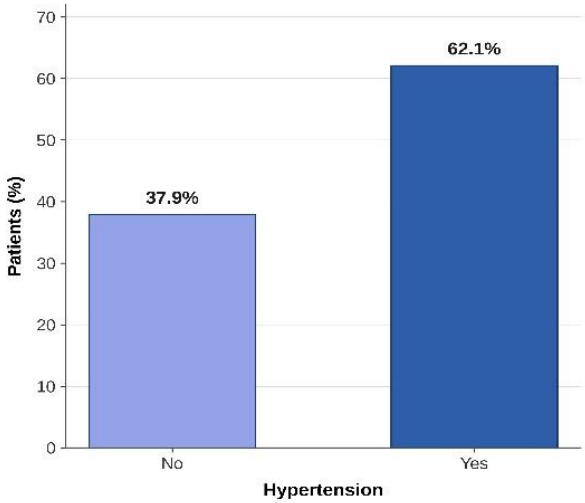

Figure 3. Patients with atrial fibrillation diagnosed with hypertension

Table 1. Gender and hypertension among patients with atrial fibrillation

			Hypertension		Total
			No	Yes	
Gender	Male	Count	102	123	225
		% within Gender	45.3%	54.7%	100.0%
	Female	Count	75	167	242

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		% within Gender	31.0%	69.0%	100.0%
Total		Count	177	290	467
		% within Gender	37.9%	62.1%	100.0%

Myocardial infarction

Out of 467 patients, 24 (5.1%) experienced an episode of myocardial infarction before the development of AF. A chi-square test was conducted to determine the association between sex and myocardial infarction. The results showed no significant association, $\chi^2(1, N = 467) = 0.034$, $p = 0.855$, indicating no evidence of a relationship between sex and myocardial infarction in this study population (Figure 4).

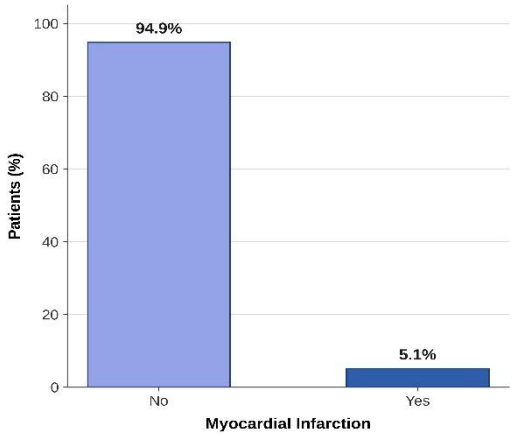

Figure 4. Patients with atrial fibrillation and previous myocardial infarction

Heart failure

Out of 467 patients, 76 (16.3%) were previously diagnosed with heart failure and subsequently developed AF. A chi-square test was conducted to determine the association between sex and heart failure. The results showed no significant association, $\chi^2(1, N = 467) = 0.823$, $p = 0.364$, indicating no evidence of a relationship between sex and heart failure in this study population (Figure 5).

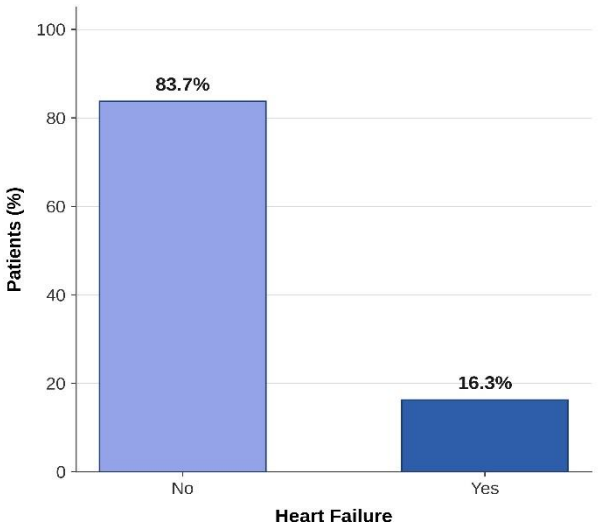

Figure 5. Percentage of patients with atrial fibrillation and heart failure

Cigarette smoke/tobacco use

Out of 467 patients, 70 (15.0%) were identified as smokers in their medical history. A chi-square test was conducted to examine the association between sex and smoking status among patients with AF. The results showed a statistically significant association, $\chi^2(1, N = 467) = 65.831$, $p < 0.001$, indicating that smoking status differed significantly between male and female patients within the study population. This finding should not be interpreted as evidence that smoking was associated with the development of AF because the study did not include a non-AF comparison group.

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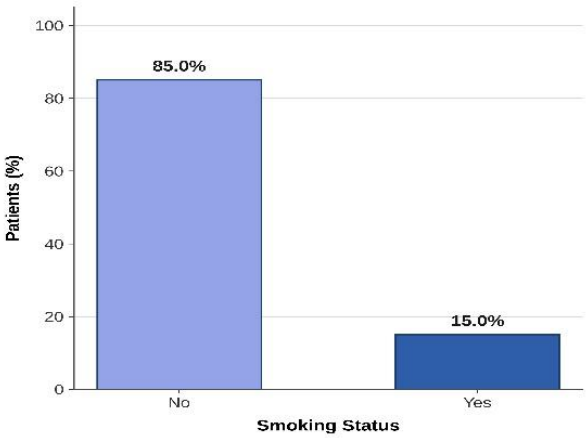

Figure 6. Smoking status among patients with atrial fibrillation

Diabetes

Out of the 467 patients, 210 (45.0%) were diagnosed with diabetes before their AF diagnosis. Diabetes was more common among female than male AF patients: 127 of the 242 female patients (52.5%) had a prior diagnosis of diabetes, compared with 83 of the 225 male patients (36.9%) (Figure 7). A chi-square test was conducted to determine the association between sex and diabetes. The results showed a statistically significant association, $\chi^2(1, N = 467) = 11.452$, $p = 0.001$, indicating that diabetes was significantly more common among female than male patients within the study population.

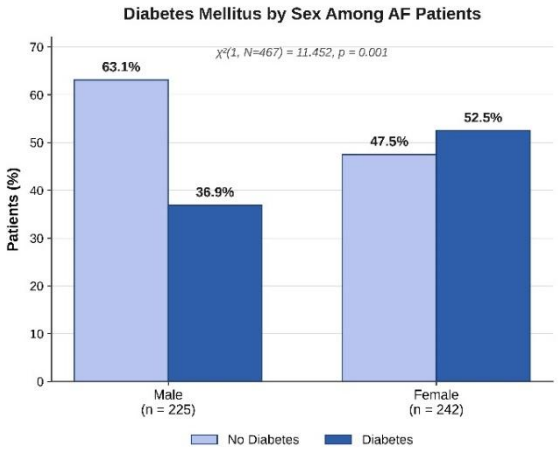

Figure 7. Patients with atrial fibrillation previously diagnosed with diabetes mellitus

Table 2. Gender and diabetes mellitus among patients with atrial fibrillation

			Diabetes		Total
			No	Yes	
Gender	Male	Count	142	83	225
		% within Gender	63.1%	36.9%	100.0%
	Female	Count	115	127	242
		% within Gender	47.5%	52.5%	100.0%
Total		Count	257	210	467
		% within Gender	55.0%	45.0%	100.0%

Chi-square test

A chi-square test was used to determine whether there was a significant association between gender and diabetes in the study population. The association was statistically significant, $\chi^2(1, N = 467) = 11.452$, $p = 0.001$. This suggests that diabetes prevalence significantly differs between male and female AF patients.

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Table 3. Chi-square test for the association between gender and diabetes mellitus among patients with atrial fibrillation

Chi-Square Tests	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	11.452[a]	1	.001		
Continuity Correction[b]	10.831	1	.001		
Likelihood Ratio	11.511	1	.001		
Fisher's Exact Test				.001	.000
Linear-by-Linear Association	11.427	1	.001		
N of Valid Cases	467				
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 101.18.					
b. Computed only for a 2x2 table					

Hypothyroidism

Of the 467 patients diagnosed with AF, hypothyroidism status was available for 466; one patient's file did not clearly document this information and was excluded from this specific analysis. Of these 466 patients, 61 (13.1%) had a documented diagnosis of hypothyroidism. Hypothyroidism was markedly more common among female than male patients: 58 of the 242 female patients (24.0%) had a documented diagnosis of hypothyroidism, compared with 3 of the 224 male patients with available data (1.3%) (Figure 8). A chi-square test was conducted to determine the association between sex and hypothyroidism. The results showed a highly significant association, $\chi^2(1, N = 466) = 52.353$, $p < 0.001$, indicating that hypothyroidism was significantly more common among female than male patients within the study population.

Table 4. Frequency of hypothyroidism among patients with atrial fibrillation

Hypothyroidism		Frequency	Percent
	No	405	86.7
	Yes	61	13.1
	Total	466	99.8
	Missing	1	.2
Total		467	100.0

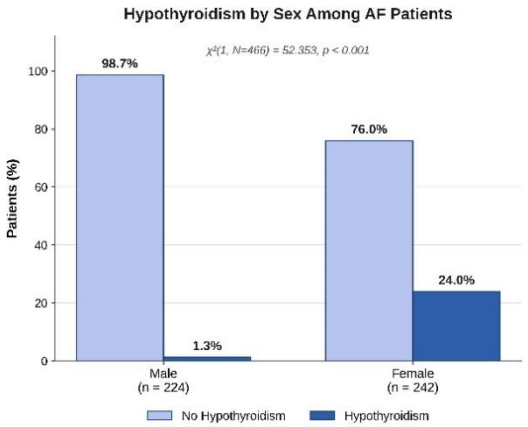

Figure 8. Patients with atrial fibrillation diagnosed with hypothyroidism

Table 5. Gender and hypothyroidism among patients with atrial fibrillation

Crosstab			Hypothyroidism		Total
			No	Yes	
Gender	Male	Count	221	3	224
		% within Gender	98.7%	1.3%	100.0%
	Female	Count	184	58	242
		% within Gender	76.0%	24.0%	100.0%
Total		Count	405	61	466
		% within Gender	86.9%	13.1%	100.0%

Chi-square test

A chi-square test showed a highly significant association between gender and hypothyroidism among patients with AF, $\chi^2(1, N = 466) = 52.353$, $p < 0.001$, indicating that hypothyroidism was more frequently recorded among female than male patients

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in this AF population. This finding does not establish that hypothyroidism was associated with the development of AF because no non-AF comparison group was included.

Table 6. Chi-square test for the association between gender and hypothyroidism among patients with atrial fibrillation

Chi-Square Tests	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	52.353[a]	1	.000		
Continuity Correction[b]	50.383	1	.000		
Likelihood Ratio	63.330	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	52.241	1	.000		
N of Valid Cases	466				
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 29.32.					
b. Computed only for a 2x2 table					

Prevalence of atrial fibrillation

The estimated hospital-based prevalence of AF at the National Cardiac Center of Benghazi during the three-year study period was approximately 4.9%. The hospital was unable to provide the exact number of admissions during the study period; based on the patient files available, approximately 9,400 admissions were estimated, of whom 467 were diagnosed with AF. Because the denominator was estimated rather than verified, the reported 4.9% should be interpreted cautiously as an estimated hospital-based prevalence and not as a population prevalence for Benghazi. In 2022, 161 patients were diagnosed with AF, with an estimated 2,400 hospital admissions during the year, giving an estimated hospital-based prevalence of **6.71%**. In 2023, 185 patients were diagnosed with AF, with an estimated 3,800 hospital admissions during the year, giving an estimated hospital-based prevalence of **4.87%**. In 2024, 121 patients were diagnosed with AF, with an estimated 3,200 hospital admissions during the year, giving an estimated hospital-based prevalence of **3.78%**.

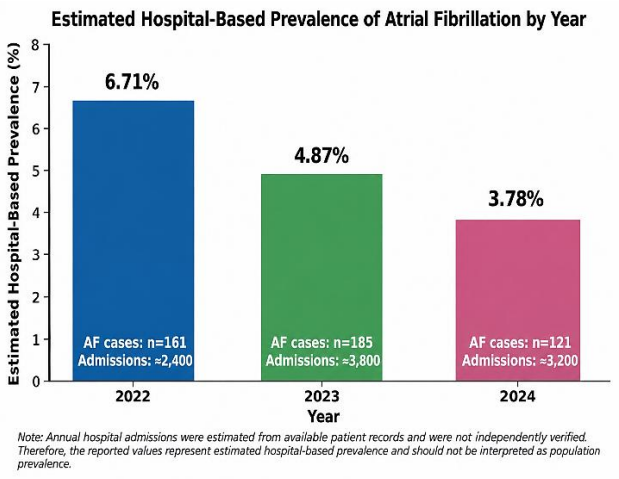

Figure 9. Annual number of atrial fibrillation cases at the National Cardiac Center of Benghazi, 2022–2024

Monthly distribution of AF

The number of patients diagnosed with AF varied by month across the study period (Figure 10). July had the highest number of recorded AF cases (n = 48), followed by August (n = 47), while November had the lowest number (n = 28), followed by April (n = 31). These findings describe monthly variation in recorded AF diagnoses; because monthly hospital-admission denominators were not available, they should not be interpreted as confirmed seasonal variation in AF prevalence.

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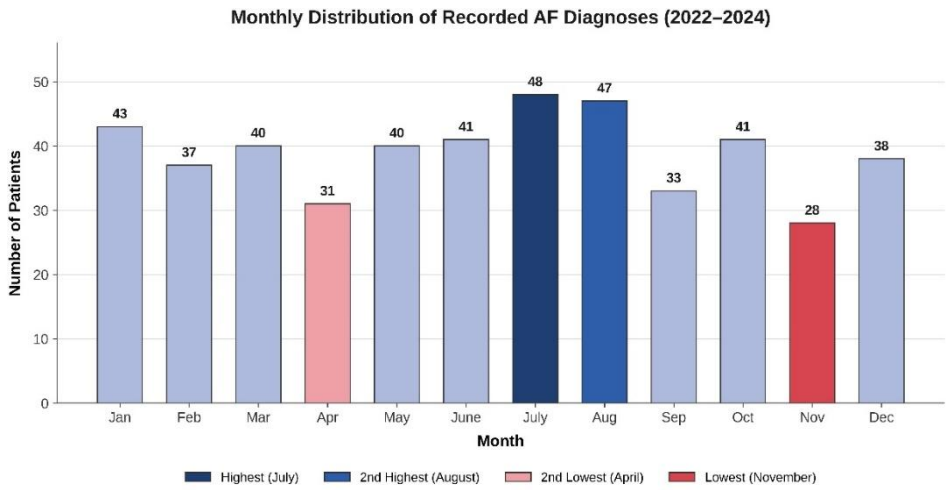

Figure 10. Monthly distribution of atrial fibrillation cases during the study period (2022–2024)

Discussion

This retrospective hospital-based study provides descriptive data on atrial fibrillation (AF) among patients attending the National Cardiac Center of Benghazi between 2022 and 2024. A total of 467 patients with AF were identified during the study period, corresponding to an estimated hospital-based prevalence of approximately 4.9%. The estimated annual prevalence was 6.7% in 2022, 4.86% in 2023, and 3.7% in 2024. However, these figures should be interpreted cautiously because the total numbers of hospital admissions used as denominators were estimated rather than obtained from verified hospital records. Therefore, the observed numerical decline across the three years cannot be considered definitive evidence of a true reduction in AF prevalence in Benghazi. The estimated prevalence observed in the present study is broadly comparable with findings from some international hospital-based studies. Yuniadi et al. reported an AF prevalence of 3.2% in a tertiary hospital survey in Indonesia [18].

Differences between studies may reflect variation in study populations, age structure, referral patterns, methods of AF detection, and healthcare settings. Direct comparison should nevertheless be made cautiously because the present study represents a single-center hospital population and uses an estimated denominator. Age was an important characteristic of the AF cohort. The mean age at diagnosis was 63.54 ± 13.04 years, and the largest proportion of cases occurred in patients aged 60–68 years, representing 30% of the study population. This finding is consistent with the established epidemiology of AF, in which AF occurrence increases substantially with advancing age [3]. Age-related structural and electrical changes in the atria, together with the accumulation of cardiovascular and metabolic comorbidities, may contribute to the greater occurrence of AF among older individuals. Regarding sex distribution, 51.8% of the AF cases were female, and 48.2% were male, indicating a slight female predominance within this study cohort. This finding should not be interpreted as demonstrating a higher prevalence of AF among females because the sex distribution of the underlying hospital population was not available.

Sex-related differences in AF are complex and may be influenced by age, cardiovascular comorbidities, and other clinical factors [20]. Hypertension was the most frequently recorded comorbidity, affecting 62.1% of AF patients, and it was more common among females in this cohort. This observation is consistent with the recognized close relationship between hypertension and AF [21]. Chronic elevation of blood pressure may contribute to atrial structural remodeling, enlargement, and fibrosis. Nevertheless, because the present study included only patients with AF and did not include a non-AF comparison group, the findings demonstrate the burden of hypertension within the AF cohort rather than establishing hypertension as an independent predictor of AF in this population. Diabetes mellitus was also common, being recorded in 45.0% of patients, and was more frequently recorded among females. The coexistence of diabetes and AF is clinically important because both conditions are associated with cardiovascular morbidity. However, the current study design does not allow determination of whether diabetes independently increased the risk of developing AF; the significant statistical finding represents a difference in diabetes distribution between male and female AF patients. Hypothyroidism was documented in 61 of 466 patients (13.1%) for whom thyroid information was available and showed a marked female predominance. The present study specifically evaluated hypothyroidism; therefore, this terminology is used consistently throughout the manuscript.

Smoking was recorded in 15.0% of the AF cohort and differed significantly by gender. This association reflects a gender difference in smoking status within the AF cohort rather than evidence that smoking increased the risk of AF. Regarding temporal distribution, July had the highest number of recorded AF diagnoses (n = 48), followed by August (n = 47), whereas November had the lowest number (n = 28). Khan and Halder reported a different seasonal pattern in cardiovascular hospital admissions in Bangladesh [19]. In the absence of monthly admission denominators, the present findings are better interpreted as variation in monthly AF case counts rather than proof of a seasonal effect. Differences in climate, healthcare-seeking behavior, referral patterns, and other unmeasured factors may contribute to the observed pattern. Overall, these findings provide useful descriptive information regarding AF patients managed at a major cardiac center in Benghazi and contribute local data from a setting where published information remains limited. Larger multicenter studies using verified

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denominators, standardized AF definitions, de-duplicated patient-level data, and appropriate comparison populations are needed to define the epidemiology and determinants of AF more accurately in Libya.

Limitations

Several limitations should be acknowledged. First, the retrospective nature of the study means that the analysis depended on the completeness and accuracy of existing hospital records, which may introduce information or misclassification bias. Second, this was a single-center hospital-based study at a specialized cardiac center, creating the possibility of selection and referral bias and limiting generalizability to the wider population of Benghazi, other regions of Libya, or North Africa. Third, the exact number of hospital admissions during the study period was unavailable, and the denominator used to calculate prevalence was estimated; therefore, the reported 4.9% value represents an estimated hospital-based prevalence and cannot be interpreted as population-based prevalence. Fourth, missing or incomplete data were present: incomplete files were excluded, the total number excluded was not documented in the available manuscript data, and hypothyroidism information was unavailable for one patient. Fifth, the study did not include a non-AF control group; consequently, the recorded comorbidities and smoking status cannot be interpreted as independent risk factors for AF, and causal relationships cannot be inferred. Sixth, the available records did not clarify whether the 467 AF cases represented unique patients or whether repeated admissions of the same patient were included; if repeat admissions were counted separately, the case counts and estimated prevalence could be affected. Finally, potentially relevant variables such as alcohol consumption, medication use, and detailed ECG characteristics were not collected, and monthly admission denominators were unavailable, limiting interpretation of apparent seasonal variation.

Conclusion

This study provides descriptive hospital-based data on atrial fibrillation at the National Cardiac Center of Benghazi from 2022 to 2024. AF cases were concentrated in older age groups, and hypertension and diabetes were common comorbidities. The sex distribution of the cohort was nearly balanced, while several recorded clinical characteristics differed by gender. The estimated hospital-based prevalence was approximately 4.9%; however, this estimate is limited by the use of an unverified admission denominator and should not be generalized to the Benghazi population. Future multicenter studies using verified denominators, standardized AF definitions, de-duplicated patient-level data, and appropriate comparison populations are needed to better define the epidemiology and determinants of AF in Libya

Recommendation

Future work in the field of atrial fibrillation must prioritize several strategic directions to strengthen both clinical practice and epidemiological understanding. First, the establishment of a standardized electronic AF registry is essential to ensure accurate documentation of diagnoses, admissions, clinical characteristics, and patient outcomes. Such a registry would provide a reliable foundation for surveillance and quality improvement. Second, larger multicenter and population-based studies using verified denominators are needed to determine the true prevalence and distribution of AF in Benghazi and across Libya. These studies would help overcome current limitations in data accuracy and provide a clearer picture of disease burden. Third, screening and management of common comorbidities—particularly hypertension, diabetes mellitus, and thyroid disorders—must be strengthened, as these conditions were frequently identified among AF patients and represent modifiable risk factors. Finally, prospective analytical studies with appropriate comparison groups are required to evaluate potential risk factors, sex-related differences, and possible temporal or seasonal patterns of AF. Such investigations would provide deeper insights into disease dynamics and inform tailored prevention and management strategies.

Conflict of interest. Nil

References

1. Nattel S. New ideas about atrial fibrillation 50 years on. Nature. 2002;415(6868):219-226. doi:10.1038/415219a.
2. Benjamin EJ, Wolf PA, D'Agostino RB, Silbershatz H, Kannel WB, Levy D. Impact of atrial fibrillation on the risk of death: the Framingham Heart Study. Circulation. 1998;98(10):946-952. doi:10.1161/01.cir.98.10.946. [cited 2024 Oct 28]. Available from: https://pubmed.ncbi.nlm.nih.gov/9737513
3. Kornej J, Börschel CS, Benjamin EJ, Schnabel RB. Epidemiology of atrial fibrillation in the 21st century: novel methods and new insights. Circ Res. 2020;127(1):4-20. doi:10.1161/CIRCRESAHA.120.316340.
4. Stroke Prevention in Atrial Fibrillation Study. Final results. Circulation. 1991;84(2):527-539. doi:10.1161/01.cir.84.2.527.
5. Lip GY, Hee FLS. Paroxysmal atrial fibrillation. QJM. 2001;94(12):665-678. doi:10.1093/qjmed/94.12.665.
6. Shukla A, Curtis AB. Avoiding permanent atrial fibrillation: treatment approaches to prevent disease progression. Vasc Health Risk Manag. 2013;9:1-12. doi:10.2147/VHRM.S39782.
7. Staerk L, Sherer JA, Ko D, Benjamin EJ, Helm RH. Atrial fibrillation: epidemiology, pathophysiology, and clinical outcomes. Circ Res. 2017;120(9):1501-1517. doi:10.1161/CIRCRESAHA.117.309732.
8. JJM BB, Xun A, True HM, Kuipers MF, YH LG. Atrial fibrillation (primer). Nat Rev Dis Primers. 2022;8(1). doi:10.1038/s41572-022-00347-9.
9. Iwasaki YK, Nishida K, Kato T, Nattel S. Atrial fibrillation pathophysiology: implications for management. Circulation. 2011;124(20):2264-2274. doi:10.1161/CIRCULATIONAHA.111.019893.

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10. López B, González A, Querejeta R, Larman M, Rábago G, Díez J. Association of cardiotrophin-1 with myocardial fibrosis in hypertensive patients with heart failure. Hypertension. 2014;63(3):483-489. doi:10.1161/HYPERTENSIONAHA.113.02099.
11. Sun Y, Yu B, Yu Y, Wang B, Tan X, Lu Y, Wang Y, Zhang K, Wang N. Sweetened beverages, genetic susceptibility, and incident atrial fibrillation: a prospective cohort study. Circ Arrhythm Electrophysiol. 2024;17(3):e012145. doi:10.1161/CIRCEP.123.012145.
12. Reiffel JA. The importance of atrial fibrillation's associated comorbidities as clinical presentation and outcome contributors. J Atr Fibrillation. 2021;14(2):20200517. doi:10.4022/jafib.20200517.
13. Computational tools for atrial arrhythmia detection on ECG signals: the contribution of different leads. [No author given – please check and complete].
14. Gutierrez C, Blanchard DG. Diagnosis and treatment of atrial fibrillation. Am Fam Physician. 2016;94(6):442-452. PMID: 27637120.
15. Manolis AA, Manolis TA, Manolis AS. Current strategies for atrial fibrillation prevention and management: taming the commonest cardiac arrhythmia. Curr Vasc Pharmacol. 2025;23(1):31-44. doi:10.2174/0115701611317504240910113003.
16. Jones NR, Round T, Rajappan K. Atrial fibrillation: NICE 2021 update and the focus on anticoagulation. Br J Gen Pract. 2022;72(717):193-195. doi:10.3399/bjgp22X719069. PMCID: PMC8966932.
17. Lloyd-Jones DM, Wang TJ, Leip EP, Larson MG, Levy D, Vasan RS, D'Agostino RB, Massaro JM, Beiser A, Wolf PA, Benjamin EJ. Lifetime risk for development of atrial fibrillation: the Framingham Heart Study. Circulation. 2004;110(9):1042-1046. doi:10.1161/01.CIR.0000140263.20897.42.
18. Yuniadi Y, Supit AI, Hanafy DA, Raharjo SB, Hermanto DY, Basalamah F, Hartono B, Agustinus R, Chandranegara AF, Ahmad C, Iqbal M, Tondas AE, El-Rasyid H, Haryadi H, Lukito AA, Tanubudi D, Yansen I, Maharani E, Julario R, Rizal A, Antara PS, Amir M. Prevalence of atrial fibrillation based on tertiary hospital survey in Indonesia: a smartphone-based diagnosis. J Arrhythm. 2024;40(5):1102-1107. doi:10.1002/joa3.13137. PMCID: PMC11474569.
19. Khan RC, Halder D. Effect of seasonal variation on hospital admission due to cardiovascular disease – findings from an observational study in a divisional hospital in Bangladesh. BMC Cardiovasc Disord. 2014;14:76. doi:10.1186/1471-2261-14-76.
20. Niiranen TJ, Schnabel RB, Schutte AE, Biton Y, Boriani G, Buckley C, Cameron AC, Damasceno A, Diederichsen SZ, Doehner W, Guo Y, Hobbs FDR, Joung B, Hankey GJ, Lip GYH, Lobban T, Løchen ML, Mairesse G, Mbakwem A, Noseworthy PA, Ntaios G, Steinhubl S, Stergiou G, Svendsen JH, Tieleman RG, Wang J, Poulter NR, Healey JS, Freedman B. Hypertension and atrial fibrillation: a frontier review from the AF-SCREEN International Collaboration. Circulation. 2025;151(12):863-877. doi:10.1161/CIRCULATIONAHA.124.071047.
21. Grbic D. Sex-based disparities in atrial fibrillation. The Cardiology Advisor. 2022 May 23. Available from: https://www.thecardiologyadvisor.com/features/sex-based-disparities-in-atrial-fibrillation/

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