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ORIGINAL ARTICLE

# Occurrence of hypokalemia in patients with new-onset atrial fibrillation presenting within 48 hours

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## ABSTRACT

**Background:** Atrial fibrillation (AF) is the most common cardiac rhythm disorder. Various reversible conditions, particularly electrolyte abnormalities, may contribute to its development or persistence. Reduced serum potassium levels can influence cardiac electrical activity and myocardial repolarization, potentially increasing the propensity for atrial arrhythmias. This study was therefore undertaken to assess the frequency of hypokalemia among patients presenting with new-onset AF within 48 hours of symptom onset. This study was therefore undertaken to determine the frequency of hypokalemia among patients presenting with new-onset AF within 48 hours of symptom onset.

**Methods:** The study design was descriptive cross-sectional study at Fauji foundation hospital Peshawar. A total of 102 patients with new-onset atrial fibrillation, diagnosed on clinical and electrocardiographic assessment, were enrolled. The required sample size was calculated using the WHO Sample Size Calculator based on an anticipated hypokalemia proportion of 4.43%, a 4% margin of error, and a 5% level of significance. All participants underwent clinical assessment and serum electrolyte measurement. Hypokalemia was defined as a serum potassium concentration below 3.5 mmol/L.

**Results:** The mean age of the study population was 39.9 ± 16.22 years. The mean duration of presenting symptoms was 1.39 ± 0.49 hours, while the mean systolic blood pressure and body mass index were 139.9 ± 13.98 mmHg and 28.71 ± 6.82 kg/m², respectively. Among the 102 patients with new-onset atrial fibrillation, hypokalemia was identified in 7 patients (6.9%). Hypokalemia was significantly associated with higher body mass index (p=0.017), hypertension (p=0.013), and diabetes mellitus (p=0.011).

**Conclusion:** Hypokalemia identified in a proportion of patients presenting with new-onset atrial fibrillation was significantly associated with diabetes mellitus, hypertension, and increased body mass index. Assessment of routine potassium may be particularly important in these patients.

**Keywords:** Atrial Fibrillation, Cardiac Arrhythmia, Hypokalemia

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## Introduction

Atrial fibrillation (AF) is the most frequently encountered sustained cardiac arrhythmia and represents an increasing global health burden. Its prevalence varies across

populations, with advancing age being one of the most important determinants. (1,2)

Improvements in diagnostic facilities have also contributed to greater recognition of AF in clinical practice (3).

The development of AF is influenced by multiple cardiovascular and non-cardiovascular risk factors. These include increasing age, hypertension, diabetes mellitus, obesity, obstructive sleep apnea, valvular heart disease, abnormalities of lipid metabolism, and disturbances in electrolyte balance. (4) AF is associated with substantial morbidity and mortality because of its relationship with thromboembolic events, ischemic stroke, heart failure, and cardiovascular death (5). Although some patients remain asymptomatic, others may present with palpitations, dyspnea, dizziness, chest discomfort, or reduced exercise tolerance.

Identification of potentially reversible precipitating factors is an important component of the initial assessment of patients with newly diagnosed AF. Evaluation should include consideration of conditions such as myocardial ischemia and electrolyte disturbances. Among electrolyte abnormalities, alterations in serum potassium are of particular clinical interest because potassium plays an important role in cardiac membrane excitability and myocardial electrical stability. Hypokalemia may therefore contribute to the development or maintenance of cardiac arrhythmias (6). Previous epidemiological evidence has suggested a relationship between lower serum potassium concentrations and the occurrence of AF. In the Rotterdam Study, Krijthe et al. reported an association between serum potassium concentration and the risk of developing AF, with hypokalemia identified in approximately 4.43% of individuals who subsequently developed AF. (7) Other investigations have also linked abnormal potassium concentrations with adverse outcomes among patients with AF, including short-term mortality (8).

Evidence from other populations has further suggested that reduced serum potassium may be associated with an increased likelihood of AF. Nishant Saxena et al. reported a higher frequency of AF among individuals with hypokalemia compared with those with normal potassium concentrations. (9) Differences in study populations, clinical characteristics, and study designs, however, make direct comparison between these findings difficult.

Hypokalemia is potentially identifiable and correctable, making its assessment clinically relevant in patients presenting with new-onset AF. Despite evidence from international studies, limited data are available regarding the frequency of hypokalemia among patients with newly diagnosed AF in our local population. Establishing the frequency of this electrolyte abnormality may help clinicians recognize patients who require prompt electrolyte assessment and correction as part of their initial management.

The present study was therefore undertaken to determine the frequency of hypokalemia among patients presenting with new-onset AF at a tertiary care hospital in Peshawar. The study also assessed the relationship between hypokalemia and selected clinical characteristics, including body mass index, diabetes mellitus, and hypertension. The findings may provide locally relevant information for clinicians and may serve as a basis for future prospective studies evaluating the relationship between potassium abnormalities and AF.

## Methods

This descriptive, and cross-sectional study was conducted in the department of cardiology, cardiac family, Fauji Foundation Hospital, Peshawar during six months from January 2026-July 2026. Ethical clearance (Approval No. 00011/DME/CFPL/FFH) was secured prior to the start of the study. All the participants/legal guardians gave written informed consent after a detailed explanation of the goals and procedures for the study. No patient information was disclosed without consent, and confidentiality and privacy were ensured.

The patients included were those with new onset of atrial fibrillation within 48 hours of symptom onset and were aged 18–80 years who could be followed up for at least 12 months after the procedure. Patients included were those who had new onset of atrial fibrillation within 48 hours of onset of symptoms and those between the ages of 18-80 who could be followed for at least 12 months following the procedure. A 12-lead electrocardiogram confirmed the diagnosis, which was made clinically. ECG features of AF included absence of discrete P waves, irregular atrial activity and irregular ventricular rhythm. Patients who had previously been diagnosed with chronic atrial fibrillation, received an antiarrhythmic drug (e.g., amiodarone) or had a previous history of stroke were excluded. People with known heart problems such as valvular heart disease, cardiomyopathy, congenital heart disease, or coronary artery disease were also not included. Patients with a history of thyroid surgery or those being treated for thyroid diseases were also excluded.

A non-probability consecutive sampling technique was used to select the participates. 102 patients met the inclusion criteria and were enrolled. The sample size was calculated using WHO Sample Size Calculator with a previously reported hypokalemia prevalence of 4.43% among patients with atrial fibrillation and a margin of error of 4% and level of significance of 5% (7). Demographic and clinical data was collected with a structured approach and confirmed by clinical evaluation and a 12-lead electrocardiogram performed on a machine (Fukuda ME C110) with a paper speed of 25 mm/sec and a voltage calibration of 0.1 mV / mm in patients with clinical symptoms suggestive of new onset AF. Data collected were age, sex, address, hospital/ward number, contact details, weight, height, body mass index (BMI), blood pressure, diabetes mellitus, hypertension and previous history of atrial fibrillation. Diabetes mellitus was identified by the study protocol as a random blood glucose level greater than 200 mg/dL, a fasting blood glucose level greater than 126 mg/dL or a glycated hemoglobin greater than 6.5%. 5 mL of peripheral venous blood was collected using standard aseptic precautions. Samples were collected in tubes of 5 mL sodium citrate, and kept on ice prior to and after collection. All specimens were immediately sent to the clinical chemistry laboratory and the serum separated by centrifugation. The serum potassium concentration was determined with a Roche Cobas 6000 analyzer (standard laboratory procedure). The analysis was done by an experienced laboratory technologist and potassium was reported in mmol/L. Hypokalemia was defined as a serum potassium level < 3.5 mmol/L.

The data were entered and analyzed with the help of SPSS version 25. For continuous variables such as age, BMI, duration of symptoms and systolic blood pressure, mean

and standard deviation were used. The categorical variables such as age group, sex, diabetes mellitus, hypertension and hypokalemia were shown as frequencies and percentages. Stratified analysis was carried out to evaluate the association of hypokalemia with selected variables such as BMI, diabetes mellitus and hypertension. Stratification was followed by the application of chi-square test with a p value > 0.05 being statistically significant.

## Results

Hypokalemia was identified in 7 (6.9%) patients, whereas 95 (93.1%) had no hypokalemia. Table 1 presents the demographic and clinical characteristics of the 102 patients with new-onset atrial fibrillation. The mean age was 39.99 ± 16.22 years, with a mean symptom duration of 1.39 ± 0.49 hours. The mean systolic blood pressure was 139.90 ± 13.98 mmHg, while the mean BMI was 28.71 ± 6.82 kg/m². Most patients (76.5%) were aged 18–50 years. Females comprised 51.0% and males 49.0% of the study population. Hypertension was present in 54.9% of patients, while diabetes mellitus was observed in 40.2%.

**Table-1: Demographic and Clinical Characteristics of Study Participants (n=102)**

| **Quantitative Variables** | **Mean ± SD** |
|---|---|
| • Age (Years) | 39.99±16.22 |
| • Duration of symptoms (Hours) | 1.39±0.49 |
| • Systolic BP (mmHg) | 139.90±13.98 |
| • BMI (kg/m²) | 28.717±6.82 |
| **Qualitative Variables** | **Mean ± SD** |
| Age, n (%) | |
| • 18-50 years | 78 (76.5%) |
| • 50-80 years | 24 (23.5%) |
| Gender, n (%) | |
| • Male | 50 (49.0%) |
| • Female | 52 (51.0%) |
| Hypertension, n (%) | |
| • Yes | 56 (54.9%) |
| • No | 46 (45.1%) |
| Diabetes Mellitus, (n %) | |
| • Yes | 41 (40.2%) |
| • No | 61 (59.8%) |
| Hypokalemia, (n %) | |
| • Yes | 7 (6.9%) |
| • No | 95 (93.1%) |

Table 2 demonstrates the association between hypokalemia and selected clinical characteristics. Hypokalemia was significantly associated with high body mass index, with all patients having hypokalemia belonging to the BMI >25 kg/m² group (p=0.017). Similarly, all patients with hypokalemia had hypertension, showing a significant association between hypertension and hypokalemia (p=0.013). Diabetes mellitus was also significantly more frequent among patients with hypokalemia, with 6 of 7 hypokalemic patients (85.7%) being diabetic (p=0.011). These findings indicate significant associations between hypokalemia and higher BMI, hypertension, and diabetes mellitus; however, the results should be interpreted cautiously because only seven patients had hypokalemia.

**Table-2: Stratification of Hypokalemia with various effect modifiers (n=102)**

| **Variables** | | **BMI** | | **Total** | **p-value** |
|---|---|---|---|---|---|
| | | **≤ 25 kg/m²** | **> 25 kg/m²** | | |
| Hypokalemia | Yes | 0 | 7 | 7 | 0.017 |
| | | 0.0% | 100.0% | 100.0% | |
| | No | 44 | 51 | 95 | |
| | | 46.3% | 53.7% | 100.0% | |
| Total | | 44 | 58 | 102 | |
| | | 43.1% | 56.9% | 100.0% | |

| | | Hypertension | | Total | p-value |
|---|---|---|---|---|---|
| | | Yes | No | | |
| Hypokalemia | Yes | 7 | 0 | 7 | 0.013 |
| | | 100.0% | 0.0% | 100.0% | |
| | No | 49 | 46 | 95 | |
| | | 51.6% | 48.4% | 100.0% | |
| Total | | 56 | 46 | 102 | |
| | | 54.9% | 45.1% | 100.0% | |
| | | Diabetes Mellitus | | Total | *p*-value |
| | | Yes | No | | |
| Hypokalemia | Yes | 6 | 1 | 7 | 0.011 |
| | | 85.7% | 14.3% | 100.0% | |
| | No | 35 | 60 | 95 | |
| | | 36.8% | 63.2% | 100.0% | |
| Total | | 41 | 61 | 102 | |
| | | 40.2% | 59.8% | 100.0% | |

Table 2 therefore demonstrates that in patients presenting with new-onset AF within 48 hours, hypokalemia was significantly associated with higher BMI, hypertension, and diabetes mellitus.

## Discussion

Atrial fibrillation is a major cardiac arrhythmia and its occurrence is associated with considerable morbidity and mortality. Previous epidemiological studies have demonstrated an increased risk of cerebrovascular events among individuals with AF. In the Framingham cohort, Wolf et al. identified AF as an independent risk factor for stroke, while subsequent studies have also demonstrated associations between AF and heart failure, cardiovascular mortality, and overall mortality. (10,11,12)

Electrolyte disturbances are recognized as potentially important contributors to cardiac electrical instability. Among these abnormalities, reduced serum potassium has received particular attention because potassium concentration directly influences myocardial membrane excitability and repolarization. Hypokalemia, conventionally defined as a serum potassium concentration below 3.5 mmol/L, has been associated with various cardiovascular complications, including ventricular arrhythmias and cardiac arrest. (13)

The relationship between potassium concentration and AF has also been explored in population-based studies. Krijthe et al., using data from the Rotterdam Study, reported an association between serum potassium concentration and the occurrence of AF. Their study included 4,059 participants and identified hypokalemia in approximately 4.4% of the population developing AF. (7) In the present study, hypokalemia was identified in 7 of 102 patients with new-onset AF, corresponding to a frequency of 6.9%.

Nishant Saxena et al. reported a substantially higher proportion of hypokalemia among patients at risk of AF, with an observed association between lower serum potassium concentrations and AF. (9) The difference between their findings and those of the present study may be related to differences in sample characteristics, study design, patient selection, disease duration, and clinical setting. The present investigation was conducted at a single tertiary-care center and specifically focused on patients with new-onset AF.

Evidence from cardiac surgical populations has also suggested an association between low potassium concentrations and AF. Wahr et al. reported that preoperative hypokalemia was associated with postoperative AF among patients undergoing cardiac surgery. (14) Similarly, Auer et al. observed an increased risk of postoperative AF in patients with lower serum potassium levels following cardiac surgery. (15) Although these studies involved postoperative patients and therefore differ from the population examined in the current study, their findings support the potential role of potassium imbalance in atrial electrical instability.

Changes in atrial electrophysiology may provide another explanation for the observed relationship. Severi et al. demonstrated that electrolyte abnormalities can influence atrial electrophysiological properties, including P-wave characteristics. (16) Prolongation of P-wave duration has subsequently been associated with an increased likelihood of AF in other populations. (17,18) These observations suggest that alterations in electrolyte concentrations may influence atrial conduction and thereby contribute to an arrhythmogenic substrate.

The electrophysiological effects of hypokalemia are complex. Reduced extracellular potassium can alter the resting membrane potential and modify several ionic currents involved in cardiac repolarization. Experimental work has suggested that hypokalemia can reduce repolarization reserve and facilitate abnormal electrical activity through effects on sodium and calcium currents and intracellular calcium handling. (19,20) These mechanisms may increase susceptibility to triggered activity and other forms of arrhythmia.

The association between hypokalemia and arrhythmia has also been observed in critically ill populations. Phillips et al. evaluated large cohorts of patients receiving critical care and reported hypokalemia in a substantial proportion of patients in both cardiac and general intensive care settings. (21) Although the clinical characteristics of those populations differ from the patients in the present study, these observations emphasize the importance of monitoring potassium concentrations in patients at increased risk of cardiac arrhythmias.

More recently, Cacioppo et al. investigated potassium administration in patients with non-permanent AF and reported an association between intravenous potassium administration and spontaneous conversion of AF to sinus rhythm without pharmacological cardioversion. (22) These findings provide additional support for the clinical relevance of potassium balance in AF, although they do not establish that hypokalemia is a direct cause of AF.

In the current study, hypokalemia was significantly associated with higher BMI, diabetes mellitus, and hypertension. These associations may have several plausible mechanisms. Obesity is associated with increased renin–angiotensin–aldosterone system activity and elevated aldosterone levels, which enhance renal potassium secretion.(19,20) In diabetes mellitus, hyperglycemia may cause osmotic diuresis and urinary potassium loss, while disturbances in insulin–potassium homeostasis may also influence serum potassium levels.(21) Hypertension may similarly be associated with increased aldosterone activity and, in some patients, the use of potassium-wasting diuretics, both of which can promote renal potassium loss.(20,22) However, these mechanisms should be interpreted cautiously in the present study because only seven patients had

hypokalemia, limiting the reliability of these associations and precluding causal inference.

The present study adds local data regarding the frequency of hypokalemia among patients presenting with new-onset AF less than 48 hours. The observed frequency of 6.9% suggests that hypokalemia is not uncommon in this clinical setting and supports consideration of serum potassium measurement during the initial evaluation of such patients. Nevertheless, because this was a descriptive cross-sectional study, the findings demonstrate an association rather than a causal relationship between hypokalemia and AF.

Further research involving larger, multicenter populations and prospective follow-up would be valuable. Such studies could clarify whether hypokalemia independently contributes to the development of AF, determine whether potassium correction modifies rhythm outcomes, and identify clinical characteristics that predict clinically important potassium abnormalities.

**Study Limitations:** This single-center, cross-sectional study had a relatively small sample size, limiting generalizability and causal inference. Only seven patients had hypokalemia, reducing the power of subgroup analyses. The findings, particularly associations with BMI, diabetes, and hypertension, should therefore be interpreted cautiously and confirmed in larger multicenter studies.

## Conclusion

Although hypokalemia was identified in a small proportion of patients presenting with new-onset atrial fibrillation, a significant association was observed between hypokalemia, raised BMI, diabetes mellitus, and hypertension. These findings suggest that assessment of serum potassium can be part of the clinical evaluation of patients presenting with newly diagnosed AF, particularly in those with associated metabolic or cardiovascular risk factors.

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