

Frequency of Electrolyte Imbalance and Hypertension in patients with Atrial Fibrillation

MUHAMMAD ASAD RAZA¹, CH. ADNAN AHMED ATHER², MARIA NASIR³, QAMAR SAJAD⁴, SAADIA CH⁵, HAMMAD UR REHMAN BHATTI⁶

¹Mayo Hospital, Lahore

^{2,4}Ganga Ram Hospital, Lahore

^{3,5}Lahore Medical and Dental College, Lahore

⁶Islam medical college, Sialkot.

Correspondence to Dr. Maria Nasir, Email: mb21079@lmdc.edu.pk

ABSTRACT

Aims: To determine the frequency of electrolyte imbalance and hypertension in patients with atrial fibrillation

Method: A cross-sectional study was conducted on 163 patients in the Accident and Emergency department of Mayo Hospital Lahore from July 30, 2020 to January 30, 2021. Venous blood samples were taken from patients presenting with atrial fibrillation and sent to the Pathology department in Mayo Hospital to check for serum sodium and potassium levels. Patients were selected using non-probability consecutive sampling, with inclusion criteria of both genders of all ages, diagnosed with atrial fibrillation on the basis of electrocardiogram findings. Patients were excluded on the basis of patient's history of prior use of anti-arrhythmic medications, congenital heart disease, valvular disease, chronic obstructive pulmonary disease or severe infections. Informed consent was taken from the patients after explanation of the study.

Results: The study was conducted on a total of 163 patients of AF out of which 54 also had electrolyte abnormalities, and 22 were hypertensive. 15 of the patients with AF had coexisting hypertension and electrolyte imbalance (p value = 0.00001).

Conclusion: The results show a high incidence of electrolyte imbalance and hypertension in patients of atrial fibrillation.

Keywords: Atrial fibrillation, electrolyte imbalance, hypertension

INTRODUCTION

Atrial fibrillation (AF) is the most commonly occurring cardiac arrhythmia¹. It is defined as a rapid and irregular rhythm pattern of the heart, originating in the atrial chambers. A report by Craig et al defines AF as a supraventricular tachyarrhythmia characterized by uncoordinated atrial activation with consequent deterioration of atrial mechanical function².

In recent years, AF has become an increasingly important clinical problem with the prevalence of reported cases having increased by 33% between the years 1997 and 2017³.

Craig et al. classify AF into the following subtypes based on clinical presentation and onset of symptoms²:

- Paroxysmal AF – AF that terminates spontaneously or with intervention within 7 days of onset (includes episodes recurring with variable frequency)
- Persistent AF – continuous AF that is sustained >7 days
- Long-standing persistent AF – continuous AF >12 months in duration
- Permanent AF – term used when patient and clinician both mutually decide to stop further attempts to restore and/or maintain sinus rhythm
- Non-valvular AF – AF in the absence of rheumatic mitral stenosis, a mechanical or bioprosthetic heart valve or mitral valve repair

Multiple risk factors are associated with AF, including obesity, hypertension, diabetes, diet, alcohol consumption, smoking, dyslipidemia, physical activity and sleep disorders^{4,16,17}. Long standing hypertension has been found to have a strong association with an increased risk of atrial fibrillation. Hypertension increases cardiac load, resulting in hypertrophy and decreasing compliance of the left ventricular muscle. Impaired ventricular filling results in atrial enlargement. It is subsequent cardiac remodeling as a result of long-standing hypertension that results in the development of AF⁵. Hypertension is a modifiable risk factor⁶, good control of which can effectively reduce the risk of AF. Development of hypertension has been known to depend on excretion of electrolytes like sodium and potassium from the body^{7,8} and in addition to causing hypertension, electrolyte imbalance also plays a role in the development of AF^{9,10}.

In this study, a positive history for hypertension was studied in association with frequency of electrolyte disturbances in patients of AF. Electrolyte imbalances in this study include hypo- and hyper- states of both sodium and potassium. This study provides evidence that electrolyte abnormalities frequently coexist with hypertension in patients of AF. Sodium and potassium are two electrolytes that are particularly important in the maintenance of fluid and electrolyte balance. Abnormal levels of sodium and potassium influence the circulating blood volume¹¹ and ionic kinetics¹² of the heart. Sodium commonly found in salt, is an osmotically active cation that plays a key role in regulation of membrane potential of all cells, including cardiac myocytes where it is responsible for the membrane potential and depolarization of myocytes. Potassium is another cation responsible for pacemaker action potentials by playing a role in repolarization phase of pacemaker cells. An increased intake of salt in diet is strongly associated with the development of hypertension and other cardiovascular diseases¹³, thus electrolyte imbalances resulting from abnormal levels of sodium also appear to play an indirect role in the development of AF. This research studies the relationship of both factors with AF by recording the frequency of their occurrence in patients presenting to the hospital with AF.

The objective of the study was to determine the frequency of electrolyte imbalance and hypertension in patients with atrial fibrillation.

METHODS

After permission from hospital Ethical Review Board a cross-sectional study was conducted in the Accident and Emergency Department at Mayo Hospital Lahore between July 30, 2020 and June 30, 2021 to study the frequency and association of electrolyte abnormalities and hypertension in patients of AF. Patients were selected for the study after confirming the diagnosis of atrial fibrillation on the basis of electrocardiogram findings of irregularly irregular rhythm and absent p waves. The inclusion criteria were patients of both genders of all ages with a confirmed diagnosis of AF. Patients were excluded based on prior history of congenital heart disease, valvular heart disease known to predispose to AF, chronic obstructive pulmonary disease, prior use of antiarrhythmic medications and severe infections. Venous blood samples were taken from patients and sent to the Pathology laboratory at Mayo Hospital Lahore to test for serum sodium and potassium levels.

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Data was collected using non-probability consecutive sampling from 163 patients with AF. Patient anonymity was ensured and informed consent was taken from the patients after explaining the study.

Data analysis: Data was analyzed using SPSS v25.0 (p-value ≤ 0.05 was considered as significant)

RESULTS

Out of a total of 163 patients, 54 patients (33.1%) had electrolyte imbalances (deranged sodium and/or potassium levels) and 22 patients (13.5%) with AF had preexisting hypertension. It was noticed that out of the 22 patients of AF that were hypertensive, 15 also had coexisting electrolyte abnormalities (68.2%). The results of the study showed a high incidence of electrolyte imbalance in hypertensive patients of AF (p-value = 0.00001)

Table 1: Frequency distribution of electrolyte imbalance

| Electrolyte imbalance | Frequency | Percent |
|-----------------------|-----------|---------|
| Yes | 54 | 33.1 |
| No | 109 | 66.9 |
| Total | 163 | 100.0 |

Fig. 1: Electrolyte imbalance in AF patients

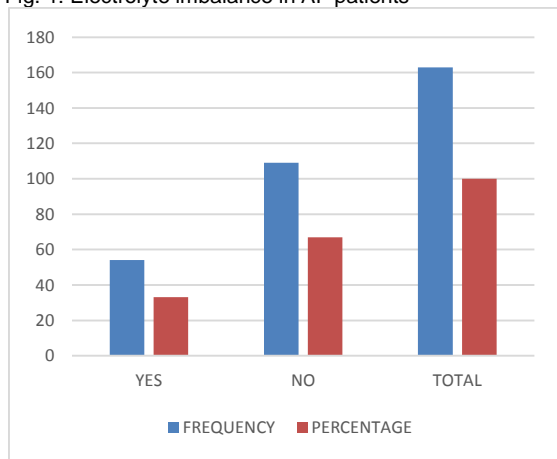


Table 2: Frequency distribution of hypertension

| Hypertension | Frequency | Percent |
|--------------|-----------|---------|
| Yes | 22 | 13.5 |
| No | 141 | 86.5 |
| Total | 163 | 100.0 |

Fig. 2: Hypertension in AF patients

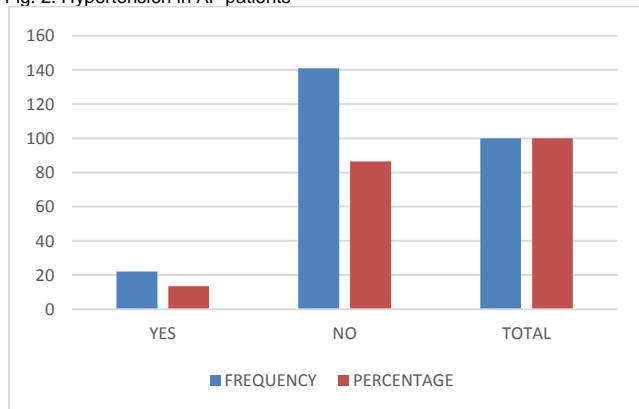


Table 3: Stratification of electrolyte imbalance with respect to hypertension in patients of AF

| Hypertension | Electrolyte imbalance | | Total | p-value |
|--------------|-----------------------|-------|--------|---------|
| | Yes | No | | |
| Yes | 15 | 7 | 22 | 0.00001 |
| | 68.2% | 31.8% | 100.0% | |
| No | 39 | 102 | 141 | |
| | 27.7% | 72.3% | 100.0% | |
| Total | 54 | 109 | 163 | |
| | 33.1% | 66.9% | 100.0% | |

DISCUSSION

The frequency of electrolyte imbalance and hypertension was studied in 163 patients presenting with atrial fibrillation to establish the role of these two variables in the etiology of AF. The results of the study prove that hypertension and electrolyte imbalance frequently coexist in patients of AF (p value = 0.00001).

There has been some evidence of the role electrolyte abnormalities in causing AF in studies conducted previously^{9,10}. Prior studies prove that deranged levels of potassium influence the development of AF. One study reported an increased incidence of perioperative arrhythmias including AF in patients with preoperative hypokalemia¹⁴, while another investigated the role of reduced sodium levels in the prognosis of AF¹⁰. Literature suggests that imbalance of the studied electrolytes could have a direct bearing as one of the factors causing AF¹⁵, as sodium and potassium in the ECF influence conducting cells as well as contractile cells of the heart¹². Long standing hypertension is also a known risk factor for AF⁴, causing cardiac remodeling resulting in an increased likelihood of development of AF⁵.

While there has been evidence regarding the role of each of the studied factors in the etiology of AF, this study identified that the two frequently coexist in patients, and therefore effective management of AF in such patients requires focus on controlling both problems.

However, the results of this study do not account for imbalances in other electrolytes for example Mg, Ca and Cl, and the study does not establish an independent relationship with each of the hypo- and hyper- states of sodium and potassium in relation with atrial fibrillation. The scope of data source is also narrow as the data was collected from a sample population from one hospital, therefore limiting the generalizability of the study.

CONCLUSION

The results of the study show a higher incidence of electrolyte imbalance in hypertensive patients with AF.

Conflict of interest: Nil

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