

## RESEARCH ARTICLE

# Serum potassium levels of patients on angiotensin converting enzyme inhibitors – A cross-sectional study

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### ABSTRACT

**Background:** Angiotensin-converting enzyme (ACE) inhibitors are commonly used in clinical practice to treat hypertension. Hyperkalemia develops in approximately 10% of outpatients within a year of prescription of these drugs. **Aim and Objective:** The aim of this study was to identify the prevalence of hyperkalemia among outpatients who are taking ACE inhibitors for hypertension for more than 6 months. **Materials and Methods:** This was a cross-sectional study conducted in the Hypertension Clinic, Tirunelveli Medical College. Around 152 hypertensive patients taking ACE inhibitors for more than 6 months were enrolled in the study. Blood samples were obtained, and their serum potassium levels were measured. **Results:** Among 152 patients, there were 88 male patients (57.9%) and 64 female patients (42.1%). Ten patients (35.71%) out of 18 patients who were on monotherapy presented with hyperkalemia and 20 patients (16.12%) out of 104 patients who were on combination therapy had hyperkalemia. A higher number of patients with hyperkalemia falls in the age group of 46–60 years of age. Out of 152 patients who took enalapril, 30 patients (19.73%) were found to have hyperkalemia. Of them, 20 patients (13.15%) had mild hyperkalemia, and ten patients (6.57%) had moderate hyperkalemia. There were no cases of severe hyperkalemia. **Conclusion:** Hence, it is of considerable importance for physicians to identify patients at risk by regular monitoring and to implement measures to lessen the likelihood of the development of hyperkalemia.


**KEY WORDS:** Hyperkalemia; Hypertension; Angiotensin-converting enzyme inhibitors

### INTRODUCTION

Angiotensin-converting enzyme (ACE) inhibitors are commonly used in the treatment of hypertension nowadays. Around 10% of outpatients develop hyperkalemia within 1 year of taking these groups of drugs. Patients with impaired renal function and diabetes are at higher risk of developing hyperkalemia as there exists a defect in the excretion of renal potassium in those patients already.

Normal potassium levels range from 3.5 to 5.5 mEq/L.<sup>[4]</sup> Hyperkalemia is defined as the increase in serum potassium levels more than 5.5 mEq/L. There is a decrease in ventricular excitability possibly leading to heart block and sinus arrest in patients presenting with hyperkalemia.<sup>[2]</sup>

Study by Goyal *et al.* revealed that the mortality rate was less in patients who had serum potassium levels between 3.5 and 4.5 mEq/L. However, patients with potassium levels of more than 4.5 mEq/L or <3.5 mEq/L were found to have higher mortality.<sup>[3]</sup> Studies concerned with the prevalence and management of hyperkalemia in patients taking ACE inhibitors are limited. Hence, this study has been designed to estimate the serum potassium levels of all patients on ACE inhibitors as mono or combination therapy for a period of more than 6 months attending hypertension outpatient

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department and identify the prevalence of hyperkalemia among them.

### Objective

The aim of this study was to identify the prevalence of hyperkalemia and its severity among outpatients who are taking ACE inhibitors for hypertension for more than 6 months.

## MATERIALS AND METHODS

### Study Design

This was cross-sectional study.

### Study Center

Hypertension clinic, Department of Medicine, Tirunelveli medical college hospital, Tirunelveli.

### Sample Size

This sample size was 174 patients.

### Study Duration

This study duration was 1 month (1/11/2012–30/11/2012).

### Inclusion Criteria

- Patients of both genders who are on ACE inhibitors for hypertension for more than 6 months as monotherapy (enalapril alone) or combination therapy (enalapril with beta blockers or calcium channel blockers or both) were included in the study.

### Exclusion Criteria

The following criteria were excluded from the study:

- Newly diagnosed patients
- Patients on ACE inhibitors for <6 months with hypertension
- Patients with diabetes
- Patients with impaired renal function
- Patients with history of liver disease/seizure disorder/malignancy/substance use
- Lactating women
- Patients on loop or thiazide diuretics, Non-steroidal anti-inflammatory drugs, and potassium-sparing diuretics
- Combination of trimethoprim-sulfamethoxazole.

### Methodology

The study was commenced after getting approval from the Institutional Ethics Committee. Based on the inclusion and

exclusion criteria, 173 patients who were on monotherapy or combination therapy with ACE inhibitors for hypertension for more than 6 months attending hypertension outpatient department were included in this study. Written informed consent was obtained in the local vernacular language from all patients enrolled in the study. Serum potassium levels were measured using an electrolyte analyzer. Hyperkalemia was graded as follows:

Mild – 5.5–6 mEq/L

Moderate – 6.1–7 mEq/L

Severe – 7.0 mEq/L and above.<sup>[6]</sup>

Blood urea nitrogen and blood sugar levels of these patients were found to be normal.

### Statistics

Descriptive statistics were used for the analysis of data. The frequency was shown as a percentage.

## RESULTS

Among 174 patients, only 152 patients gave blood samples for serum potassium levels, 18 patients did not give their blood samples, and blood samples obtained from 4 patients were inadequate.

Among 152 patients, there were 88 male patients (57.9%) and 64 female patients (42.1%) [Figure 1].

Ten patients (35.71%) out of 18 patients who were on monotherapy presented with hyperkalemia and 20 patients (16.12%) out of 104 patients who were on combination therapy had hyperkalemia [Figure 2].

A higher number of patients with hyperkalemia falls in the age group of 46–60 years of age [Figure 3].

Out of 152 patients who took Enalapril, 30 patients (19.73%) were found to have hyperkalemia. Of them, 20 patients

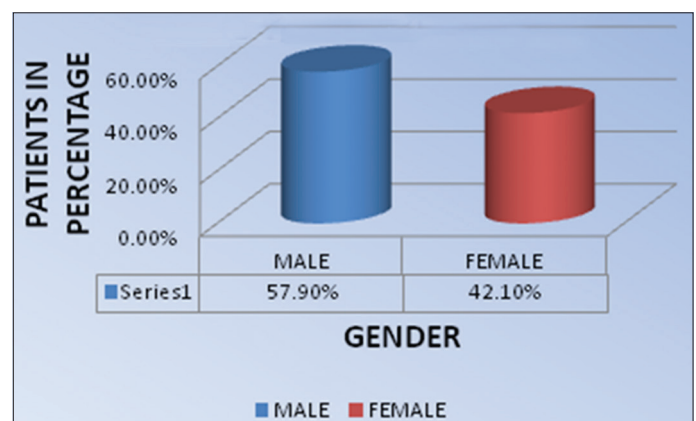


Figure 1: Distribution of the patients according to gender

(13.15%) had mild hyperkalemia, and ten patients (6.57%) had moderate hyperkalemia. There were no cases of severe hyperkalemia [Figure 4].

**DISCUSSION**

In our study, 35.71% of patients who were on monotherapy with ACE inhibitor presented with hyperkalemia and 16.12% of patients on combination therapy had hyperkalemia. A maximum number of persons in the age group of 46–60 years presented with hyperkalemia.

A study by Reardon *et al.* revealed that around 194 patients (11%) developed hyperkalemia among 1818 patients who

were using ACE inhibitors. On a follow-up after a period of 1 year, it was found that out of 146 patients who remained on ACE inhibitor therapy, 15 (10%) of them presented with severe hyperkalemia. Furthermore, the incidence of congestive cardiac failure, cerebrovascular disease, and peripheral vascular disease was significantly high in patients who had hyperkalemia.<sup>[1]</sup> The results of our study disclose that 19.73% of hypertensives taking ACE inhibitors had hyperkalemia. Pakistan armed forces medical journal reported that at the end of 2 years study in patients on ACE inhibitors, 46.80% of patients had moderate hyperkalemia and 26.59% of patients presented with severe hyperkalemia.<sup>[5]</sup> In our study, 20 patients (13.15%) had mild hyperkalemia, and ten patients (6.57%) had moderate hyperkalemia. There were no cases of severe hyperkalemia.

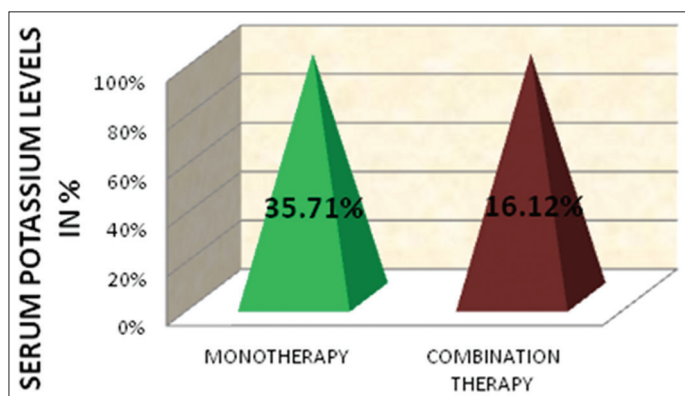


Figure 2: Prevalence of hyperkalemia

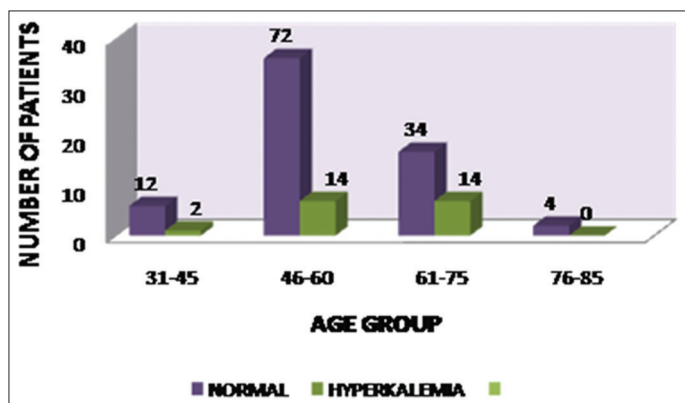


Figure 3: Distribution of the patients according to age

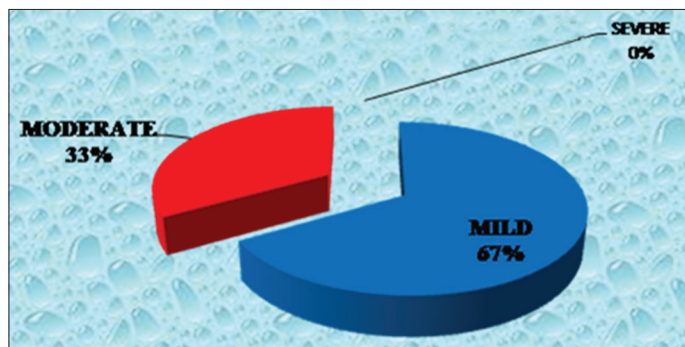


Figure 4: Severity of hyperkalemia

The strength of our study would be that it was done in a tertiary care hospital involving patients in all age groups. The limitation of our study would be the number of patients who were included in the study and the duration of the study. This will be overcome in the upcoming study involving a large group of patients for a longer duration of time.

Rose study reveals the association between hyperkalemia and increase in frequency of tall T waves in electrocardiogram (ECG).<sup>[6]</sup> Hence, in the evaluation of patients with hyperkalemia, ECG assessment also must be made mandatory based on several other clinical references.<sup>[7]</sup> There is a decrease in ventricular excitability possibly leading to heart block and sinus arrest in patients presenting with hyperkalemia.<sup>[8]</sup> However, monitoring of potassium levels in patients taking ACE inhibitors is still lacking in our hospitals. Hence, it is very much important that every physician ensures to regularly monitor the patients at risk so that the complications due to hyperkalemia can be prevented at the earliest.

**CONCLUSION**

It is of considerable importance for physicians to identify patients at risk by regular monitoring and to implement measures to lessen the likelihood of development of hyperkalemia.

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