Original article:

Study of ECG changes in correlation to elevated serum Potassium levels

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INTRODUCTION

Potassium, the second most-abundant cation in the body, performs several important physiological functions, including cellular metabolism, glycogen and protein synthesis, and maintenance of the electrical action potential across cell membranes, especially in the myocardium (1).

Hyperkalemia is defined as a serum potassium level exceeding 5 mEq/L; the disorder may be fatal when the potassium level is greater than 6.5 mEq/L (2). It results from extracellular shifts of potassium, excessive ingestion of potassium, and/or impaired elimination of potassium by the kidneys. It is a fairly common electrolyte disorder, affecting approximately 10% of hospitalized patients.

It is well known to cause induce deadly cardiac arrhythmias. Electrocardiographic manifestations of hyperkalemia vary from the classic sine-wave rhythm, which occurs in severe hyperkalemia, to nonspecific repolarization abnormalities seen with mild elevations of serum potassium.

The challenge in managing hyperkalemia comes from the fact that it can be difficult, if not impossible, to identify the condition solely on the basis of electrocardiographic information. Patients who present with hyperkalemia may have a normal electrocardiogram or have changes that are so subtle that physicians frequently have difficulty attributing these changes to increased potassium levels.

In general, the treatment of hyperkalemia is governed by the patient's clinical presentation, by how rapidly the disorder developed, by the severity of the potassium abnormality, and by the presence of ECG changes.

In emergency department, there is a dire necessity of diagnosing the Hyperkalaemia and initiating appropriate treatment. However, conventional measurement of serum potassium has a time limitation in the context of emergency room. Added to the fact is the confounding factor of hemolysed samples that can misguide the ER physician. In Indian settings, lack availability of round the clock laboratory services also burdens the ER physician with dilemma.

In this context, it is important to develop non-invasive and bed side methods of diagnosing life threatening hyperkalemia. Understanding in depth ECG manifestations of Hyperkalaemia can contribute towards the dilemma discussed previously. These exists lacunae in the literature regarding evidence based studies on manifestations of ECG changes in Hyperkalemia in India.Hence, present research intends to study ECG manifestations of patients with Hyperkalaemia at a tertiary Hospital in Southern India.

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AIMS AND OBJECTIVES

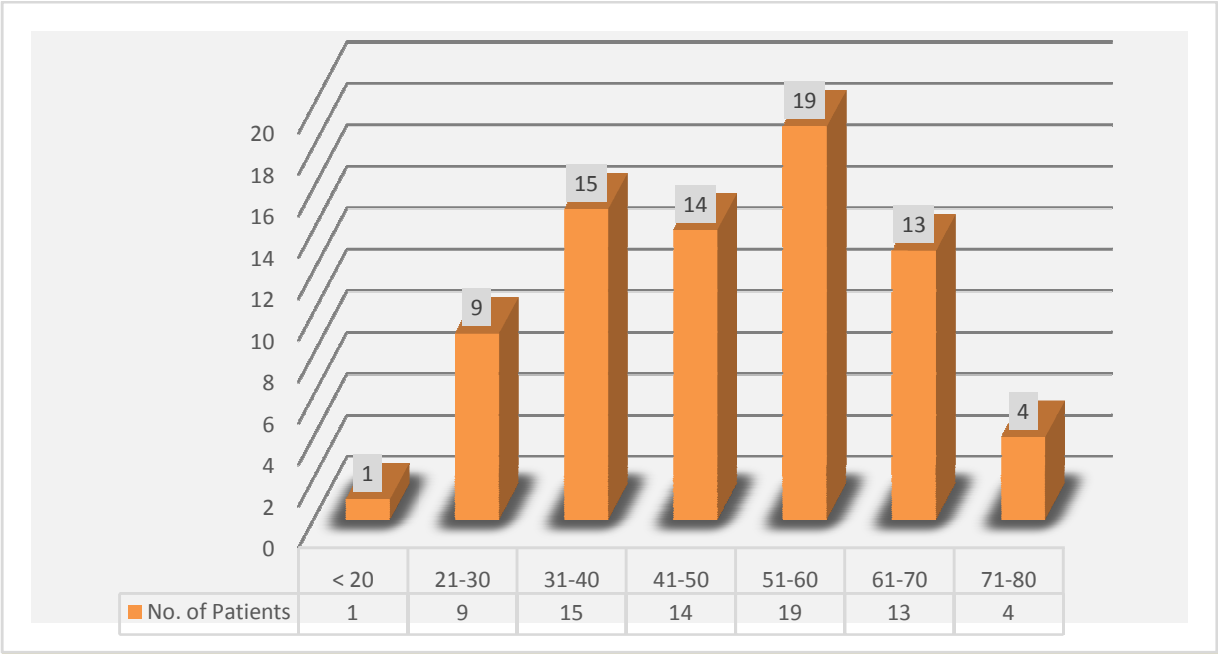
To study the occurrence of ECG changes (such as peaking of T waves, widening of QRS complex, decrease in P wave amplitude, disappearance of P waves, sine wave pattern) with elevated levels of serum potassium and To assess the correlation of the ECG changes with varying levels of elevated serum potassium.

MATERIALS AND METHODS

After obtaining approval from ethics committee, patients presenting to Emergency Medicine department with bicochemical evidence Hypekalemia at Department of Emergency Medicine, Maxcure Hospitals, Hyderabad were studied for ECG manifestations of Hyperkalemia (Sample size: 75 patients).

OBSERVATION AND RESULTS

Age profile:



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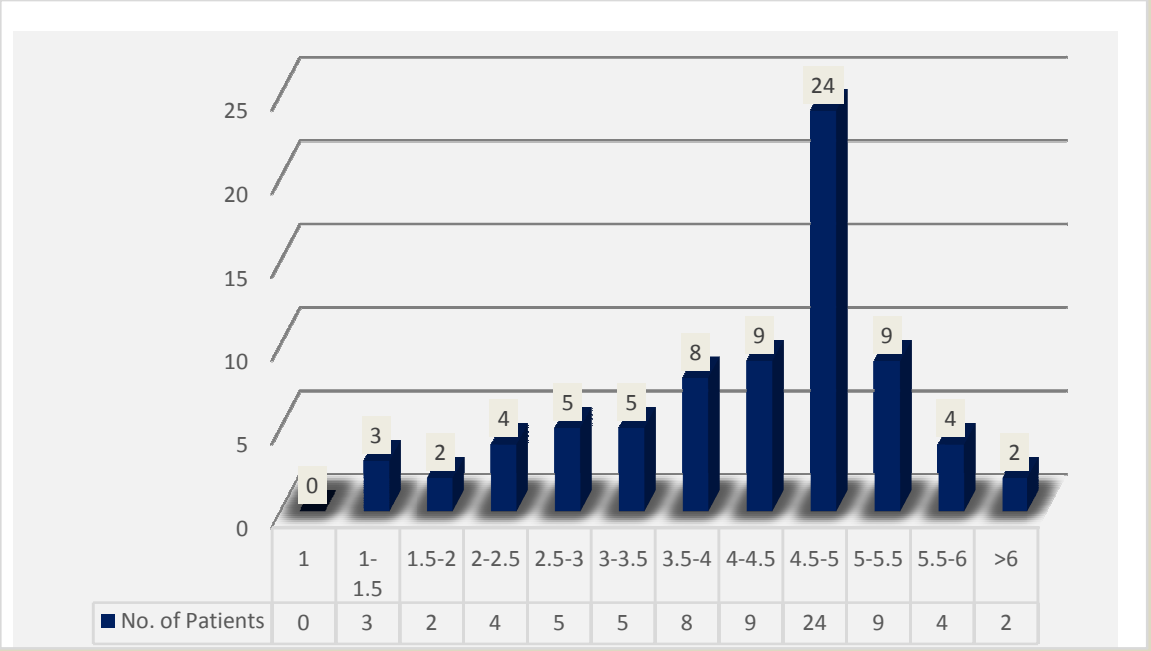
Distribution of Creatinine levels:



Serum Potassium Levels by ECG Findings Consistent with Hyperkalemia :

Potassium Levels (Meq/L)	**Peaked T-Waves**	**Decrease in P wave amplitude**	**Absent P waves**	**Prolonged QRS**	**Prolonged QTc**	**Prolonged PR Interval**	**No ECG Changes**
5.5-5.9	1	2	0	2	0	4	6
6-6.9	14	7	4	3	2	22	11
7-7.9	9	8	5	2	2	10	3
8-8.9	3	1	2	1	0	2	0
Total	27	18	11	8	4	43	20

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Serum Potassium Levels by ECG Findings Consistent with Hyperkalemia

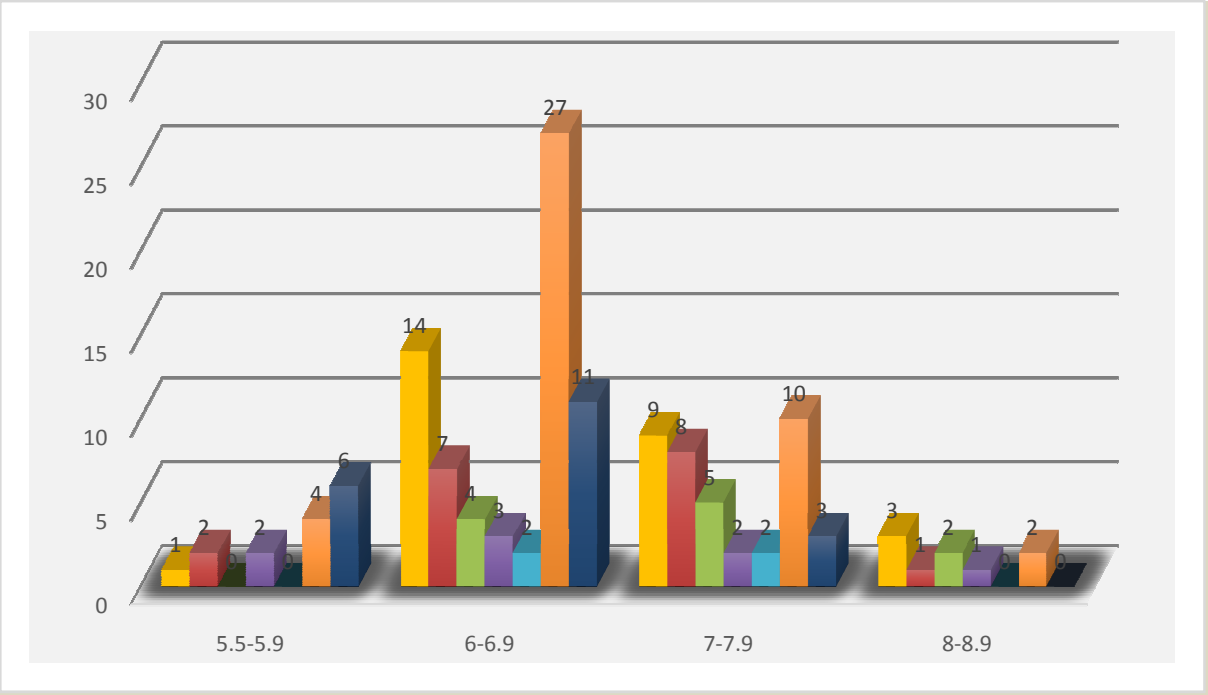
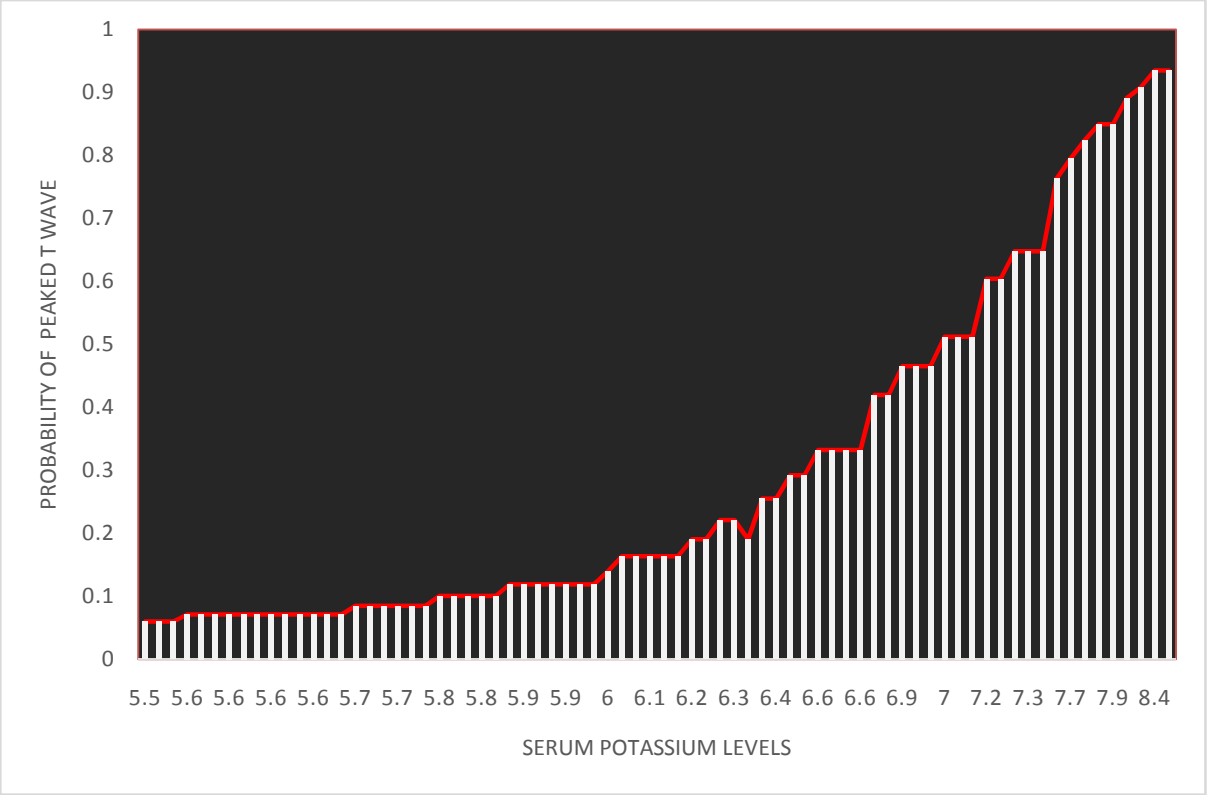


Table.. Logistic Regression for Peaked T wave in Hyperkalemia

Variables	Values
Coefficient	1.76
Std Error	0.435
Odds Ratio	6.12 (2.864 - 12.654)
P Value	0.0000

Logistic Regression for Peaked T wave in Hyperkalemia



Logistic Regression for Absent P wave in Hyperkalemia

Variables	Values
Coefficient	0.1265
Std Error	0.1376
Odds Ratio	1.276
P Value	0.543

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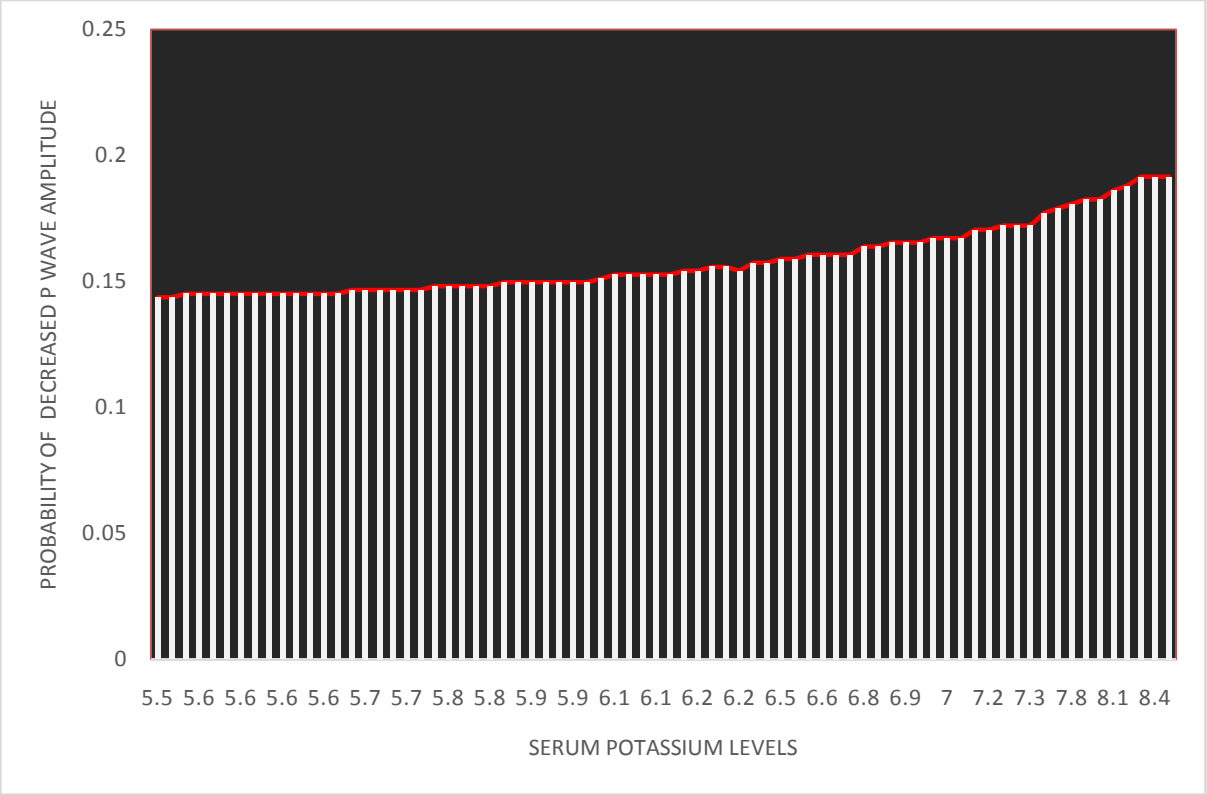
Logistic Regression for Peaked T wave in Hyperkalemia



Logistic Regression for No change in ECG in Hyperkalemia

Variables	**Values**
Coefficient	-0.6763
Std Error	0.4263
Odds Ratio	0.4852 (0.2782 - 1.0542)
P Value	0.0765

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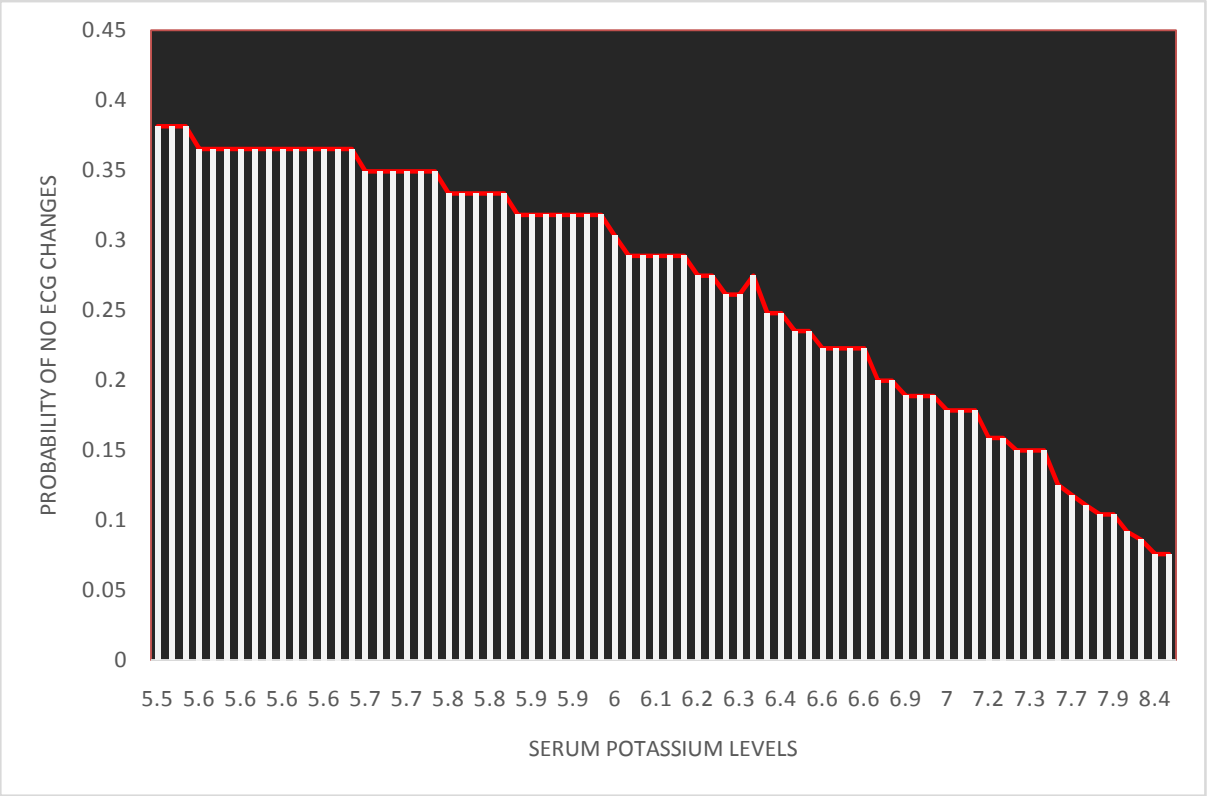
Logistic Regression for No change in ECG in Hyperkalemia



CONCLUSION

Hyperkalemia causes range of ECG changes, but manifestation of such changes varies individually. Among all ECG manifestations, tall t waves and absent p wave are most frequent ECG changes noted in our study.

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