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**ORIGINAL ARTICLE**

# Hypokalemia Improving the Investigation, Management and Therapeutics Monitoring of Hypokalemic Medical Inpatients at Tertiary Care Hospital A Clinical Audit

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## ABSTRACT

**Background:** One of the most frequent diseases in hospitalized individuals is Hypokalemia. it is more prevalent in individuals with underlying chronic conditions such as diabetes mellitus, heart failure, or chronic kidney disease (CKD).

**Objective:** The objective of this audit was for improving the investigation, management and therapeutics monitoring of hypokalemic medical inpatients at tertiary care hospital**.**

**Methodology:** The current clinical audit conducted at the department of cardiology, Hayatabad Medical complex Peshawar from January 2018 to December 2021. The audit covered all medical inpatients with hypokalemia during a one-week period. Prior to data collection, a daily list of medical inpatients with confirmed blood potassium levels of less than or equal to 3.4 mmol/L was obtained from the laboratory database in order to identify these individuals. After then, the patient's records were found and examined to determine whether the patient had severe, moderate or mild, hypokalemia.

**Results**: In the current clinical audit a total of 34 individuals were included in the pre-intervention group**.** The study found 26(76.4%) individuals with mild hypokalemia (3.1-3.4 mmol/L) & with significant hypokalemia (2.5-3.0 mmol/L) and only three individuals (8.8%) intended an ECG to check for cardiac arrhythmia. 14 (41.1%) participants had repeat U&E analysis after starting therapy. Only 7.5% (20%) of participants had their serum magnesium levels tested. Just eight (23.5%) individuals received proper treatment following conventional standards. Four weeks after the intervention, results were first gathered, and they revealed a significant improvement. Over all 32 individuals were included in the post-intervention group in which 21 were females and 11 were males. 15 participants (46.7%) had moderate hypokalemia (2.5–3.0 mmol/L), and 17 of them (53.2%) had mild hypokalemia (3.1–3.4 mmol/L). There were not any individuals found to have severe hypokalemia (<2.5)

**Conclusion**: This audit significantly improved management by using a number of initiatives to raise knowledge and comprehension of the evaluations, care, and monitoring of the hypokalemic individuals.

**Keywords:** Hypokalemia; Management; Therapeutics monitoring

## INTRODUCTION

The normally range of potassium in blood plasma is 3.5 -5.1 mmol/l. A 70 kg male needs 70 mmol of potassium per day, whereas a 40 kg woman needs 40 mmol. The most prevalent electrolyte imbalance among hospitalized patients is hypokalemia. Just two percent of otherwise healthy individuals have hypokalemia, which is defined as a value of less than 3.5 mmol/L and is present in twenty percent of hospital inpatients but only affects 2% of individuals who are otherwise healthy.[1-3] Serum potassium levels below 3.0 mmol/mL are found in around 5% of hospitalized individuals with confirmed hypokalemia.[4] Furthermore, throughout their hospital stay, as much as fifty percent of individuals with normal potassium upon admission may have hypokalaemia.[5] Hyperkalemia and hypokalemia are two extremes that are associated with a higher risk of heart problems. Severe Q-T interval extension may result from potassium levels below 3.0 mmol/l, increasing the danger of torsade des points, heart failure, and heart attack.[6] Individuals with heart failure, left ventricular hypertrophy, and myocardial ischemia are especially vulnerable since even mild to severe hypokalemia raises the incidence of cardiac arrhythmias in these individuals.[2] For instance, compared to the general inpatient population, the death rate for hypokalemic people with cardiovascular disease was ten times greater.[7] When severe (less than 2.5 mmol/L), hypokalemia can be fatal, but in otherwise healthy individuals, it is typically easily tolerated, and patients are frequently asymptomatic. Therefore, the diagnosis is often overlooked, and in order to lower the prevalence of hypokalemic consequences, high-risk patient identification, regular laboratory monitoring, and timely treatment are crucial.[8] Elderly people on diuretics are more likely to get hypokalemia, and this risk is increased by coexisting conditions like heart disease or nephritis syndrome. It's also critical to take Iatrogenic factors into account. Ten to forty percent of individuals on non-potassium-sparing diuretics experience hypokalemia.[9] Additional morbidities linked to an increased prevalence of hypokalemia include individuals following bariatric surgery, 12.6% of inpatients with alcoholism, and 21% of admitted people with AIDS.[10-12] Twenty-four percent of people in hospitals have hypokalemia that is not well managed.[13] Severe hypokalemia frequently results in the following side effects: paresthesia (38%), muscular weakness (14%), cramping (7%) and thirst (43%).[4] Additionally, it has been discovered that people with hypokalemia had a five-fold greater risk of ventricular fibrillation than those with hyperkalaemia.[15] Hypokalemia is a potentially fatal illness, hence it is critical that patients receive high-quality care. Quality improvement of hypokalemia therapy was required to direct staff professional development and enhance outcomes for patients due to patient safety problems that were discovered in our institution.

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## MATERIAL AND METHOD

The current clinical audit conducted at the department of cardiology, Hayatabad Medical complex Peshawar from January 2018 to December 2021. The audit covered all medical inpatients who had hypokalemia (serum potassium <3.5 mmol/L on a standard biochemical sample) during a one-week period. Prior to data collection, a daily list of medical inpatients with confirmed blood potassium levels of less than or equal to 3.4 mmol/L was obtained from the laboratory database in order to identify these individuals. After then, the patient's records were found and examined to determine whether the patient had severe, moderate or mild, hypokalemia.

**The following standards were applied:**

(i) Mild: 3.1–3.4 mmol/L
(ii) (ii) Moderate: 2.5–3.0 mmol/L
(iii) Severe: <2.5 mmol/L

To ensure the program's sustainability, the trust must adopt the management procedure an incorporate it into local hospital norms. These instructions should be accessible on the Healthcare staff should be educated about their location and the hospital's intranet for easier access. Junior physicians and nurses should continue their education on managing hypokalemia. A hypokalaemia treatment pathway was first created. The pathway for managing mild, moderate, and severe hypokalemia was easy to understand, with distinct treatment options. To promote awareness of hypokalemia therapy, we created management algorithm posters for all inpatient medical wards. Junior physicians in medical departments received formal instruction and awareness sessions on how to recognize and manage hypokalemia. The hypokalemia treatment protocol and summary of audit and pre-intervention outcomes were emailed to junior doctors & senior house officers on medical wards to raise awareness of areas for improvement and management choices. Following 4 weeks of treatments, we did a one-week re-audit. The findings seemed good. The following few months were devoted implementing hypokalemia care into hospital standards and delivering educational 'refresher' seminars to junior doctors, especially because the Foundation changeover coincided with this cycle. Three months after an audit was conducted to assess performance against the revised hypokalemia proforma and treatment algorithm. After a successful audit, the data was provided at hospital performance meeting.

## RESULTS

In the current clinical audit a total of 34 individuals were included in the pre-intervention group. Out of which 21(61.7%) were males and 13(38.2%) were female as presented in figure 1. The study found 26(76.4%) individuals with mild hypokalemia (3.1-3.4 mmol/L) & with significant hypokalemia (2.5-3.0 mmol/L) and only three individuals (8.8%) intended an ECG to check for cardiac arrhythmia. 14 (41.1%) participants had repeat U&E analysis after starting therapy. Only 7.5% (20%) of participants had their serum magnesium levels tested. Just eight (23.5%) individuals received proper treatment following conventional standards. Four weeks after the intervention, results were first gathered, and they revealed a significant improvement as presented in table 1.Over all 32 individuals were included in the post-intervention group in which 21 were females and 11 were males. 15 participants (46.7%) had moderate hypokalemia (2.5–3.0 mmol/L), and 17 of them (53.2%) had mild hypokalemia (3.1–3.4 mmol/L). There were not any individuals found to have severe hypokalemia (<2.5) . During the pre-intervention audit, it was often noted that treatment monitoring was not being carried out with follow-up U&Es, ECG requests, or blood magnesium level analysis. Even though there was no discernible change in the analysis of blood magnesium levels 9 (28.1%), it was heartening to observe increased knowledge of more research related to hypokalemia, which would promote better patient safety. Medication reviews were essentially the same across the groups, despite clear improvements in understanding hypokalemia management options and the identification of suitable management options for varying levels of hypokalemia and the administration of appropriate medication doses. Three months later, a re-audit revealed even more sustained progress. A total of 62 sets of individuals records with the code "hypokalemia" were found and examined in hindsight. Since employment changes were expected to occur at the time of the re-audit, we chose to employ coded notes to get a larger number of samples for analysis plus a retrospective technique to guarantee the junior doctor base remained the same. Due to junior doctors' reactions to our presence on the ward, this also lessened bias towards favorable findings. Every case that was identified by coding was checked against test findings at the time of admission to make sure it satisfied our requirements for hypokalemia as well as to confirm that the coding was accurate.

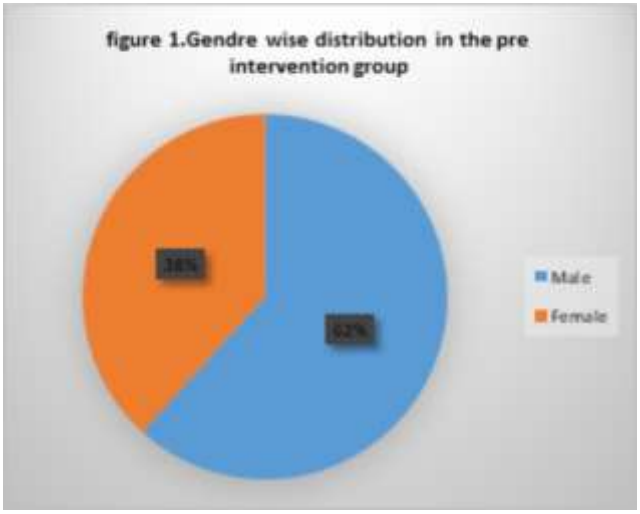


**Table 1: Demographic features and results of the clinical audit**

| Frequency of hypokalaemic individuals | Pre intervention 34 | Value of P | Post intervention One month 32 | Value of P | Post intervention Three months 62 | Value of p |
|---|---|---|---|---|---|---|
| Investigations required (%) | | | | | | |
| ECG | 7 | | 94 | | 81 | |
| Repeat UE's | 42 | | 81 | | 88 | |
| Magnesium level | 20 | | 28 | | 26 | |
| Medication Reviewed | | | | | | |
| Medication review Carried out | 48 | - | 45 | - | 66 | - |
| Appropriate management (%): | | | | | | |
| Cases properly accomplished based on guideline | 23 | <0.05 | 64 | >0.05 | 76 | >0.05 |

## DISCUSSION

An electrolyte imbalance known as hypokalemia.[16] It is more prevalent in individuals with underlying chronic conditions such as diabetes mellitus, heart failure, or chronic kidney disease (CKD), as well as in patients receiving medication known to affect potassium excretion or cell absorption.[17] Despite being well acknowledged, hypokalemia presents several clinical problems, including its complex etiology, cryptic presentation, and quick onset of serious consequences.[18] The numerous potassium-altering drugs used in the inpatient setting, such as beta blockers, angiotensin converting enzyme inhibitors, angiotensin receptor blockers, potassium-sparing diuretics, and non-steroidal anti-inflammatory drugs , increase the risk of hypokalemia. These drugs can worsen this condition, especially in those with renal impairment or who are taking several medicines at once, even if they are helpful in treating chronic conditions including heart failure and hypertension. [19] Delays in monitoring and identification of low potassium levels can contribute significantly to avoidable negative consequences. Since it has clinical significance, there is a deficit of data from low- and middle-income nations, such as Pakistan. Nonetheless, it is crucial to evaluate the local components of the

burden of hypokalemia and pinpoint the context-specific risk factors that contribute to its development. Clinical audits are also effective tools for verifying that evidence-based procedures are being followed and for assessing care gaps that may be addressed with changes. By systematically analyzing inpatient instances of hypokalemia, healthcare facilities can determine which cases could have been avoided and what tactics can be created to lessen the burden of the avoidable cases. The audit's goal is to evaluate how well a tertiary care hospital treats, monitors, and assesses medical inpatients with hypokalemia. The audit covered all medical inpatients who satisfied the criteria for hypokalaemia (serum potassium <3.5 mmol/L on a standard biochemical sample) during a one-week period. To determine if the patient had mild, moderate, or severe hypokalaemia, the patient's records were obtained and examined. In the current clinical audit a total of 34 individuals were included in the pre-intervention group**.** The study found 26(76.4%) individuals with mild hypokalemia (3.1-3.4 mmol/L) & with significant hypokalemia (2.5-3.0 mmol/L) and only three individuals (8.8%) intended an ECG to check for cardiac arrhythmia. 14 (41.1%) participants had repeat U&E analysis after starting therapy. Only 7.5% (20%) of participants had their serum magnesium levels tested.

Just eight (23.5%) individuals received proper treatment following conventional standards. Four weeks after the intervention, results were first gathered, and they revealed a significant improvement. Our findings are similar to the study conducted by Halevy.[20] Undoubtedly, baseline data taken before to the intervention regarding compliance with hypokalemia recommendations were noteworthy and indicated a clear association between poor patient care and absence of a strategy for therapy ($p<0.05$). The post intervention group's results, however, suggest a less clear correlation ($p>0.05$) between the implementation of new clinical recommendations and instruction sessions and better hypokalemia care. Although the explanation of this is uncertain, there has been evidence of quality improvement in patient treatment in spite of these statistical findings. We now know that with modest but thoughtful interventions, junior physicians may bring about significant changes to clinical practice. The significance of evidence-based medicine and the need for it to continuously advance in order to influence and build future practice have been brought to light by this audit. It was obvious that the examination and treatment of hypokalemia may be significantly enhanced with a well-organized educational campaign targeted at a variety of medical experts and a straightforward and easily understandable management guideline. The management of hypokalemia in this hospital is expected to advance with more training and adjustments to the interventions created during this audit.

Additionally, the participation of pharmacists and nurses in this process has aided in motivating physicians to further question their own practices and emphasize the advantages of holistic, MDT-led patient treatment. This project's shortcomings include its limited sample sizes and dearth of information on how to treat severe hypokalemia. Potassium levels below 2.5 mmol/L are rare [18], and we haven't been able to assess how well these individuals are treated with the right pharmacological approaches and care escalation. However, based on the audit's findings, we expect that the treatment protocol will be well-complied with while treating severe hypokalemia. Furthermore, we have not investigated the incidence of problems among patients whose care deviated from the recommended course of therapy. We acknowledge that the HDU/ICU and surgical wards were left out of this audit, allowing for project growth at a later time. Individuals who have had surgery frequently have low potassium levels, and those who have experienced significant and ongoing fluid loss from their gastrointestinal system are more likely to develop hypokalaemia.[21] Additionally, pre-operative serum potassium levels below 3.5 mmol/L are linked to a higher incidence of arrhythmias compared to pre-operative levels over 3.5 mmol/L, and anesthetists have long been particularly concerned about the adverse impacts of anesthesia in patients with hypokalaemia.[22]

## CONCLUSION

This audit significantly improved management by using a number of initiatives to raise knowledge and comprehension of the evaluations, care, and monitoring of the hypokalemic individuals.

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