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Review article

Current insights and challenges in the management of hyperkalemia

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ABSTRACT

Hyperkalemia is an electrolyte disorder characterized by elevated serum potassium levels, which can be dangerous and lead to severe cardiac complications. This condition is particularly common in patients with comorbidities such as diabetes mellitus, chronic kidney disease, heart failure, and hypertension, among others. Additionally, hyperkalemia frequently develops in patients treated concurrently with certain medications, especially renin-angiotensin-aldosterone system inhibitors, which are commonly used to manage cardiac and nephrological conditions, significantly increasing the risk of hospitalizations and mortality in these patients.

This review aims to identify key challenges in the management of hyperkalemia, including improving early detection, optimizing access to appropriate therapies, ensuring continuous monitoring, and establishing effective strategies to manage complications. Furthermore, it is essential to raise awareness of its significance and promote a multidisciplinary approach to enhance health outcomes and the quality of life of patients with hyperkalemia.

Perspectivas actuales y retos en el tratamiento de la hiperpotasemia

Palabras clave:
Hiperpotasemia
Enfermedad renal crónica
Insuficiencia cardiaca

RESUMEN

La hiperpotasemia es un trastorno electrolítico caracterizado por valores séricos elevados de potasio, lo cual puede ser peligroso y causar complicaciones cardiacas graves. Esta afección es especialmente común en aquellos pacientes con comorbilidades como la diabetes mellitus, la enfermedad renal crónica, la insuficiencia cardiaca y la hipertensión arterial, entre otras. Asimismo, es frecuente el desarrollo de esta enfermedad en pacientes tratados concomitantemente con determinados fármacos, especialmente los inhibidores del sistema renina-angiotensina-aldosterona, utilizados comúnmente para tratar enfermedades cardiacas y nefrológicas, lo que aumenta considerablemente el riesgo de hospitalización y mortalidad en estos individuos.

El objetivo de esta revisión fue identificar retos clave en el abordaje de la hiperpotasemia, como mejorar la detección temprana, optimizar el acceso a tratamientos, garantizar una monitorización continua y establecer estrategias para tratar complicaciones. Además, es crucial aumentar la concienciación sobre su importancia y promover un enfoque multidisciplinar para mejorar la salud y calidad de vida de los pacientes.

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Abbreviations

CKD: chronic kidney disease
DM: diabetes mellitus
MRA: mineralocorticoid receptor antagonists
RAASi: renin-angiotensin-aldosterone system inhibitors
SZC: sodium zirconium cyclosilicate

INTRODUCTION

Hyperkalemia is an electrolyte disorder characterized by serum potassium levels greater than 5 mEq/L.[1] Hyperkalemia is classified as mild, moderate, or severe based on serum potassium concentrations and the presence of cardiac manifestations on the electrocardiogram, with reference thresholds of 5.0 mEq/L, 6.0 mEq/L, and 6.5 mEq/L, respectively.[1,2] Potassium is essential for neuronal excitability, muscle (including heart) contraction, and water and acid-base balance. Maintaining normal serum potassium is essential for vital organs, especially the heart and central nervous system. Its levels are regulated hormonally (eg, insulin, aldosterone) and via renal excretion; consequently, disruptions can cause pathological increases.

The prevalence of hyperkalemia varies widely (0.1%-73.5%) due to differences in patient populations, comorbidities, use of medications affecting potassium, regional and temporal variations in clinical practices, potassium thresholds used to define hyperkalemia, and the frequency of potassium measurements. Moreover, considering the limited evidence among ethnic or socioeconomic groups, there is a need to investigate the occurrence of hyperkalemia among different ethnic and socioeconomic populations in the future, representing an important area for further research. Understanding these factors would help to explain the observed heterogeneity and is important for implementing effective strategies for prevention, early detection, and management of hyperkalemia among diverse clinical settings.[3]

A recent meta-analysis performed between 1976 and 2021 estimated that the global prevalence of hyperkalemia was 6.3% in the adult population.[3] In 2021, a study performed among 39 501 hospitalized patients reported a prevalence of severe hyperkalemia, defined as a serum $K^+ > 6.5$ mEq/L, of 0.6%.[4] Despite national records on hospitalized hyperkalemia, data are limited by inconsistent criteria among regions and professionals and incomplete recording of diagnoses.

The etiology of hyperkalemia is complex and multifactorial. Typically, a potassium-rich diet is not a primary cause of elevated serum potassium levels. Instead, hyperkalemia is more frequently related to underlying medical conditions, including chronic kidney disease (CKD), heart failure (HF), diabetes mellitus (DM), and hypertension, or a combination of these comorbidities.[5–9]

In 2019, a Spanish study conducted with more than 2000 patients determined that the prevalence of hyperkalemia ($K^+ > 5.5$ mEq/L) in patients with CKD was 12.6%.[10] In 2024, the CARDIOREN registry, conducted in more than 1000 HF patients in 2021 and 2022, showed a prevalence of 19% for $K^+ > 5$ mEq/L.[11]

Moreover, certain medications, such as renin-angiotensin-aldosterone system inhibitors (RAASi), special medical situations, such as kidney and/or heart transplant, aging, and/or less frequently other commonly used medications (eg, heparin, digoxin, beta-blockers, and calcineurin inhibitors) can also affect the normal potassium balance in the body and generate hyperkalemia.[5,8,12–18] In fact, the prevalence of hyperkalemia can increase from 12.6% to 25% in patients with stage 5 (end-stage) CKD who are undergoing treatment with RAASi.[10]

Clinically, patients with hyperkalemia may not have obvious symptoms, increasing the risk of not identifying the disease and not controlling it before serious effects occur. In cases of moderate or severe hyperkalemia, symptoms such as weakness, nausea, muscle pain, respiratory difficulty, or chest discomfort may occur. Without proper control, the condition poses a significant risk and may even be fatal, particularly due to its potential cardiac (eg, asystole or ventricular fibrillation) and neurological (eg, flaccid paralysis or respiratory failure) complications due to the effects of potassium on membrane potentials and electrical conduction.[19] In a cohort of 911 698 patients followed up for 18 months, the risk of mortality progressively increased with dyskalemia, reaching 6.6% to 29.7% in patients with HF, CKD, or DM vs 1.2% in controls, highlighting the strong clinical impact of abnormal potassium levels.[7]

Early detection and management of hyperkalemia are crucial to prevent serious complications. Understanding its pathogenic mechanisms and clinical approach allows treatment optimization and improves the prognosis of affected patients.

CARE APPROACH IN PATIENTS WITH HYPERKALEMIA

Currently, the diagnosis of hyperkalemia is based on serum potassium quantification, complemented by clinical evaluation and electrocardiography.[1,2] The therapeutic approach to hyperkalemia varies depending on whether it is an acute episode or a chronic situation, as well as on its severity (ie, K^+ levels). Its treatment algorithm is described in detail in a recent consensus document on the management of hyperkalemia.[2] Acute hyperkalemia refers to a rapid and sudden increase in blood potassium levels (not associated with pseudohyperkalemia), which can cause severe cardiac disturbances. In contrast, chronic hyperkalemia is a sustained and progressive elevation of potassium over a period of more than 3 months, with no significant changes (< 10%) in at least 3 consecutive measurements,[20] typically associated with CKD or prolonged use of certain medications. While less urgent, it is also dangerous in the long-term.

In acute hyperkalemia with severe symptoms, electrocardiography and neuromuscular assessment guide urgent stabilization. Emergency interventions lower potassium and protect the heart, with periodic monitoring recommended after treatment initiation.[21] The treatment may involve strategies to: *a)* stabilize the cardiac membrane and prevent arrhythmias (calcium gluconate or calcium chloride), *b)* facilitate potassium entry into cells (insulin-glucose infusion, beta-2 adrenergic agonists, and sodium bicarbonate if there is metabolic acidosis), and *c)* facilitate the elimination of excess potassium from the body by increasing renal and digestive elimination or by dialysis.

Patients with prior hyperkalemia are at higher risk of recurrence, especially with repeated episodes, often due to underlying conditions (CKD, HF, DM, hypertension) and associated chronic treatments.[22–24] Chronic hyperkalemia requires continuous management rather than rapid potassium reduction. Key strategies include potassium elimination (binders or cation exchange resins), dietary modifications to reduce intake, and optimizing cardio- and nephroprotective therapies (RAASi).

Ion-exchange resin treatment has been used for decades in the management of hyperkalemia. These resins work by exchanging calcium or sodium in the compound for potassium in the body, helping to lower elevated potassium levels.[25,26] However, their use has been controversial due to several factors that limit their efficacy and tolerability.[27–30] Potassium binders, sodium zirconium

cyclosilicate (SZC), and patiromer have proven their effectiveness in the chronic treatment of hyperkalemia in various patient profiles, including DM, hypertension, CKD, and HF.[31–40]

RAASi are a class of medications used in the treatment of various medical conditions, including HF with reduced ejection fraction, CKD, hypertension, and DM, with the aim of improving their prognosis.[41–45] Patients with CKD or HF commonly face a 14% risk of hospitalization due to hyperkalemia, a risk that nearly doubles in those treated with RAASi.[46] However, interruption or dose reduction of RAAS inhibitor therapy may lead to adverse cardiorenal outcomes. Accordingly, experts and clinical guidelines recommend that dose reduction or discontinuation of these agents should be considered a last resort in the management of hyperkalemia, and, if necessary, they should be reinitiated once the episode has resolved.[47–51]

CHALLENGES IN HYPERKALEMIA MANAGEMENT

Managing hyperkalemia poses significant challenges for health care professionals. Overall, a recent study showed that the annual cost per patient with chronic hyperkalemia in Spain amounted to €5929, indicating a direct proportional relationship to the severity of this condition.[8] Moreover, the cost of treating severe hyperkalemia is estimated to be more than double the average per patient expense, reaching €12 705.[8] This increase mainly reflects spending on specialized care and hyperkalemia management.[8] New potassium binders (SZC and patiromer) enable better hyperkalemia control in RAASi-treated patients with CKD or HF, improving management and potentially reducing health care resource use and costs.[46,52]

Challenges in hyperkalemia management encompass a range of clinical and practical issues (figure 1), including the accurate identification of elevated potassium levels, the identification of the underlying causes, and the selection of the most appropriate therapeutic approaches. Moreover, hyperkalemia management is complex due to diverse patient populations, including those with CKD and HF, and the interplay of medications, lifestyle factors, and comorbidities.

Challenges in research

Development of new therapeutic strategies for hyperkalemia

Sodium-glucose cotransporter 2 inhibitors lower blood glucose by inhibiting its reabsorption in the kidneys, promoting excretion in urine. These agents reduce cardiovascular and renal risks and improve survival in CKD and HF patients, regardless of type 2 DM.[53–56] Furthermore, sodium-glucose cotransporter 2 inhibitors have been associated with a lower risk of hyperkalemia in patients with type 2 DM and CKD, which may facilitate broader use of RAASi. A meta-analysis performed in 2023 demonstrated that the combination of these inhibitors and mineralocorticoid receptor antagonists (MRA) along with angiotensin-converting enzyme inhibitors/angiotensin receptor blockers notably reduces the development of hyperkalemia in patients with diabetic kidney disease.[57]

Sodium-glucose cotransporter 2 inhibitors, a foundational class I treatment in HF, may be an important adjuvant therapy in hyperkalemia, based on the lower risk of this complication observed with their use.

Finerenone is a third-generation selective nonsteroidal MRA, primarily used in the treatment of CKD, type 2 DM, and cardiovascular disease.[58,59] Unlike traditional MRAs, finerenone has greater selectivity toward the mineralocorticoid receptor, addressing certain limitations of earlier-generation MRAs.[60]

These differences between MRAs may impact the risk of developing hyperkalemia.[60] Although finerenone has been associated with modest increases in potassium levels in patients with HF,[61] its safety and lower risk of raising potassium make finerenone a promising RAAS-modulating option to reduce hyperkalemia recurrences, though further studies comparing it with traditional MRAs are needed.

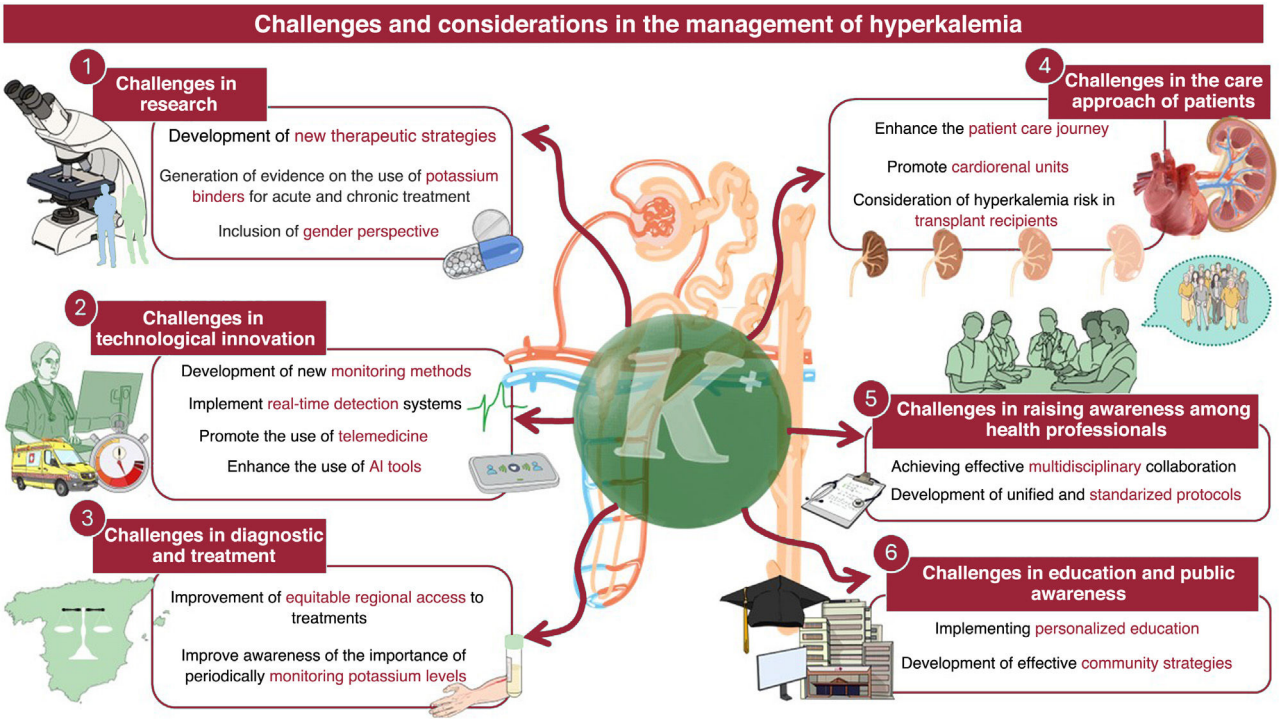

Figure 1. Central illustration. Challenges and considerations in the management of hyperkalemia. AI, artificial intelligence.

Generation of evidence on the use of potassium binders for acute and chronic hyperkalemia

New potassium binders (SZC and patiromer) offer safe, effective hyperkalemia control with good patient tolerance and improved adherence.

The REALIZE-K and DIAMOND trials provide important evidence supporting the use of potassium binders to optimize guideline-directed medical therapy in patients with HF and hyperkalemia.[62,63] In REALIZE-K, SZC enabled safe and sustained use of spironolactone in patients with HF with reduced ejection fraction, significantly reducing the risk of hyperkalemia and treatment discontinuation.[62] In this setting, a higher number of hospitalizations was reported in the SZC arm. Given the exploratory nature of this analysis and the limited sample size, these results should be viewed with caution, especially considering the imbalance in baseline risk—with older age, poorer renal function, and higher N-terminal pro-B-type natriuretic peptide in the SZC group—likely contributing to the observed differences. Similarly, the DIAMOND trial demonstrated that patiromer effectively maintained normokalemia and allowed the continuation and up-titration of RAASi, including MRAs, in patients with a history or risk of hyperkalemia.[63] Both studies highlight the role of potassium binders as enablers of optimal HF pharmacotherapy, potentially improving long-term outcomes by preventing underuse or withdrawal of life-saving treatments due to elevated potassium levels.

The choice of binder for chronic hyperkalemia may affect prognosis. No direct trials have compared SZC and patiromer, and there are no mortality studies. Both have shown efficacy vs placebo, but comparisons are limited by study differences.[2] In addition, another factor to consider is that patiromer can cause constipation and hypomagnesemia, while SZC may lead to mild edema due to its sodium content.[64] Clinicians should consider both benefits and potential adverse effects when choosing therapy.

Trials and extensions show potassium binders maintain efficacy for weeks to months (up to 12 months; some observational data to 1 year).[32] No consensus based on randomized clinical trials exists on treatment duration; treatment continues while risk persists. Evidence on tapering and postwithdrawal outcomes is limited, highlighting the need for randomized studies comparing discontinuation vs indefinite maintenance.

Given all the above-mentioned issues, high-quality comparative trials between patiromer and SZC are needed to guide optimal use based on patient needs, clinical, and economic factors. Mortality studies are also essential to understand the long-term impact and improve hyperkalemia management.

In acute hyperkalemia, evidence on new potassium binders is still limited. The ENERGIZE trial showed that SZC provided an additional potassium reduction at 2 hours, but not at 4 hours.[65] The ongoing PLATINUM trial is currently assessing the role of patiromer in the emergency setting.[66] Current guidelines consider these agents, especially SZC, as adjuncts to enhance elimination and reduce rebound, but not as substitutes for stabilization, redistribution, or dialysis when indicated.[2]

Inclusion of gender perspective in research and care approach

Given the existing variability between men and women in terms of prevalence, diagnosis, and management of several conditions that predispose to hyperkalemia (eg, CKD, HF and DM),[67–71] it is essential to recognize the importance in addressing hyperkalemia from a gender perspective.

In this regard, the prevalence of hyperkalemia in men is slightly higher than in women, 6.3% vs 5.1%,[3] a difference that has been observed in various studies and contrasts with the higher incidence of hypokalemia in women.[72,73] The reasons for these differences are unknown.

Additionally, among patients with CKD not on dialysis, hyperkalemia is more common in men than in women, whereas in the hemodialysis population, the prevalence of hyperkalemia is higher in women than in men.[73]

Women with CKD not on hemodialysis are more likely to have RAASi discontinued despite lower hyperkalemia prevalence than men, highlighting gender differences in care that need further study.[73] Therefore, the diagnosis and treatment of hyperkalemia should consider sex differences for personalized care, incorporating a gender perspective by ensuring equitable access, addressing socioeconomic barriers, researching gender effects, and raising health professionals' awareness.

CHALLENGES IN TECHNOLOGICAL INNOVATION

Development of new monitorization methods for hyperkalemia follow-up

There are currently no portable devices like glucose meters to directly measure potassium. Hyperkalemia is diagnosed via serum potassium and electrocardiography, but both have limitations: electrocardiography provides indirect information, and potassium measurement requires invasive methods.

However, improved technology is driving the development of minimally invasive sensors for continuous potassium monitoring.[74] Despite this, challenges remain, such as the clinical validation of nonblood samples (urine, interstitial fluid, and sweat), the lack of correlation between potassium levels in different body fluids, and the biocompatibility of in vivo sensors.[74] Overcoming these barriers would optimize hyperkalemia management, reducing adverse events and costs while improving quality of life. A 2022 study estimated that a 10% to 15% event reduction via continuous monitoring would cut costs and increase quality-adjusted life years.[75]

Nowadays, the use of artificial intelligence in hyperkalemia is emerging as a valuable tool for early detection, risk prediction, and personalized management of this potentially life-threatening condition.[76–78] Artificial intelligence-driven algorithms could analyze large datasets from electrocardiograms to identify patients at risk of hyperkalemia before critical levels are reached or even with a normal laboratory potassium level and alert physicians to impending episodes.[77]

Implement real-time detection systems

The diagnosis of elevated potassium levels may be overlooked in routine clinical tests. Current digital systems offer an effective solution by creating alerts in the electronic health record. These automatic alerts are designed to capture the health care provider's attention, ensuring immediate and appropriate patient evaluation. This improves the quality of medical care and minimizes the risks associated with hyperkalemia.

Furthermore, the automation of alerts would optimize resource use in laboratories and national health care systems. Detecting hyperkalemia in its early stages would allow rapid intervention before symptoms worsen. Rapid detection and treatment improve outcomes, reduce invasive interventions, and decrease recurrence and associated morbidity and mortality, especially in high-risk patients.

Promote the use of telemedicine

Telemedicine delivers remote medical services (diagnosis, treatment, follow-up) using technology, improving care, saving time and costs, and expanding health care access.

Since the coronavirus disease 2019 (COVID-19) pandemic, telemedicine adoption has significantly increased worldwide. Studies show that Spain is a pioneer in implementing this approach after the health crisis.[79] According to a report by mediQuo, telemedicine consultations in Spain increased by 153% since March 2020, reflecting the consolidation of this modality.[80] Additionally, the 2023 VI Health and Lifestyle Study by Aegon revealed that 23.3% of respondents avoid in-person doctor visits due to factors like public health care saturation (41.2%) and the growing availability of telemedicine options (28.1%).[81] Among the same group, 41% had used telemedicine in 2023.[81]

The widespread use of telemedicine for managing hyperkalemia could represent a significant advance in several areas: *a)* improved potassium level monitoring with future portable, noninvasive devices and telemedicine for faster diagnosis and treatment; *b)* enhanced access to health care, enabling virtual consultations with specialists, which is particularly beneficial for patients in remote areas or with mobility limitations; *c)* increased patient education on hyperkalemia management remotely, improving treatment adherence and health outcomes; *d)* better coordination among specialists and with primary care through telemedicine tools; and *e)* improved health care efficiency, optimizing resource use and enhancing system transparency.

Given the growth of telemedicine usage in Spain and its adoption among medical specialties, fostering its expansion in hyperkalemia management would be beneficial.

CHALLENGES IN DIAGNOSTIC AND TREATMENT

Improvement of equitable regional access to treatments

Drug approval involves authorities reviewing medical and economic data to determine public reimbursement eligibility, ensuring strict adherence to indications and covering only patients who meet established criteria.

In Spain, new potassium binders (SZC and patiromer) for hyperkalemia management require prior authorization, with clinical criteria set by the National Health System and Pharmacy Directorate.[82,83] These restrictions limit access for many patients who could benefit, as not meeting all criteria does not mean they are ineligible or unable to benefit if they meet other technical specifications.

Drug authorization in Spain varies by region: the national government sets requirements, but implementation differs. Some regions ease access, while others enforce stricter controls, causing disparities in treatment availability, including new potassium binders.

The main challenge lies in ensuring equal access and standardizing authorization. Aligning criteria with trials and harmonizing regional reviews can promote equity, requiring collaboration among authorities, professionals, and stakeholders.

Improve awareness of the importance of periodically monitoring potassium levels

Potassium monitoring is essential to guide treatment, especially in patients at risk of acute hyperkalemia. Currently, about 1 in 4 patients who experience initial hyperkalemia will have at least 1 more episode within the next 12 months, with a quarter of these events leading to hospitalization.[84] Moreover, hyperkalemia can be asymptomatic, so regular monitoring is essential. Although continuous potassium devices are lacking, periodic measurements help detect and prevent recurrences.

Therefore, establishing a standardized protocol for periodic potassium level monitoring, for example, within 1 to 2 weeks after initiating or up-titrating RAASi therapy, and periodically thereafter depending on renal function and concomitant medications, by health care professionals is critical and feasible through telemedicine. This would lower acute hyperkalemia risk, reduce hospitalizations, and allow medication adjustments for more precise and effective control.

CHALLENGES IN THE CARE APPROACH OF PATIENTS

Enhance the patient care journey

The first line of action in the event of an acute hyperkalemic episode is the emergency and urgent care services. In Spain, between 3% and 13% of patients in emergency and urgent care services have hyperkalemia.[21]

Hyperkalemia patients in emergency services often have comorbidities complicating treatment. A study found that in hospital emergency services, 71% of patients with hyperkalemia had some degree of renal insufficiency, 35% had a history of HF, and 57% were diabetic.[85]

Interventions should stabilize patients during hyperkalemia and support informed management. Standardized protocols—including early diagnosis, rapid intervention, and continuous monitoring—are essential, especially for emergency teams using new potassium binders in recurrent cases.

Hyperkalemia is often detected during hospitalization but rarely documented in discharge reports, complicating specialist follow-up. A 2014 study found that hyperkalemia was recorded in only 15.4% of 383 patients.[86] Effective documentation and communication are essential in hyperkalemia management to prevent recurrence. Therefore, discharge reports should include potassium levels throughout the event, especially in chronic hyperkalemia patients, ensuring that acute episodes are reported to the managing specialist.

Lastly, referring hyperkalemia patients from primary care requires clear criteria based on potassium levels, symptoms, and comorbidities.

Promote cardiorenal units

Hyperkalemia can result from various medical conditions and treatments, involving multiple specialties.

Improving coordination and multidisciplinary care can be seen in cardiorenal units, which provide comprehensive management of cardiorenal syndrome, a condition that affects the heart and kidneys and is often complicated by hyperkalemia. These units focus on patients with concurrent heart and kidney diseases, emphasizing coordinated care to improve clinical outcomes.

In 2021, a study reported that, among 59 hospitals with HF units, only 10% had an associated cardiorenal unit.[87] Additionally, the study revealed that 71% of hospitals did not have established protocols for collaboration between the various departments involved in the care of patients with cardiorenal syndrome, such as cardiology, nephrology, and internal medicine.[87] Institutional care models for preventing and managing this condition are still under development.

Effective management of hyperkalemia requires a multidisciplinary approach, involving various health care professionals to optimize care. Establishing cardiorenal units can enhance collaboration and improve clinical outcomes for patients with cardiorenal syndrome.

Consideration of hyperkalemia risk in transplant recipients

Prevalence estimates of hyperkalemia in transplant recipients range from 5% to 40%, influenced by disease progression, renal function, specific treatments (calcineurin inhibitors, trimethoprim-sulfamethoxazole for pneumocystis prophylaxis), and individual factors. A 2022 study of kidney transplant recipients found a 22.7% prevalence of hyperkalemia ($K^+ > 5$ mEq/L), with male sex and RAASi as significant risk factors.[15]

In heart transplant recipients, the incidence of hyperkalemia is exceptionally high in the first posttransplant year, affecting 95% in mild cases ($K^+ > 5$ mEq/L) and 24% in severe cases ($K^+ > 6$ mEq/L), with over half requiring treatment.[15]

Because of the strong association between cardiac and renal conditions and hyperkalemia, which can occur at various stages, transplant recipients (kidney or heart) are particularly vulnerable.[14] Proper organ preservation and reperfusion techniques are essential in the pretransplant phase to minimize potassium imbalances.[14] During transplant, factors such as anesthetics, heparin, blood transfusions, and low cardiac output can cause hyperkalemia, with preventive strategies including medication adjustments and hemodynamic stabilization.[14] Posttransplant hyperkalemia can result from cardiac surgery, immunosuppressants, and some antibiotics, requiring monitoring, medication adjustments, and possibly hemodialysis due to delayed graft function.[14]

Despite multiple checkpoints during transplantation that can trigger potassium imbalances, research on its impact remains limited. Given the high risk, regular monitoring of potassium levels and medication review is essential to prevent complications.

CHALLENGES IN RAISING AWARENESS AMONG HEALTH PROFESSIONALS

Evidence-based medicine is continuously evolving, with clinical practice guidelines and algorithms providing clear directives for hyperkalemia management.[2,47–49,88] However, new evidence and treatments directly impact existing guidelines, requiring their continuous updating and adaptation. Professionals must use updated protocols and decision tools.

Although online resources support continuous education, their volume can overwhelm providers. Organized initiatives are vital to give easy access to the most relevant, up-to-date hyperkalemia management information.

Managing hyperkalemia requires interdisciplinary collaboration and interprofessional education. Joint training and continuous education for primary care professionals help improve teamwork and keep clinicians up-to-date on guidelines and best practices.

Interprofessional simulations help practice communication, collaboration, and decision-making. Open communication and learning are vital for effective hyperkalemia care.

CHALLENGES IN EDUCATION AND PUBLIC AWARENESS

Improving education and awareness of hyperkalemia is crucial, especially in high-risk patients (HF, CKD, DM). Proper treatment adherence is key to preventing complications, ensuring therapy effectiveness, and improving quality of life.

Public awareness can encourage regular serum potassium testing, leading to early detection and timely treatment, reducing severe complications and recurrence risk. The reduction of dietary potassium intake is a widely adopted measure in cases of hyperkalemia, although most guideline recommendations in this regard are primarily based on expert opinion due to limited evidence and potential biases in available studies.[89] Health professionals should provide dietary recommendations regarding potassium intake, and labeling potassium content in foods could help individuals to better control potassium intake and avoid hyperkalemia.[90]

Collaborating with health care professionals to offer community sessions, patient schools, and expert webinars can raise hyperkalemia awareness, promote treatment adherence, and empower patients and families to manage the condition effectively.

Providing each patient with personalized information about their condition, the importance of treatment adherence, and recognizing hyperkalemia symptoms is essential, tailored to their understanding and individual needs.

CONCLUSIONS

Managing hyperkalemia presents several challenges, including the need for early detection, improved access to effective treatments, continuous monitoring, and strategies to prevent complications. It is essential to assess the long-term benefits of current therapies, as they effectively regulate potassium levels, and their timely administration must be ensured to optimize treatment timing. Addressing these issues requires greater awareness of the risks of the condition, a multidisciplinary approach to patient care, and ongoing efforts to enhance treatment protocols. Strengthening clinical guidelines, advancing medical education, and developing safer, more accessible treatments will be key to improving outcomes and quality of life in patients with hyperkalemia.

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STATEMENT ON THE USE OF ARTIFICIAL INTELLIGENCE

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AUTHORS' CONTRIBUTIONS

All authors contributed equally to the conception and design of the work and revised the manuscript critically for important intellectual content. Each author provided input based on their clinical and research expertise in nephrology and cardiology.

CONFLICTS OF INTEREST

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