GLOBAL PREVALENCE OF CHRONIC KIDNEY DISEASE, THE IMPORTANCE OF LABORATORY INDICATORS IN EARLY DETECTION, AND PREVENTION STRATEGIES

I.Ibragimov
Central Asian Medical University
Clinical residiency

Abstract Chronic kidney disease (CKD) is a growing global health challenge with significant morbidity and mortality. CKD affects more than 10 % of the world's population, and its prevalence continues to increase due to aging populations and rising rates of diabetes mellitus and hypertension. Because early CKD is often asymptomatic, delayed detection can lead to irreversible disease progression and serious complications. Laboratory biomarkers are essential for early diagnosis and risk stratification, thus enabling prompt intervention and effective preventive strategies. This article reviews current global prevalence data, the role of key laboratory markers including estimated glomerular filtration rate (eGFR), albuminuria, and emerging biomarkers, and discusses evidence-based prevention approaches.

Keywords: chronic kidney disease, early diagnosis, laboratory biomarkers, eGFR, albuminuria, cystatin C

Introduction

Chronic kidney disease (CKD) represents a major public health concern worldwide. Recent global estimates suggest that **between 700 million and 850 million people are affected by CKD**, with a prevalence exceeding 10 % of the adult population. CKD may surpass common chronic diseases in prevalence yet remains underdiagnosed due to its silent early course and varied screening practices. [1,2,3,4,5,6]

CKD's asymptomatic nature during early stages, combined with low awareness and inadequate screening programs, contributes to late presentation and increased disease burden. Globally, CKD ranks among the leading causes of death and disability, with projections indicating rising mortality if detection and prevention measures are not improved. [7,8,9,10,11]

Global Prevalence and Epidemiology

Systematic reviews indicate that **general population prevalence of CKD stages 1–5 is approximately 13.4 %**, and stages 3–5 at around 10.6 %, with variations depending on region, age, and risk factors. [12,13,14,15]

Epidemiological studies also show variability across countries and settings. Targeted screening among high-risk populations often reveals higher detection rates than general population screening. For example, CKD detection rates are significantly higher in people with diabetes or hypertension compared with unselected populations.

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Despite this high global prevalence, **a large portion of CKD remains undiagnosed or underrecognized**, especially in low- and middle-income countries where screening and early identification efforts are limited. [16,17,18,19,20]

Importance of Early Detection Using Laboratory Indicators

Effective laboratory screening plays a central role in identifying CKD before progression to advanced stages. Early detection enables clinicians to implement timely interventions that reduce progression to end-stage kidney disease and associated complications.[21,22,23,24,25]

1. Serum Creatinine and Estimated Glomerular Filtration Rate (eGFR)

Serum creatinine measurement and eGFR estimation remain the backbone of CKD diagnosis. eGFR reliably reflects kidney filtration function and is used to stage CKD. Persistent **eGFR < 60 mL/min/1.73 m² for at least 3 months** is a diagnostic criterion for CKD. [26,27,28,29,30]

2. Albuminuria and Urine Tests

Albuminuria, typically assessed through the urine albumin-to-creatinine ratio (UACR), is an early indicator of kidney damage, especially in diabetic and hypertensive patients. Regular monitoring of albuminuria is recommended for high-risk individuals to facilitate early detection.[31,32,33,34]

3. Emerging Biomarkers

Beyond traditional markers, **emerging biomarkers**—such as cystatin C, neutrophil gelatinase-associated lipocalin (NGAL), and kidney injury molecule-1 (KIM-1)—hold promise for earlier and more sensitive CKD detection, especially during subclinical kidney injury. These novel markers may improve prediction and risk stratification but require further validation for routine clinical use. [35,36,37,38]

Screening Strategies and Clinical Significance

CKD often progresses silently, making routine laboratory screening essential, particularly in high-risk groups such as individuals with diabetes, hypertension, cardiovascular disease, or family history of kidney disease. Targeted screening has shown higher diagnostic yield than population-based screening alone. [39,40]

International nephrology bodies also emphasize the need for consistent screening programs and improved access to laboratory diagnostics to promote early CKD identification and reduce the burden of advanced disease.[41]

Prevention and Risk Reduction

Primary and secondary prevention strategies for CKD include:

Control of major risk factors: Effective management of hypertension, diabetes, and obesity is crucial in reducing the risk and progression of CKD.

Healthy lifestyle promotion: Diet modification, physical activity, and avoidance of nephrotoxic substances help mitigate CKD risk.

Patient education and awareness: Increasing public and clinical awareness about CKD and its asymptomatic nature can improve early diagnosis rates.

Routine laboratory monitoring: Periodic assessment of eGFR and albuminuria in at-risk populations enables early intervention.

These measures collectively contribute to reducing CKD incidence, slowing disease progression, and minimizing cardiovascular and renal complications.

Conclusion

Chronic kidney disease poses a significant global health burden, with a high prevalence that is likely underestimated due to inadequate early detection. Laboratory markers, including eGFR, albuminuria, and emerging biomarkers, play an indispensable role in early CKD diagnosis. Evidence-based screening targeting high-risk populations, combined with preventive strategies and risk factor management, can substantially reduce disease progression and improve patient outcomes. Strengthening global screening policies and expanding access to laboratory diagnostics are essential steps toward reducing the worldwide impact of CKD.

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