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# CHRONIC KIDNEY DISEASE: MODERN APPROACHES TO EARLY DIAGNOSIS, RISK STRATIFICATION AND PREVENTION OF DISEASE PROGRESSION

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**Abstract Background:** Chronic kidney disease (CKD) represents a major global public health problem associated with increased cardiovascular morbidity, premature mortality and substantial healthcare expenditure. The asymptomatic nature of early CKD frequently results in delayed diagnosis and missed opportunities for effective intervention.

**Objective:** To review current approaches to the early diagnosis, classification, risk assessment and prevention of CKD progression, with particular attention to estimated glomerular filtration rate and urinary albumin excretion.

**Materials and Methods**: A narrative literature review was conducted based on the supplied publication, international clinical recommendations and relevant clinical studies addressing CKD epidemiology, diagnostic criteria, risk factors and preventive strategies.

**Results**: Diabetes mellitus, arterial hypertension, cardiovascular diseases, obesity and ageing are among the major contributors to CKD development. Current diagnostic strategies emphasize the combined assessment of estimated glomerular filtration rate (eGFR) and urinary albumin-to-creatinine ratio (ACR). The KDIGO classification system provides a standardized framework for identifying patients at different levels of kidney disease progression risk. Early identification of renal impairment, adequate control of blood pressure and metabolic abnormalities, and regular monitoring can reduce the likelihood of progression to kidney failure.

**Conclusion:** Early detection and comprehensive risk stratification are essential components of modern CKD management. Integrating renal function assessment, albuminuria screening and individualized preventive interventions into routine clinical practice may improve long-term renal and cardiovascular outcomes.

**Keywords:** chronic kidney disease, early diagnosis, estimated glomerular filtration rate, albuminuria, risk factors, KDIGO classification, renal function, prevention.

## Introduction

Chronic kidney disease (CKD) is an important medical and socioeconomic problem worldwide. Its prevalence continues to increase due to population ageing, the growing incidence of diabetes mellitus, arterial hypertension, obesity and cardiovascular diseases. CKD is associated not only with progressive impairment of renal function but also with an increased risk of cardiovascular complications and premature death[1-2].

One of the major challenges in clinical nephrology is the frequently asymptomatic course of early-stage CKD. Patients may maintain relatively normal general health despite progressive structural and functional kidney abnormalities. Consequently, diagnosis is often established only when renal impairment has become clinically significant[1].

According to epidemiological estimates discussed in the source publication, approximately 700 million people worldwide may be affected by CKD. The burden is particularly substantial in low- and middle-income countries, where access to laboratory investigations, nephrological consultations and renal replacement therapy remains limited.

Diabetes mellitus and hypertension are particularly important causes of CKD. Approximately one-third of individuals with diabetes and one-fifth of patients with hypertension in high-income countries may have evidence of chronic kidney impairment. These observations emphasize the importance of systematic screening among high-risk populations[3-5].

The objective of this review is to analyze modern diagnostic approaches, discuss the principal risk factors and evaluate strategies for preventing CKD progression.

**Materials and Methods**

This article represents a narrative review of scientific literature concerning the epidemiology, clinical diagnosis, classification and prevention of chronic kidney disease.

The analysis was based on the supplied review article, international recommendations of Kidney Disease: Improving Global Outcomes (KDIGO), and selected clinical studies published in nephrology and internal medicine journals.

Particular attention was given to:

Epidemiological characteristics of CKD.

Major metabolic and cardiovascular risk factors.

Assessment of estimated glomerular filtration rate.

Detection and quantitative assessment of albuminuria.

Clinical classification and risk stratification.

Early preventive and therapeutic interventions.

The review focused on the clinical relevance of combining laboratory indicators with individual patient characteristics.

**Results and Discussion**

Epidemiology and major risk factors

CKD develops as a consequence of various pathological processes that progressively damage renal structures and reduce their functional capacityThe most significant risk factors include diabetes mellitus, arterial hypertension, cardiovascular disease, obesity, older age and a family history of kidney disorders.Diabetic kidney disease is particularly important because chronic hyperglycemia induces glomerular hyperfiltration, endothelial dysfunction, oxidative stress and progressive glomerulosclerosis. Hypertension contributes to renal microvascular damage, increased intraglomerular pressure and interstitial fibrosis.The interaction between metabolic disturbances and vascular abnormalities creates a pathological cycle that accelerates renal function deterioration.Environmental factors, occupational exposures, infectious diseases and climate-

related changes may also contribute to the development of acute kidney injury and subsequent chronic kidney damage.Early diagnosis of chronic kidney disease

Early diagnosis is essential because therapeutic interventions are generally more effective before substantial irreversible renal damage develops[7].

The two principal laboratory parameters used in routine CKD assessment are:

Estimated glomerular filtration rate (eGFR).

The eGFR reflects the filtration capacity of the kidneys and is calculated using serum creatinine-based equations. In selected patients, combined creatinine- and cystatin C-based estimation may improve diagnostic accuracy.

Urinary albumin-to-creatinine ratio (ACR).

Albuminuria reflects increased glomerular permeability and may indicate early kidney damage, even when eGFR remains relatively preserved.

According to KDIGO recommendations, individuals at increased risk of CKD should undergo assessment of both eGFR and urinary albumin.

An isolated abnormal laboratory result is insufficient to establish chronicity. Kidney abnormalities should generally persist for at least three months or be supported by other evidence of chronic renal damage.

Classification and risk stratification

The KDIGO classification system evaluates CKD according to the cause, glomerular filtration rate and albuminuria categories.

The GFR categories are:

G1: eGFR ≥90 mL/min/1.73 m².

G2: eGFR 60–89 mL/min/1.73 m².

G3a: eGFR 45–59 mL/min/1.73 m².

G3b: eGFR 30–44 mL/min/1.73 m².

G4: eGFR 15–29 mL/min/1.73 m².

G5: eGFR less than 15 mL/min/1.73 m².

G1 and G2 categories do not independently establish CKD without additional markers of kidney damage.

Albuminuria is classified as follows:

A1: ACR less than 30 mg/g.

A2: ACR 30–300 mg/g.

A3: ACR greater than 300 mg/g.

The combined assessment of eGFR and albuminuria provides more accurate prognostic information than either parameter alone[2].

Patients with reduced eGFR and increased albuminuria have a substantially greater risk of CKD progression and cardiovascular complications.Cardiovascular complications associated with CKD

CKD is closely associated with cardiovascular disease. The increased cardiovascular risk is explained by several interacting mechanisms, including chronic inflammation, oxidative stress,

endothelial dysfunction, arterial stiffness, hypertension and disturbances in mineral metabolism[4]. Patients with CKD frequently develop left ventricular hypertrophy, heart failure, ischemic heart disease and vascular calcification.Importantly, cardiovascular complications may develop before advanced kidney failure becomes clinically apparent. Therefore, cardiovascular risk assessment should be incorporated into the routine management of patients with CKD. Prevention of CKD progression

Preventive interventions should be initiated as early as possible and individualized according to the underlying cause of renal impairment.The principal preventive measures include:

Adequate blood pressure control [5].Effective management of diabetes mellitus.Reduction of excessive dietary sodium intake.Maintenance of a healthy body weight.Smoking cessation.Avoidance of unnecessary nephrotoxic medications.Regular monitoring of serum creatinine, eGFR and urinary albumin.Timely referral to a nephrologist in patients with progressive disease.Renin–angiotensin system inhibitors, including angiotensin-converting enzyme inhibitors and angiotensin receptor blockers, have an important role in patients with appropriate clinical indications, particularly those with albuminuria.

Sodium–glucose cotransporter 2 inhibitors have also become important components of contemporary nephroprotective treatment. Clinical implications The integration of CKD screening into routine management of patients with diabetes and hypertension may improve early identification of renal abnormalities[6]. General practitioners, internists, cardiologists and endocrinologists should consider kidney function assessment as an essential component of comprehensive cardiovascular and metabolic risk management.A structured approach involving early laboratory testing, periodic monitoring and individualized intervention may reduce delayed diagnosis and improve patient outcomes.

**Conclusion**

Chronic kidney disease remains a major global healthcare challenge because of its increasing prevalence, asymptomatic early stages and close association with cardiovascular morbidity and mortality.

The combined assessment of eGFR and urinary albumin-to-creatinine ratio represents the foundation of modern CKD diagnosis and risk stratification.

Early identification of high-risk patients, appropriate treatment of diabetes and hypertension, lifestyle modification and regular monitoring are essential for preventing disease progression.

The implementation of standardized diagnostic and preventive strategies in primary healthcare may contribute to reducing the clinical and socioeconomic burden of CKD.

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