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Acute and Chronic Disease Report

Commentary

Advancements in Early Diagnosis of Chronic Kidney Disease (CKD) using Biomarkers

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DESCRIPTION

Chronic Kidney Disease (CKD) affects an estimated 10% of the global population and often progresses silently until significant kidney damage has occurred [1]. Early diagnosis and timely intervention are important in managing CKD and reducing complications such as cardiovascular disease and End-Stage Renal Disease (ESRD) [2]. Traditional diagnostic methods for CKD-namely serum creatinine and estimated Glomerular Filtration Rate (eGFR)-generally detect kidney damage in later stages, often when options to slow progression are limited [3].

Key biomarkers for early (CKD) detection

Cystatin C: Cystatin C is a low-molecular-weight protein filtered almost exclusively by the kidneys, with levels in the blood reflecting renal function. Unlike serum creatinine, which can be influenced by factors like muscle mass, Cystatin C is largely unaffected by age, sex or body composition [4]. Studies indicate that Cystatin C can detect early-stage kidney dysfunction more accurately than Creatinine, especially in populations with altered muscle mass, such as elderly patients [5]. Cystatin C is currently seen as a reliable complement to eGFR and has been incorporated into diagnostic guidelines for CKD assessment [6].

Kidney Injury Molecule-1 (KIM-1): KIM-1, a protein expressed by renal tubular cells in response to injury, has shown as a marker for both Acute Kidney Injury (AKI) and early CKD [7]. Elevated levels of KIM-1 in urine suggest tubular damage, making it particularly relevant in cases of diabetic kidney disease or exposure to nephrotoxic agents. Its ability to indicate kidney injury before functional loss occurs makes KIM-1 a powerful tool for early detection and risk stratification in patients at high risk for CKD [8].

Advantages of biomarker-based approaches: The use of biomarkers for CKD diagnosis offers several advantages over traditional methods [9]. First, biomarkers allow for earlier detection of kidney injury by reflecting cellular damage even before significant GFR decline. Second, many biomarkers, such as Neutrophil Gelatinase-Associated Lipocalin (NGAL) and Albumin-to-Creatinine Ratio (ACR), can be measured through non-invasive urine tests, making regular monitoring more accessible and less burdensome [10].

CONCLUSION

The advancement of biomarkers in CKD diagnostics represents a significant step forward in nephrology. Biomarkers like Cystatin C, KIM-1 and Neutrophil Gelatinase-Associated Lipocalin (NGAL) offer potential for identifying kidney injury at its earliest stages, enabling interventions that may slow disease progression. While further studies and standardization are needed, the future holds for biomarker-based diagnostic models that can improve CKD management and ultimately reduce the burden of chronic kidney disease globally. Additionally, biomarkers allow for more accurate risk stratification, aiding clinicians in distinguishing between patients who may require intensive monitoring *versus* those who may benefit from preventive care. Combined with traditional diagnostics, biomarkers provide a more comprehensive view of renal health, improving diagnostic precision.

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