CLINICAL REVIEW

Rational Renometrics

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ABSTRACT

The precise evaluation of renal function and structure is indispensable clinical medicine. This is required not only to screen, diagnose and monitor kidney disease, but also to allow accurate choice of drugs and their dosages while treating individuals. Traditional methods, exemplified by glomerular filtration rate (GFR) calculations and urinalysis, have long served as pillars of nephrology. However, their inherent limitations introduce diagnostic ambiguities, raising concerns for both health care providers and patients. This comprehensive review introduces the concept of "Rational Renometrics", a transformative approach that harmonizes various tests and factors to provide a holistic assessment of renal health. It focuses on correct urine sample collection, mitigates false positives in urinalysis and embraces the concept of permissive hypercreatinemia. The evidence-based, data-driven perspective of rational renometrics empowers health care providers and patients, leading to more accurate diagnoses, individualized treatment strategies and improved therapeutic outcomes. Rational renometrics allows accurate risk assessment and institution of preventive interventions, reinforcing its pivotal role in preserving renal health and optimizing patient care. We describe the principles, advantages, challenges and potential clinical applications of rational renometrics, emphasizing the need for continued research and validation of this concept.

Keywords: Renal function assessment, transformative, permissive hypercreatinemia, risk assessment

Renal function assessment is a cornerstone of clinical medicine, providing critical insights for the diagnosis and management of kidney diseases.[1] It also helps ensure appropriate choice and accurate dosage of drugs for management of disease.[2] However, the conventional methodologies employed for renal evaluation, such as glomerular filtration rate (GFR) calculations and urinalysis, are not immune to inherent limitations.[3-6] These limitations often result in ambiguous interpretation of results, and erroneous decisions based on them. We propose the concept of "Rational Renometrics" to offer a comprehensive and data-driven perspective on renal function assessment, potential to significantly enhance the quality of care provided to patients with renal conditions.

Rational renometrics, as a systematic framework, mandates consideration of a multitude of factors and ancillary tests to contextualize clinical data. For patients, this translates into a more precise evaluation of their renal health status, potentially allaying unwarranted apprehensions and facilitating a more individualized approach to medical care. Consider, for example, a patient presenting with marginally elevated creatinine levels but concomitant radiological assessments demonstrating unremarkable renal structures and urinalysis results indicating no evidence of kidney dysfunction. The traditional interpretation of isolated elevated creatinine levels in routine blood tests may often precipitate anxiety and concerns related to underlying renal dysfunction.[7] However, it is imperative to acknowledge that creatinine levels are subject to various nonrenal determinants, including age, muscle mass and dietary factors. In such instances, an isolated elevation in creatinine may not necessarily signify inherent renal pathology.[3,4,8] In this scenario, rational renometrics would provide a more grounded and rational perspective, reducing unjustified anxiety and enabling health care providers to make informed decisions.

By providing a concordant view of both renal function and structure, rational renometrics empowers patients to engage in data-driven discussions with their health care providers. It ensures that treatment decisions, lifestyle modifications and further diagnostic tests are founded on precise and rational assessments, thereby fostering enhanced patient confidence in the health care delivery system. In this review, we will expound upon the

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principles, advantages, challenges and potential clinical applications of rational renometrics. Additionally, we will discuss the necessity for research and validation to establish this approach as a standard practice in nephrology, as well as explore future directions for the field. Through this review, we aim to underscore the transformative potential of rational renometrics for health care providers and patients, culminating in more accurate diagnoses, individualized treatment strategies and improved patient outcomes.

RENAL FUNCTION ASSESSMENT

Renal function assessment is a critical aspect of clinical medicine, providing essential insights into the health and performance of the kidneys.[1] The two primary pillars of this assessment have traditionally been the estimated glomerular filtration rate (eGFR) and urinalysis.[4,5] While these methods have played a pivotal role in nephrology, it is important to acknowledge their inherent limitations.

Urinalysis, particularly albumin or red blood cells (RBCs) in urine, is a fundamental tool used in renal assessment.[5] Despite its wide usage, urinalysis is not without significant limitations. Albuminuria is a critical marker for kidney disease.[9,10]

However, it is important to recognize that albuminuria is not always indicative of underlying renal pathology. Urinary albumin levels can be influenced by factors unrelated to kidney health, such as systemic inflammation, exercise and urinary tract infections (UTIs).[1] This presents a challenge in interpreting urinalysis results, as false positives may lead to unwarranted concerns and potentially unnecessary follow-up procedures. Similarly, the presence of RBCs in urine may not always be indicative of intrinsic kidney disease. Nonrenal factors, such as strenuous exercise, menstruation and UTIs, can also lead to hematuria.[1] This complicates the interpretation of urinalysis results and raises the potential for misdiagnosis.

Estimation of GFR using creatinine measurements is a widely accepted and commonly used method for assessing renal function.[3,4] However, it relies heavily on the assumption that creatinine production and elimination are relatively stable within individuals. This assumption may not hold true for all patients, particularly those with conditions that can affect creatinine metabolism.[3,4] For example, individuals with varying muscle mass, age or diet may exhibit different creatinine production rates, leading to inaccurate GFR estimates.[1,3,4]

Serum creatinine levels can vary between different laboratories, and even within the same laboratory over time, due to differences in assay methodologies and equipment calibration. These variations can result in discrepancies in GFR estimations when using creatinine-based equations. This inconsistency can be a source of diagnostic uncertainty, and patients may be misclassified as having kidney dysfunction when they do not.[4,11]

The concept of "permissive hypercreatinemia" refers to the phenomenon where elevated creatinine levels within a certain range do not necessarily indicate kidney dysfunction.[12-14] In some cases, creatinine levels may be chronically elevated but stable, and patients may have normal renal function. Using creatinine-based GFR estimation alone may lead to incorrect diagnoses of renal impairment or disease progression in such cases, causing unnecessary concern and medical interventions. Certain medications, such as cimetidine, trimethoprim and some antibiotics, can interfere with creatinine secretion and reabsorption in the renal tubules. This can lead to inaccuracies in GFR estimations based on creatinine levels, potentially causing overestimation of renal function.[3,4,11] Creatinine-based GFR estimations may be less accurate in specific populations, such as elderly individuals, pediatric patients or individuals with extremes in muscle mass. In these cases, the limitations of creatinine-based GFR calculations become more pronounced.

To address these shortcomings and improve the accuracy of renal function assessment, the rational renometrics approach emphasizes the need for a more comprehensive evaluation. It incorporates a range of tests, accounts for confounding factors and considers the broader clinical context to provide a more accurate and rational assessment of renal health. Furthermore, rational renometrics underscores the importance of collecting urine samples correctly and accounting for various confounding factors to reduce the incidence of false positives. This approach helps reduce diagnostic uncertainties, unnecessary concern and the potential for misclassification of kidney function.

RATIONAL RENOMETRICS FRAMEWORK

Rational renometrics seeks to provide a holistic and rational approach to the assessment of renal function and structure.

- **Investigations and their interpretation**
  - **Integration of radiological and nuclear tests:** The framework incorporates radiological and nuclear imaging alongside traditional assessments to provide a more comprehensive view of renal health.

- **Addressing false positives:** The approach accounts for potential false positives, such as albuminuria in the presence of UTIs, in urinalysis interpretation.
- **Creatinine variation consideration:** Rational renometrics acknowledges variations in creatinine levels between different laboratories or at different times and seeks to account for these fluctuations.
- **Permissive hypercreatinemia concept:** The framework recognizes that elevated creatinine levels within a certain range may not necessarily indicate kidney dysfunction and takes a more nuanced approach to interpretation.

➲ **Clinical evaluation and approach**

- **Comprehensive patient evaluation:** Rational renometrics aims to provide a comprehensive and individualized assessment, tailoring the evaluation to each patient's unique clinical context.
- **Improved diagnostic accuracy**: By considering a wider range of parameters and addressing nuances, rational renometrics enhances the accuracy and reliability of renal health diagnoses.
- **Informed treatment decisions:** The approach empowers physicians and patients to make more informed decisions about treatment, lifestyle changes and further diagnostic tests based on a rational and comprehensive assessment.
- **Research and validation**: To establish rational renometrics as a standard practice in nephrology, research and validation studies are necessary, encompassing various patient populations and clinical settings.

POINT OF CARE TESTING

The availability of accurate point of care testing (POCT) devices for the measurement of urine albumin-to-creatinine ratio (UACR) has helped improve the efficiency of clinical decision making and health care delivery. Availability of test reports within minutes allows rapid titration of therapy and improves patient's satisfaction with health care.

CHALLENGES AND CAVEATS

Rational renometrics is not without its challenges. The complexity of integrating various tests and the need for standardized protocols pose logistical hurdles.

Table 1. Challenges and Caveats Related to Rational Renometrics

Challenges	Comments
Complex Integration	Integrating various tests, including radiological and nuclear imaging, in a systematic manner can be logistically challenging, requiring standardization and coordination among health care providers.
Interpretation Complexity	The interpretation of test results, especially when variations exist across different laboratories or time points, demands meticulous attention to detail, introducing potential sources of error.
Change in Diagnostic Workflow	Implementing rational renometrics in clinical practice necessitates changes in traditional diagnostic workflows and may require health care providers to adapt to a new paradigm of assessment.
Data-Driven Approach	Rational renometrics relies heavily on data-driven decision-making, which requires accurate and consistent data collection, storage and analysis.
Point of Care Services	Point of care testing facilities are required to help optimize usage and benefits of renometrics in clinical decision-making.
Standardization Challenges	The development of standardized protocols for implementation of rational renometrics across diverse health care settings can be complex task.
Validation Requirements	The establishment of rational renometrics as standard practice in nephrology requires extensive research and validation studies, which can be resource-intensive and time-consuming.
Patient Education	Patients must be educated about rational renometrics nuances to understand rationale behind assessment and its potential impact on their decisions.
Collaboration	Successful implementation of rational renometrics requires interdisciplinary collaboration among pathologists, radiologists and other health care providers.
Integration with Electronic Health Records	Rational renometrics may necessitate integration of new data points and test results into electronic health records and electronic medical record systems, posing technical and administrative challenges.

Table 2. Various Advantages of Rational Renometrics

Challenges	Comments
Accurate Diagnoses	Rational renometrics provides more reliable assessment of renal function and structure, reducing potential for misdiagnosis and unnecessary concern.
Tailored Treatment Strategies	The comprehensive evaluation empowers health care providers to design individualized treatment plans, optimizing patient care and outcomes.
Reduced Diagnostic Uncertainty	By accounting for variations in test results and incorporating wider range of parameters, rational renometrics reduces diagnostic uncertainties and ensures more confident clinical decision-making.
Early Disease Detection	The approach offers improved sensitivity for detecting early stages of kidney disease, enabling timely intervention and preventive measures.
Data-Driven Discussions	Rational renometrics encourages data-driven discussions between health care providers and patients, fostering patient engagement and informed decision-making.
Patient Confidence	Patients benefit from a more rational and nuanced assessment of their renal health, leading to reduced anxiety and enhanced confidence in their health care providers.
Monitoring Disease Progression	Rational renometrics is effective for monitoring disease progression and treatment response, allowing health care providers to make timely adjustments to the management plan.
Improved Risk Assessment	The approach aids in the identification of patients at risk of developing chronic kidney disease, facilitating targeted interventions to mitigate risks.
Enhanced Patient Outcomes	Rational renometrics ultimately contributes to improved patient outcomes by ensuring that clinical decisions are grounded in accurate and comprehensive data.
Potential for Preventive Medicine	By identifying early signs of renal dysfunction and addressing modifiable risk factors, rational renometrics supports preventive medicine and the preservation of renal health.

Interpreting test results, particularly when variations exist across different laboratories, requires meticulous attention. Additionally, addressing the practical implementation of rational renometrics in clinical practice presents challenges, as it necessitates changes in diagnostic workflows and requires interdisciplinary cooperation. The challenges and caveats related to rational renometrics have been depicted in Table 1.

Overcoming these challenges and addressing the associated caveats is essential to successfully implementing rational renometrics and realizing its potential benefits in clinical practice.

ADVANTAGES AND CLINICAL APPLICATIONS

The advantages of rational renometrics are promising. This approach can lead to more accurate diagnoses, improved monitoring of kidney health and better-informed treatment decisions. The various advantages of rational renometrics have been depicted in Table 2.

The advantages and clinical applications of rational renometrics hold the potential to revolutionize the assessment of renal function and structure, leading to more accurate diagnoses, tailored treatment strategies and improved patient outcomes.

CONCLUSION

In conclusion, rational renometrics emerges as a transformative approach to renal health assessment, effectively addressing the limitations of traditional methods. By providing a more comprehensive, data-driven evaluation of renal function and structure, it empowers health care providers and patients to make informed decisions, allaying uncertainties and fostering individualized care.

While challenges and standardization remain key considerations, the potential for more accurate diagnoses, personalized treatment strategies, and improved patient outcomes highlights the significance of rational renometrics in modern nephrology. Its evolving role in risk assessment and preventive medicine positions it as a pivotal tool in the preservation of renal health and the optimization of patient care.

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Effect of Symptom Burden on Physical Activity in Persons with COPD

There is an inverse association between moderate-to-vigorous physical activity and severity of symptoms in patients with chronic obstructive pulmonary disease (COPD), as per a new research published in the journal *Chronic Obstructive Pulmonary Diseases*.[1]

A total of 1,558 COPD patients, ≥40 years, from the Canadian Cohort Obstructive Lung Disease study (CanCOLD) were enrolled for this multicenter cross-sectional study to examine the association between physical activity of moderate-to-vigorous intensity and COPD symptoms. The selected participants were grouped into four categories: 474 individuals at-risk for COPD (ever-smokers and normal spirometry), 406 participants with mild COPD (GOLD 1 stage), 287 with moderate COPD (GOLD 2 stage) and 347 healthy subjects (never-smokers and normal spirometry). The study excluded patients with GOLD stage 3 and 4. Moderate-to-vigorous intensity physical activity, measured as energy expenditure (kcal/week) was the primary endpoint of the study.

Significant associations were observed between lower moderate-to-vigorous intensity physical activity levels and high symptom burden overall and in patients with moderate COPD ($\beta = -717.09$). Seventy-two percent of patients had never been diagnosed with COPD ($\beta = -694.1$) prior to their recruitment in this study. These undiagnosed subjects had significantly higher moderate-to-vigorous intensity physical activity vis-à-vis those with physician-diagnosed COPD ($\beta = -592.41$).

Shortness of breath or dyspnea, especially during physical activity, is a characteristic symptom of COPD, which is a deterrent for physical activities. In this study of patients with newly diagnosed COPD of mild to moderate severity, moderate-to-vigorous intensity physical activity was inversely associated with greater severity of symptoms. Therefore, evaluation of symptom burden enables identification of patients with lower moderate-to-vigorous intensity physical activity, especially in those with moderate disease severity as well as relatively inactive patients with mild COPD. These patients should be encouraged to engage in relatively less strenuous exercises such as gentle yoga at a slower pace and walking, under supervision, to improve their quality of life.

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