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Newer Point-of-Care Biosensors Are Expected to Permit Early Detection and Better Management of Acute and CKD

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See Clinical Research on Page 1110

For any intervention in the public health of large populations to be effective, accurate knowledge of the incidence and prevalence of acute and chronic diseases is a basic requirement. Recognition of a disease and its severity is a multistaged process, but its implementation is dependent not only on clinical suspicion, confirmatory measures, and a final diagnosis, but also on modifiers, such as awareness of the condition, the diagnostic context, and the resources available to implement confirmatory studies (Figure 1).[1]

In populations that reside in limited-resource environments, measurements are hampered by a lack of trained human resources, equipment, and communication. The result of this situation is that because diseases are poorly measured and understood, they remain ignored, with severe individual and population consequences, including decreased survival, disability, hampered maternal and infantile health, and exacerbated poverty.[2]

Newer point-of-care (POC) sensor technologies allow the detection and monitoring of important biological variables in patients with acute and chronic kidney diseases (CKDs). These advances have permitted early measurement of key biological variables (biomarkers) with great accuracy, as well as minimal cost and resource investment.[3] Such devices permit the assessment of renal function in people living with HIV in resource-limited settings in urban Zambia,[4] cost-effective screening for CKD among Canadian indigenous peoples,[5] and early detection of kidney disease in Australia.[6] Using volunteer research students and technological innovation, including GPS, digital photography, and POC biochemical analysis, these devices have measured, for the first time, the burden of CKD and other public health priorities in Rivas, Nicaragua.[7] These endeavors will generate cohorts suitable for long-term studies and investigations in disease prevalence, incidence, treatment, and multiple other public health matters.

In acute kidney injury (AKI) in resource-limited environments, early intervention is currently the only option to decrease morbidity and mortality.[1] Within an initiative designed to maximize sustainability (the 0by25 Initiative of the International Society of Nephrology), the selective use of POC devices among patients who clinically presented with a high likelihood of AKI permitted early identification of new cases and early implementation of interventions (such as teleconsultation and transfer of cases to higher level of care centers when necessary) by using rural health centers, solar-powered phones, and POC devices that were resistant to heat and humidity.[8]

In this issue of *Kidney International Reports*, Kumar *et al*.[9] reported on the clinical application of a nanotechnology-based multianalyte POC biosensor diagnostic device in Bangalore, India. The device was minimally invasive, could be used with minimal training, and was able to measure many of the critical variables important in the detection and management of diabetic kidney disease (glycosylated hemoglobin, hemoglobin, serum and urine albumin, urine creatinine, and the albumin-to-creatinine ratio). The use of a nonenzymatic- and nonantibody-based electrochemical POC device permitted accurate reading of results in the field in <1 minute, with a rechargeable handheld, Bluetooth enabled apparatus. Importantly, the biosensor is self-contained, has no special storage requirements, and appears to be unaffected by temperature, humidity, or pH variations.

A large proof-of-concept and an even larger validation cohort make for reliable measurement results compared with gold standard laboratory results, as shown by the high

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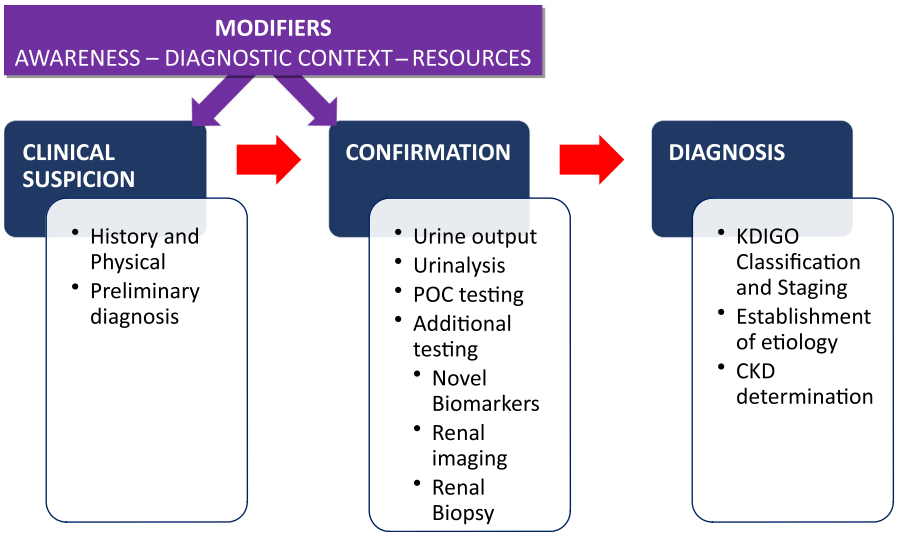

Figure 1. Acute kidney injury (AKI) recognition: the process and its modifiers. In addition to the usual AKI trajectory from clinical suspicion to confirmation to diagnosis, other factors modify the process. The degree of AKI awareness, the context in which the patient is encountered, and the available diagnostic resources may facilitate, delay, or impede the achievement of early AKI diagnosis. CKD, chronic kidney disease; KDIGO, Kidney Disease: Improving Global Outcomes; POC, point of care. Reprinted with permission from www.ADQI.org

correlation coefficients ($R^2 > 0.8$) and good linearity. It is expected that the use of devices (such as this POC device) in remote communities in underserved areas of the world, where the incidence and prevalence of diabetes mellitus and diabetic kidney disease continues to increase exponentially[9] and where delivery of care is woefully inadequate, will result in significant improvement in recognition and early management of diabetes and its complications. Deployment of inexpensive, simple devices such as this will exponentially increase the visibility of these problems and hopefully lead to implementation of measurable interventions that will affect the length and quality of millions of lives.[10]

DISCLOSURE

The author declared no competing interests.

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