Reading between the (guide)lines—the KDIGO practice guideline on acute kidney injury in the individual patient

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The KDIGO guidelines for acute kidney injury (AKI) are designed to assist health-care providers around the world in managing patients with AKI. Clinical guidelines are intended to help the clinician make an informed decision based on review of the currently available evidence. Due to the generic nature of guidelines, it is sometimes difficult to translate a guideline for a particular individual patient who may have specific clinical circumstances. To illustrate this point, we have discussed the interpretation of the KDIGO guideline in patients who have subtleties in their clinical presentation, which may make treatment decisions less than straightforward.

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There have been a plethora of clinical practice guidelines (CPG) produced by individual national and international specialist medical societies. By critically evaluating relevant scientific evidence (Table 1), CPG can provide recommendations for clinical practice[1] and help improve the quality of clinical decision making. However, there is often insufficient good quality scientific data to positively advocate one intervention over another, and as such recommendations made by CPG committees often become subjective and 'opinion-based'. Even when a generic recommendation is available, it may not always be suitable for an individual patient due to their particular circumstances.[2] In addition, CPG may be manipulated by health-care purchasers, and other organizations.[3] Although CPG have generally been reported to improve overall quality of patient care,[4] whether this is always achieved on a daily basis remains debatable.[2]

DEVELOPMENT OF THE KDIGO (KIDNEY DISEASE: IMPROVING GLOBAL OUTCOMES) GUIDELINE FOR ACUTE KIDNEY INJURY (AKI)

Reviewing evidence to develop guidelines is a prolonged process. An initial working group of recognized clinical experts in the field of acute kidney injury determined key topics to be addressed. This expert panel was expanded to include other clinicians not only from nephrology and intensive care but other relevant specialities to form individual workgroups, supported by an 'evidence review team' specialized in the field of guideline development, which formulated recommendations and provided reasoning for their guidance depending upon the quality of available evidence. Provisional guidelines were then posted on the KDIGO website for general comment and additionally sent to individual clinicians for review. Following external comments, the revised guidelines were finally published.

WHY DO WE NEED GUIDELINES FOR AKI?

One of the fundamental problems in interpreting studies in AKI has been the lack of a unified definition. There were discrepancies between the two more commonly used definitions,[5–7] leading to differences in incidence and outcomes of AKI. It was therefore essential to have an agreed

Table 1 | Grading of evidence

Level 1 'We recommend'	Most patients should receive the recommended course of action
Level 2 'We suggest'	Different choices will be appropriate for different patients. Each patient needs help to arrive at a management decision consistent with her or his values and preferences
Grade A high quality	Evidence obtained from at least one properly designed randomized controlled trial
Grade B good quality	Evidence obtained from well-designed controlled trials without randomization
Grade C moderate quality	Evidence obtained from well-designed cohort or case-control analytic studies, preferably from more than one center or research group
Grade D poor quality	Evidence obtained from multiple time series with or without the intervention and uncontrolled trials

definition for epidemiological studies, assessment of risk factors for AKI, evaluation of biomarkers predicting severity and recovery from AKI, and interventional trials. In addition, it was also important to review the basic resuscitation and management of patients with AKI, to standardize practices and establish not only whether interventional treatments could reduce the risk of developing or severity of AKI but also whether different supportive therapies could potentially hasten renal recovery, or reduce the risk of developing progressive chronic kidney disease (CKD) in AKI survivors.

The KDIGO AKI guidelines are intended to aid the diagnosis and provide informed decision-based management. As with any CPG, the KDIGO clinical guidelines cannot account for all the possible combinations of individual patients, health-care providers, and health-care systems. As such, clinicians need to assess the appropriateness of a particular recommendation or suggestion in the specific context of an individual patient. The KDIGO-AKI guidelines are an extensive document, and as such we cannot comment on all the aspects. We have therefore chosen to comment on those guidelines that will have the greatest impact on day-to-day clinical practice and those of a more contentious nature. Using examples of patients with AKI, we will attempt to underline the relevance of the complex interaction of factors, which often impact on the diagnosis and management of patients with AKI.

CLINICAL EXAMPLES OF THE APPLICATION OF THE KDIGO GUIDELINES FOR AKI

2: AKI DEFINITION

Guideline 2.1: Definition and classification of AKI

2.1.1: AKI is defined as any of the following (Not Graded): Increase in SCr by $\geqslant$0.3 mg/dl ($\geqslant$26 mmol/l) within 48 h; or increase in SCr to $\geqslant$1.5 times baseline, which is known or presumed to have occurred within the prior 7 days; or Urine volume of 0.5 ml/kg/h for 6 h.

2.1.2: AKI is staged for severity according to the following criteria (Table 2). (Not Graded)

2.1.3: The cause of AKI should be determined whenever possible. (Not Graded)

A 74-year-old male with a history of diabetes mellitus, fever, hypotension abdominal distension, and leukocytosis. An ultrasound of his abdomen revealed fluid collections. He underwent exploratory laparotomy in which purulent fluid was removed and drains were placed. He remained oliguric and SCr trended upward from a preoperative value of 0.8–1.0 mg/dl over 48 h and continued to rise to 1.4 mg/dl over the next several days. He remained intubated on 40% FiO2 and received intravenous norepinephrine for BP support. His fluid balance was $\sim$26l positive for the admission.

KDIGO has addressed an important need for a single definition of AKI that would impact patient care, research, and public health by combining the definitions derived from Acute Kidney Injury Network (AKIN)[6,7] and Risk, Injury, Failure, Loss and End stage kidney failure criteria,[5] which have been well validated. However, the diagnosis of AKI may be missed when using one or the other classification schemes.[5–7] Thus combining the two criteria ensures that the diagnosis is captured. Although a single definition has its merits, several issues remain with a creatinine-based definition of AKI, which are outlined in Section 2.4. Firstly, serum creatinine is reported as a concentration and hence is affected by hydration status. For example, there may be a dilutional effect on serum creatinine in patients who have received significant volume expansion with intravenous fluids. In this case, despite a significant reduction of glomerular filtration rate (GFR), there may only be a small rise in serum creatinine, which may not meet the definition of AKI according to AKIN criteria but would meet the criteria for Risk, Injury, Failure, Loss and End stage kidney failure. KDIGO combines the definitions, hence an absolute rise in serum creatinine of $>$0.5 mg/dl within 7 days would meet the criteria for AKI. The dilutional effect may alter the potential impact of early diagnosis and magnitude of injury. Adjustment of serum creatinine can be made by factoring for volume accumulation.[8] Creatinine production falls during AKI, due to reduced hepatic creatine synthesis. It remains to be determined whether the fall in creatine synthesis reflects systemic inflammation or is disease specific in AKI. On the other hand, muscle injury will increase creatinine release. Second, the KDIGO definition of AKI depends on the increase in serum creatinine from baseline, which in many instances is not available. KDIGO recommends that in the absence of a premorbid baseline serum creatinine an estimated creatinine should be determined based upon an