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A Dietitian's Review of the RIFLE Classification of Acute Renal Failure and What It Means for Nutrition Therapy

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Until the past few years, there has been much ambiguity surrounding the diagnosis of acute renal failure (ARF) and the variety of terms used to describe renal dysfunction; i.e. renal insufficiency, acute kidney injury (AKI), and renal impairment (1). In an effort to add clarity and staging to acute renal dysfunction, the Acute Dialysis Quality Initiative (ADQI) Work Group met in May 2002 to develop criteria for better classifying acute renal dysfunction (2). They named these criteria the RIFLE system, for the stages of renal dysfunction into which it separates patients:

1) Risk of renal dysfunction
2) Injury to the kidney
3) Failure of kidney function
4) Loss of kidney function
5) End stage renal disease (ESRD)

The last two classifications, Loss and ESRD, are outcome categories that extend beyond temporary renal dysfunction. The categories of renal dysfunction are defined by changes in blood creatinine or glomerular filtration rate (GFR) from a baseline value and rates of urinary output per body weight over a specified time period, as shown in Table 1 (3). Criteria was defined to allow clinicians/physicians to better track and stage the development of ARF as well as allowing for better comparisons and research studies. In the past, the incidence and outcomes of AKI across many studies has been inconsistent and limited in scope due to variations in how AKI was defined (3).

Over the past few years, many large retrospective studies have been done to test the RIFLE criteria on intensive care unit (ICU) patients. Recently a study by Bagshaw et al, involving 120,123 patients from 57 ICU's was done to quantify the occurrence of AKI within twenty-four hours of ICU admission using the RIFLE criteria (3). Of these patients, the median age was 64.3 years, 59.5% were male, 28.6% had co-morbidities, 50.3% were medical admissions and the initial mean Acute Physiologic Assessment and Chronic Health Evaluation (APACHE) Scoring System II score was 16.9. Patients with pre-existing ESRD on

Table 1
RIFLE Criteria for Acute Renal Dysfunction

	GFR	Urine Output (UO) Criteria
Risk	Increased creatinine x 1.5 or GFR decreased > 25%	UO < 0.5 mL/kg/hr x 6 hr
Injury	Increased creatinine x 2 or GFR decreased > 50%	UO < 0.5 mL/kg/hr x 12 hr
Failure	Increased creatinine x 3 or GFR decreased > 75%	UO < 0.3 mL/kg/hr x 24 hr or anuria x 12 hr
Loss	Persistent ARF = complete loss of renal function > 4 weeks	
End Stage	ESRD	

chronic dialysis or with a prior kidney transplant were excluded from the study. According to the RIFLE criteria, AKI occurred in 36.1% of ICU patients within twenty-four hours of admission. Statistics also showed that 16.3% of patients fell into the Risk for renal dysfunction category, 13.6% fell in the Injury to the kidney category, and 6.3% fell into the Failure of kidney function group. Loss of kidney function and ESRD categories were not used since the patient population was assessed during the first twenty-four hours of hospital admission and these two categories are related to clinical outcomes.

These estimates suggest that the occurrence of AKI is much higher than previously realized. The study found that the odds of AKI were higher in older patients, females, and those with co-morbid disease (3). These patients were also more likely to be medical, rather than surgical patients, and have a primary cardiac, septic, or hepatic diagnosis. More advanced RIFLE categories were associated with increased severity of illness, as measured by the 2nd Simplified Acute Physiology Score (SAPS), APACHE II, and APACHE III scores. The higher the scores, the more at risk the patient is for hospital death. Likewise, increased RIFLE category was associated with decreased mean arterial pressures, increased heart rates, decreased serum pH and increased serum potassium levels.

In addition to categorizing levels of renal dysfunction by the RIFLE criteria, patients were also followed for hospital mortality (3). It was observed that AKI as defined by RIFLE criteria was associated with increases in hospital mortality. As RIFLE classification grades of severity increased, mortality rates increased. Mortality rates for the Risk category were 17.9%, for Injury were 27.7% and for Failure were 33.2%. As suspected by these results, AKI was associated with longer durations of ICU and overall hospital stay. Bagshaw et al, concluded that the RIFLE criterion is a simple tool that can be used for the detection, monitoring, and classification of AKI and for correlation with clinical outcomes (3).

Similarly to the above study, researchers in Japan also conducted a large retrospective study involving 20,126 patients to assess the ability of RIFLE criteria to predict mortality in hospital patients (4). The results of the study found that close to 20% of patients had some degree of acute renal impairment and the RIFLE criteria was useful in predicting hospital mortality.

Recently, the Acute Kidney Injury Network (AKIN) Working Group, an international group of nephrologists and intensivists, worked to further improve the RIFLE criteria. They recommended that a smaller change in serum creatinine (≥ 0.3 mg/dL) be used as a threshold for identifying the presence of AKI and that a time frame of 24-48 hours be used to ensure the process was acute (3). In addition, using the new AKIN model of defining AKI, patients starting renal replacement therapy are automatically classified as Stage 3 (or in Failure of kidney function using RIFLE) regardless of their creatinine and urinary output (5). Finally, the AKIN criteria eliminated the outcome categories of Loss and End Stage renal disease that appear on the RIFLE criteria. Table 2 illustrates the AKIN criteria.

In the study by Bagshaw et al, only cumulative 24-hour urine output was available and no patient weights were described (3). Therefore the study used a minor modification of the RIFLE urine output criteria, assuming an average patient weight of 70 kg, < 35 mL/hr (Risk), < 21 mL/hr (Injury), and < 4 mL/hr (Failure). In addition, baseline serum creatinine values were estimated by the Modification of Diet in Renal Disease equation as recommended by the ADQI working group.

A study by Joannidis et al, in Australia compared classification of AKI in critically ill patients with both the AKIN versus RIFLE criteria and found that each associated AKI with increased hospital mortality (6). They concluded that despite presumed increased sensitivity by the AKIN classification, RIFLE had a higher detection rate of AKI during the first 48 hours of ICU admission. This was likely due to the use of GFR in the RIFLE

Table 2
AKIN Criteria for Acute Renal Dysfunction

	Creatinine Criteria	UO Criteria
Stage 1	Increased creatinine x 1.5 or ≥ 0.3 mg/dL	UO < 0.5 mL/kg/hr x 6 hr
Stage 2	Increased creatinine x 2	UO < 0.5 mL/kg/hr x 12 hr
Stage 3	Increased creatinine x 3 or creatinine ≥ 4 mg/dL (with acute rise of ≥ 0.5 mg/dL)	UO < 0.3 mL/kg/hr x 24 hr or anuria x 12 hr

Note: Patients who receive renal replacement therapy are considered to have met the criteria for stage 3 irrespective of the stage that they are in at the time of commencement of renal replacement therapy.

criterion. A review by Cruz et al, in a recent publication in *Critical Care* cautions that using estimated GFR in place of the true GFR criterion may lead to inappropriate conclusions (5).

What Does This Mean for Nutrition Professionals?

Renal failure is responsible for an increase in severity and duration of critical illness and the catabolic phase (1). ARF is associated with metabolic alterations in protein, carbohydrate, and lipid metabolism. As outlined in the studies on AKI, renal dysfunction affects more than 20% of ICU patients and is closely associated with morbidity and mortality (3,4). Thus, it is the job of nutrition professionals to optimally support these critically ill patients and prevent nutritional deficiencies, which cause further detriment to their clinical course and outcomes.

A recent article by Valencia et al, in *Current Opinion in Clinical Nutrition and Metabolic Care,* yields a call out to nutritional professionals for the need of nutrition therapy protocols or guidelines based on RIFLE criteria (1). Valencia brings to the table the option of better identifying those patients who are most nutritionally depleted and to treat them accordingly based on their need for protein restriction or supplementation. He categorizes patients with ARF into three different groups:

- **Group I:** Patients without excess catabolism and a urea nitrogen appearance (UNA) of < 6 g nitrogen (N) above N intake/day.
- **Group II:** Patients with moderate hypercatabolism and a UNA exceeding N intake by 6 -12 g N/day.
- **Group III:** Patients with ARF in association with severe trauma, burns, or overwhelming infection. UNA is markedly elevated (>12 g N above N intake). Nutrition requirements are high.

Using Measures of UNA for AKI

UNA is an estimated measure of the urea nitrogen that is eliminated from the body in the form of urine, dialysate, drainages, etc. It takes into account changes produced in total body N for a specified period of time. Since urea is the major byproduct of protein catabolism, the amount of urea N excreted each day can be used to estimate the rate of protein catabolism for a patient and determine the amount of protein intake needed to support his/her needs (7).

Many dietitians use urinary urea nitrogen (UUN) balance to determine the degree of hypercatabolism in their patients and to estimate protein needs. Nitrogen balance using UUN can be calculated as:

$$\text{Nitrogen balance} = (\text{protein intake (g)} \div 6.25) - (\text{24-hour UUN (g)} + 4)$$

This equation cannot be used in patients with low urine outputs, fluctuating weights, or changing blood urea nitrogen (BUN) levels, excluding patients entering into some degree of renal failure. The value of 4 g added to the UUN is an estimate of the unmeasured N loss in the urine, sweat, etc (8). The factor 6.25 adjusts for the grams of protein needed for one gram of N.

UNA does take into account changes in BUN and body weight, and thus is a better measure of protein catabolism for the renal failure population (7). The equation for UNA is shown below (9):

$$\text{UNA (g/day)} = \text{UUN (g/24 hr)} + [(\text{BUN2}-\text{BUN1}) \times 0.6 \times \text{BW1}] + [(\text{BW2}-\text{BW1}) \times \text{BUN2}]$$

BUN2 = predialysis BUN (g/dL); BUN1 = postdialysis BUN (g/dL); BW1 = postdialysis weight (kg); BW2 = predialysis weight (kg)

According to the 2000 KDOQI Guidelines, the best weight to use for estimating energy and protein needs in patients with chronic kidney disease is the adjusted edema-free body weight (aBW_{ef}) (10). This can be calculated with the following equation:

$$aBW_{ef} = BW_{ef} + [(SBW - BW_{ef}) \times 0.25]$$

where BW_{ef} is the actual edema free body weight of the patient, and SBW is the standard body weight for the patient as determined by NHANES II data.

Nutrition Interventions

According to the proposals of Valencia et al, nutrition therapy can be tailored to the RIFLE criteria and patient's UNA values (1). Below, nutrition therapy goals are separated by the group classifications described before based on UNA calculations.

- **Group I:** Supplement 0.6-0.8 g of protein/kg/day with the goal of reducing ureagenesis and avoiding the need for dialysis. If this low-protein nutrition therapy continues for more than one to two weeks, discussion should include the future goals for this patient and the need to optimize nutrition support.
- **Group II:** Protein intake goal should be between 0.8-1.2 g/kg/day.
- **Group III:** If the UNA is elevated, patients will likely require 1.2-1.5 g/kg/day. Patients who are malnourished and severely hypercatabolic may even need as much as 1.8 g/kg/day of protein.

The advantage of calculating a UNA is that the degree of protein catabolism, elimination, and daily intake needs no longer become subjective, but rather objective.

Case Study Example

Patient X is a 66 year old man, with a height of 5'10" and usual weight of 78 kg, who was admitted to the medical ICU with a diagnosis of sepsis. On the day of ICU admit, the patient's creatinine was 1.0 mg/dL. On day three of the ICU stay, the patient's creatinine increased to 3.0 mg/dL and his urine output was < 10 mL/hr for the past 24 hours. The medical team, using the RIFLE and AKIN criteria, soon realized the patient was entering stage 3 of AKI. Since the patient was intubated and NPO, on day four of ICU stay, a decision was made to start enteral nutrition support. By this time, dialysis treatment was also started. The dietitian estimated the patient's nutritional needs using a standard equation and began nutrition support, ordering a UUN to be obtained the following day – day five. Once the UUN was obtained, the dietitian could better estimate the patient's protein needs. Below is the data obtained and formulas used to calculate a UNA:

- Protein intake on day 5: 75 g protein
- UUN on day 5: 2 g N in only 100 mL urine
- BUN 1 (collected postdialysis on day 5): 40 mg/dL (0.4 g/L)
- BUN 2 (collected predialysis on day 6): 50 mg/dL (0.5 g/L)
- BW1 (postdialysis weight on day 5): 80.2 kg
- BW2 (predialysis weight on day 6): 81.0 kg

On day 6, the dietitian calculated the patient's UNA:

$$\begin{gathered} \text{UNA (g/day)} = \text{UUN (g/24 hr)} + \\ [(\text{BUN2}-\text{BUN1}) \times 0.6 \times \text{BW1}] + [(\text{BW2}-\text{BW1}) \times \text{BUN2}] \\ = 2\text{ g} + [(0.5-0.4) \times 0.6 \times 80.2] + \\ [(81.0-80.2) \times 0.5] = 7.2\text{ g/day} \end{gathered}$$

This UNA result of 7.2 indicates that Patient X has a moderate degree of hypercatabolism and fits into Group II as described previously. According to the guidelines by Valencia et al, this patient should have a protein intake goal between 0.8-1.2 g/kg/day (1). The patient is currently receiving approximately 1 g/kg protein/day based on the dietitian's earlier calculations. Since the patient was started on dialysis, it may be reasonable to increase his protein intake toward the upper limit of this guideline, 1.2 g/kg/day.

Future Research

Review of the RIFLE and AKIN classification systems for AKI reveal that both systems are useful in defining and monitoring various stages of AKI and can be useful in correlating AKI with clinical outcomes. The physician authors of *UpToDate*'s "Definition of acute kidney injury" state that both the RIFLE and AKIN criteria may have the greatest utility in epidemiologic studies rather than clinical bedside use, and may eventually be replaced by sensitive, specific biomarkers of renal tubular injury (11). Further information on the popularity of using these AKI classification systems, as well as developing more detailed nutrition therapy guidelines for each level of AKI is needed.

In addition, since UNA calculations are time-consuming and not a part of many dietetic clinicians' practice, studies on the UNA levels of commonly seen AKI patients may be helpful in determining what scenarios of AKI require the most protein replacement. ◆

References

1. Valencia E, Marin A, Hardy G. Nutrition therapy for acute renal failure: a new approach based on 'risk, injury, failure, loss, and end-stage kidney' classification (RIFLE). *Curr Opin Clin Nutr Metab Care.* 2009;12:241-244.
2. Acute Dialysis Quality Initiative: Summer-Fall 2002 Newsletter. ADQI Web site. Available at http://www.adqi.net. Published 2002. Accessed August 15, 2009.
3. Bagshaw SW, George C, Dinu I, Bellomo R. A multi-centre evaluation of the RIFLE criteria for early acute kidney injury in critically ill patients. *Nephrol Dial Transplant.* 2008;23:1203-1210.
4. Uchino S, Bellomo R, Goldsmith D, Bates S, Ronco C. An assessment of the RIFLE criteria for acute renal failure in hospitalized patients. *Crit Care Med.* 2006;34(7):1913-1917.
5. Cruz D, Ricci Z, Ronco C. Clinical review: RIFLE and AKIN – time for reappraisal. *Critical Care.* 2009;13:211. Available at http://ccforum.com/content/13/3/211. Accessed August 15, 2009.
6. Joannidis M, Metnitz B, Bauer P, et al. Acute kidney injury in critically ill patients classified by AKIN versus RIFLE using the SAPS 3 database. *Intensive Care Med.* Available at http://www.springerlink.com/content/r177337030550120/. Published 2009. Accessed August 16, 2009.
7. Shils M, Shike M, Ross AC, Caballero B, Cousins R. *Modern Nutrition in Health and Disease, 10th ed.* Baltimore, MD: Lippincott Williams & Wilkins; 2006:839-840.
8. Skipper, A. *Nutrition Support Policies, Procedures, Forms, and Formulas.* Gaithersburg, MD: Aspen Publishers, Inc.;1995:86.
9. Byham-Gray L, Wiesen K. *A Clinical Guide to Nutrition Care in Kidney Disease.* American Dietetic Association; 2004:35.
10. K/DOQI Guidelines: Nutrition in Chronic Renal Failure. *Am J Kidney Dis.* 2000;35(6)(suppl 2):S36. Available at http://www.kidney.org/professionals/kdoqi/pdf/KDOQI2000NutritionGL.pdf. Accessed October 10, 2009.
11. Paulevsky P, Curhan G, Sheridan A. *Definition of acute kidney injury (acute renal failure).* UpToDate Web site. Available at http://www.uptodate.com. Updated May 1, 2009. Accessed August 18, 2009.

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