

The High Value Care

One Minute Guide to:

Fractional excretion indices in acute kidney injury

Q: Should we always use fractional excretion indices in the evaluation of acute kidney injury?

The Bottom Line: Do not order urine electrolytes to calculate fractional excretion indices as part of the initial evaluation of acute kidney injury. These indices may be helpful in differentiating pre-renal azotemia from acute tubular necrosis in oliguric patients, but are less useful in patients with underlying chronic kidney disease. Use your history and physical exam findings to decide whether a fluid challenge or diuresis should be the diagnostic or therapeutic test of choice.

Context: The two most common reasons for acute kidney injury in the hospitalized patient are either pre-renal azotemia or acute tubular injury/necrosis (ATI). Pre-renal azotemia usually requires intravascular replacement with parenteral fluids whereas parenteral fluids can lead to fluid overload state in ATI. Clinical assessment of volume may be difficult, which led to the development of urine indices, fractional excretion of sodium (FeNa) and urea (FeUrea), in an attempt to differentiate between the two causes.

The Data: FeNa, using a cutoff of $< 1\%$ for pre-renal and $> 1\%$ for ATI, was initially validated in 17 patients with oliguric renal failure. Patients with CKD, glomerulonephritis, or suspected urinary obstruction were excluded. Diagnosis was confirmed as pre-renal azotemia by return of renal function with volume replacement (1). Follow-up studies, however, have clearly established a high rate (10%) of indeterminate FeNa values in nonoliguric patients, as well as significant diagnostic misclassification due to comorbidities (2,3).

Use of diuretics can cause the FeNa to be falsely elevated in a pre-renal state. In response, researchers evaluated the FeUrea, generally using a cutoff of $< 30\%$ for pre-renal and $> 30\%$ for ATI. Urea is passively absorbed, and its urinary concentrations are regulated by volume status. The comparative studies showed a sensitivity and specificity for both indices in distinguishing pre-renal azotemia from ATI range from 60-100%. The heterogeneity of study population, definition of acute kidney injury, and cutoffs for the indices account for the wide range.

Two prospective studies in patients with oliguric and nonoliguric renal failure had different conclusions. One found FeUrea to be more sensitive and specific than FeNa in determining etiology of AKI despite diuretic usage; however the study was performed only in ICU patients.(4) Another found FeUrea to be superior to FeNa in sensitivity only in those taking diuretics, but neither index had a sensitivity or specificity over 80%. However, that study was marred by delays in both urine measurements and administration of diuretics.(5)

As described in the first study, the gold-standard for differentiating between pre-renal and ATI causes of AKI is to see if AKI resolves with fluids. A fluid challenge is often both diagnostic and therapeutic. Keep in mind that diuresis will often be diagnostic and therapeutic in the heart failure patient with AKI. Importantly, a FeNa of $< 1\%$ is one of the diagnostic criteria in hepatorenal syndrome, and thus should be ordered when it is considered a leading diagnosis.

Conclusion: FeNa and FeUrea were validated in specific populations that often do not include our patient population. The indices also fail to diagnose when patients suffer from both pre-renal azotemia and ATI. While they may help in the diagnosis and management of very specific etiologies like hepatorenal syndrome, most of the time a fluid challenge or diuresis will be the diagnostic and therapeutic tests of choice.

1. JAMA. 1976 Aug 9;236(6):579-81. PMID: [947239](#)
2. Ann Intern Med. 1978 Jul;89(1):47-50 PMID: [666184](#)
3. Semin Nephrol. 1985 Sep;5(3):224-33 PMID: [3843797](#)
4. Kidney Int. 2002 Dec;62(6):2223-9 PMID: [12427149](#)
5. Am J Kidney Dis. 2007 Oct;50(4):566-73 PMID: [17900456](#)