EDITORIAL

When evidence-based medicine and quality improvement collide

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The paper by Mathura et al. describes an effective quality assurance (QI) program to reduce the frequency of blood urea nitrogen (BUN) ordering within the emergency department (ED) [1]. The project was based upon a multifaceted three-phased QI intervention that yielded impressive results in a pre-post observational design. We applaud the authors on their well-intentioned efforts to improve laboratory testing in the ED setting, but have concerns over the evidence-base supporting the selection of the BUN as the target.

The BUN is a breakdown product of protein metabolism, and has been integrated into standard chemistry panels for decades. It is commonly associated with renal function, and is most helpful in delineating the etiology of acute kidney injury with the ratio of BUN to creatinine informing the degree to which renal dysfunction is pre-renal in origin. However, the BUN has also been implicated as a useful marker in a wide range of illnesses and through a number of clinical prediction tools in the ED setting. Table 1 suggests the biomarker has significant value in the diagnostic assessment and risk stratification across a number of conditions. The Glasgow-Blatchford Scale and the CURB65 are particularly telling examples where BUN is incorporated into clinical prediction models that inform decision-making. Further, existing systematic reviews do suggest BUN has prognostic value in the setting of COVID-19, and is widely included in ED-setting scores prognosticating acute heart failure [2, 3]. In the aesthetic infographic developed by Mathura et al., several other common ED conditions are noted to benefit from BUN collection, including pancreatitis, pericarditis, and hemolytic uremic syndromes.

The CURB65 scale is a well-validated and commonly used tool to determine the need for admission of patients with community-acquired pneumonia. Gastrointestinal bleeds present a wide spectrum of clinical severity lending to over-investigation at times, while warranting life-saving endoscopic intervention at others. Clinicians often employ the Glasgow-Blatchford scale to determine management and the patient acuity, and it compares favorably to competing scores [4]. The Glasgow-Blatchford scale uses the BUN value, a marker of blood load in the stomach and duodenum, and determines the likelihood of intervention such as transfusion, endoscopic intervention, or surgery. While BUN does not independently predict need for intervention, in patients with a BUN value over 10 mmol/L, over 30% required intervention, while 50% of patients with values over 25 mmol/L needed intervention [5]. In these patients, delay in BUN testing may result in delayed recognition of bleeding and endoscopic intervention, thus increasing morbidity and mortality. Of note, patients whose Glasgow-Blatchford Score is zero, including a BUN < 6.5 mmol/L, are at such low risk that discharge from the ED without endoscopy is usually warranted, but only if this value is known.

BUN values are also important in delineating a patient's metabolic and hydration statis. When based solely on clinical indicators, we know patient volume status assessment can be notoriously unreliable in the absence of other renal function values [6]. The BUN in conjunction with serum creatinine can indicate if a patient is suffering from pre-renal acute kidney injury, which is not always evident based on other markers such as vital signs alone. BUN values are also important in calculation of fractional urea excretion, which can be helpful in determining whether acute kidney injury is renal or pre-renal. BUN is also important in calculating osmolality, which in the setting of many suspected or confirmed poisoning and acid–base disorders, enables osmolar gap calculation.

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Table 1 Uses of BUN results in clinical reasoning and clinical prediction rules

Measure	Condition affected	Outcomes
Glasgow-Blatchford scale	Upper GI bleed	Need for endoscopic intervention and transfusion
CURB65	Pneumonia	Need for admission
FENa	Renal failure	Diagnosis of conditions causing pre-renal vs post-renal kidney failure
FEUrea	Renal failure	Diagnosis of conditions causing pre-renal vs post-renal kidney failure
Serum osmolality	Metabolic acidosis	Diagnosis of conditions involving osmolar gap acidosis
Acute heart failure risk scale	Acute heart failure	7-day sudden-adverse event frequency
BISAP	Pancreatitis	Risk of mortality
BUN alone	Uremic pericarditis	Prognosis of chronic kidney disease
	Hemolytic uremic syndrome	Diagnosis and indication of renal function

BUN testing is also important for prognostication of many conditions, and can inform discussions with other consulting services, family members, and ultimately influence patient disposition from the ED. An example is in acute COPD exacerbation, where two recent studies have demonstrated an association between BUN value and patient mortality (OR CIs 1.05–10.29 and 1.00–2.01 respectively) [7, 8]. Another scale, the BISAP score has been found to be predictive of patients at risk of in-hospital mortality when presenting with acute pancreatitis [9]. Thus, understanding the BUN at point-of-care can be important in determining the level of care and urgency warranted by a patient.

In accordance with evidence-based principles, practice-changing recommendations as one might find in clinical practice guidelines should only be derived from research conclusions with a high degree of certainty as to their benefit. In essence, we believe that Mathura et al. have implemented a practice improvement effort in the form of a QI initiative, without the appropriate evidence base supporting the change as suggested by the evidence hierarchy proposed by the Centre for Evidence-Based Medicine [10]. At a minimum, a systematic review of BUN diagnostic and prognostic utility, as well as reporting on balancing measures and other unintended consequences of the intervention would have been reasonable.

In summary, we believe removal of BUN from routine ordering is potentially harmful and appears driven primarily by cost savings. We have provided numerous examples that demonstrate how the BUN can play a critical role in improving diagnostic prevision and risk stratification, ultimately improving management decisions across a variety of clinical scenarios. Without BUN results, patients may experience harmful outcomes, as well as low-value interventions because of being deemed high-risk when they are not, and thus increased system costs and iatrogenic harm. Until further research is available, we are unconvinced that there are compelling reasons to remove the BUN from standard ED ordering sets, and that the financial benefits of doing so outweigh the potential harms.

Declarations

Conflict of interest The authors have no conflicts of interest to disclose.

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