

Laboratory

Elevated BUN to creatinine ratio

The ratio doesn't just reflect kidney function – it reflects kidney perfusion. And in this setting, that usually means volume status.

- Ryan Reynolds D.O.

Learning objectives

1. Understand what BUN and creatinine represent
2. Know what an elevated ratio means
3. Recognize common causes in nursing home patients
4. Identify early clinical signs
5. Know when to act and notify provider

BUN and Creatinine

Blood urea nitrogen (BUN) is a waste product formed from the breakdown of protein in the liver. Its level in the blood can rise not only with kidney dysfunction, but also with dehydration, high protein intake, gastrointestinal bleeding, or catabolic states.

Creatinine is a waste product generated from normal muscle metabolism. It is produced at a relatively constant rate and is filtered by the kidneys, making it a more reliable and stable indicator of kidney function compared to BUN.

In clinical practice, both values are interpreted together. Creatinine helps assess true kidney function, while BUN provides additional context about hydration status and metabolic conditions.

BUN to Creatinine Ratio

$BUN:Cr \text{ ratio} = BUN / Cr$

A normal BUN:Cr is 10:1 to 20:1. Anything greater than 20:1 represents an elevated ratio.

An elevated BUN:Cr ratio means the body is holding onto urea compared to the creatinine level.

Causes of Elevated BUN:Cr

The most common cause that comes to my mind when I see an elevated ratio is dehydration or volume depletion. With this in mind, I look for gastrointestinal fluid losses (diarrhea and vomiting), poor oral intake, illness, diuretics, and sweating.

The second cause I tend to think about is upper gastrointestinal bleeding. Clues to this would be melena (black stool), blood thinners, weakness, pale skin and conjunctiva, drop in hemoglobin, tachycardia and hypotension.

Another common cause, I see more in the ventilator homes, is high protein intake from tube feeds and even infection.

Medications are a more rare cause but some can cause it such as steroids and tetracyclines.

Early in urinary obstruction, the BUN:Cr ratio may be very elevated, but as the condition progresses, the ratio often normalizes and both BUN and creatinine rise together. I tend to see this more in the emergency department.

Clinical Pearl

In dehydration, the kidneys reabsorb more water – and BUN gets absorbed back with it, but creatinine does not. So BUN rises disproportionately to creatinine.

In upper gastrointestinal bleeding, they are essentially digesting blood. Blood is rich in protein (hemoglobin). As it gets broken down in the gastrointestinal tract, it is absorbed and processed by the liver into urea. That urea then enters the bloodstream causing the BUN to rise.

Physician Notification

The nurse should notify the provider if:

- BUN:Cr ratio is >20 with symptoms
- The BUN trend is elevating with serial labs
- Decreased intake
- New confusion
- Reduced urine output
- Suspected gastrointestinal bleeding

Case 1.

An 85-year-old male has been acting differently with no specific symptoms. Labs show sodium 141, potassium 4.0, chloride 101, BUN 50, Cr 1.0.

This is a markedly elevated BUN:Cr ratio with normal creatinine. The key question is: Why is the BUN high? My primary considerations would be dehydration and upper gastrointestinal bleeding. I will review oral intake history, vital signs, stool color, hemoglobin trend.

Case 2.

A 50-year-old ventilator-dependent patient with PEG tube has BUN 60, Cr 0.8. The patient is stable and otherwise doing well.

This is again a high BUN with a normal creatinine, but the clinical context matters. The most likely causes are high-protein tube feeds (common in ventilator/PEG populations) and possible mild dehydration. Formulas with high nitrogen content can significantly increase BUN without indicating kidney injury. To be honest, this is something I still struggle with in ventilator facilities. These patients often chronically run elevated BUN:Cr ratios because of their tube feeds, but you can't ignore volume status. You still have to ask – are they dry on top of that baseline? So just remember: In tube-fed patients, a high BUN often reflects protein load – not kidney failure – but dehydration can still coexist.

Case 3.

A 76-year-old female with normal baseline renal function hasn't been feeling well. She has had a gastroenteritis-like illness with diarrhea and vomiting. The physician has ordered labs. A BUN is 65 and Cr is 1.5. Her baseline BUN and Cr are around 10 and 0.5. She has also been noted to have been urinating less.

This is an acute rise in both BUN and creatinine, with a still elevated ratio. This represents pre-renal acute kidney injury due to hypovolemia. We need to encourage oral fluids if able but if there is ongoing fluid losses or poor oral intake we need to consider IV fluids.