

## Renal function Assessment

JERRY SMITH, 33, has been admitted with gastrointestinal (GI) bleeding from a duodenal ulcer. His blood urea nitrogen (BUN) level is 35 mg/dl and his creatinine level is 1.0 mg/dl.

Robert Dade, 58, has been admitted with suspected liver failure and hepatic encephalopathy. His BUN level is 6.5 mg/dl and his creatinine level is 0.9 mg/dl.

Louise Cleaver, 68, has diabetes. Her BUN level is 40 mg/dl and her creatinine level is 2.1 mg/dl.

All of these patients have either abnormal BUN or abnormal serum creatinine levels or both. Do you know what their lab results say about renal function? Here is a rundown of what the values measure and their relationship to one another.

What the BUN tells you

Urea, the major end product of protein metabolism, forms in the liver from ammonia and is excreted via the kidneys. Blood urea nitrogen measures this non-protein nitrogenous waste and reflects both protein intake and renal excretory function. Normal BUN levels range from 8 to 20 mg/dl.

Although elevated levels are often associated with renal disease, BUN levels also rise with decreased renal perfusion secondary to heart failure, shock, or dehydration. Factors outside the kidney, such as excessive dietary intake of protein and increased protein catabolism from burns or gastric bleeding, also elevate levels. Conversely, levels decrease with severe liver dysfunction, over-hydration, and malnutrition. Because any of these factors can alter urea levels, BUN is less specific than creatinine for evaluating renal status.

*What creatinine reveals*

Unlike BUN values, serum creatinine levels are not affected by protein metabolism or hydration. Creatinine, the end product of creatine metabolism, forms continuously at a relatively constant rate based on skeletal muscle mass. Normally, all creatinine produced by the body is filtered continuously and excreted by the kidneys, so creatinine levels relate directly to the glomerular filtration rate and are highly specific indicators of impaired renal function.

In women, normal creatinine levels range from 0.6 to 0.9 mg/dl. Because men generally have more muscle mass, their levels are slightly higher (0.8 to 1.2 mg/dl). The elderly often have decreased creatinine levels because lean muscle mass declines with age. Decreased levels may also indicate muscle atrophy, as with muscular dystrophy.

As renal function deteriorates, creatinine levels begin to rise. Levels of about 10 mg/dl indicate end-stage renal disease, with 10% or less of nephrons still functioning.

### *Reading the ratio*

You also should assess the BUN creatinine ratio. Normally, the ratio is about 10 to 1 (BUN, 10 mg/dl, and creatinine, 1.0 mg/dl), but may be as high as 20 to 1. In the presence of intra-renal failure involving the nephrons, both BUN and creatinine levels are elevated but the ratio remains normal.

A ratio greater than 20 to 1 may indicate decreased renal perfusion or increased protein metabolism.

A lower-than-normal ratio may indicate either diminished protein intake or liver dysfunction.

Back to our patients

Now let us take another look at the patients we met earlier.

Mr. Smith's GI bleeding supplies a great deal of protein for the GI system to digest, elevating the BUN level. Because his kidneys are still functioning, his creatinine level is within normal limits. When the GI bleeding is under control, his BUN level will return to normal.

You will recall Mr. Dade was admitted with hepatic encephalopathy and suspected liver failure. When liver metabolism of urea is disrupted, BUN decreases and serum ammonia levels increase, resulting in hepatic encephalopathy. Reducing protein in Mr. Dade's diet and administering lactulose to remove excess ammonia will help manage his condition.

Mrs. Cleaver, who has diabetes, has elevated BUN and creatinine levels, indicating renal insufficiency secondary to her diabetes and hypertension. Although she's asymptomatic, Mrs. Cleaver's renal impairment requires long-term monitoring and effective management of her diabetes and hypertension to prevent further kidney damage.