

# Metabolic Bone Disease and CKD

The kidneys play an essential role in the balance of calcium and phosphorous, and therefore play an important role in maintaining healthy bone mass and structure. In patient with chronic kidney disease, it is common for calcium levels to be low, phosphorus levels to be high, and parathyroid (PTH) levels to be high. It is important to try and normalize these values to minimize long-term complications.

Calcium is a mineral that builds and strengthens bones. It is found in many foods, particularly milk and other dairy products. If calcium levels in the blood become too low, four small glands in the neck release a hormone called parathyroid hormone (PTH). This hormone draws calcium from the bones to raise blood calcium levels. Too much PTH in the blood will remove too much calcium from the bones; over time, the constant removal of calcium weakens the bones.

Phosphorus, which is found in most foods, also helps regulate calcium levels in the bones. Healthy kidneys remove excess phosphorus from the blood. When the kidneys stop working normally, phosphorus levels in the blood can become too high, leading to lower levels of calcium in the blood and the loss of calcium from the bones. In order to lower phosphorus levels, your doctor will educate you on low phosphorus food alternatives and may prescribe a medication to help “bind” the dietary phosphorus so that it doesn’t get absorbed.

Vitamin D is also crucial to maintaining bone health. We get vitamin D from our diet, and from sun exposure. Healthy kidneys then produce an “active” form of vitamin D (calcitriol), to help the body absorb dietary calcium into the blood and the bones. In a patient with kidney disease, the kidneys make calcitriol in insufficient amounts. The body then cannot absorb calcium from food and starts removing it from the bones.

There is a complex interplay between calcium, phosphorus, vitamin D, and activated vitamin D. Periodically, your doctor will check your calcium, phosphorus, PTH, and vitamin D levels. Based on the results, adjustments will be made to your personalized treatment plan to help optimize the metabolic bone disease of kidney failure. There is increasing evidence that patients who have normal phosphorus, calcium, and PTH have the most favorable outcomes in terms of stability of kidney disease and long term mortality.

## Goal parameters in CKD

CKD Stage	Calcium	Phosphorus	PTH
Stage 3, GFR 30-60	8.4-10.2 mg/dL	2.7-4.6 mg/dL	35-70 pg/mL
Stage 4, GFR 15-29	8.4-10.2 mg/dL	2.7-4.6 mg/dL	70-110 pg/mL
Stage 5, GFR <15	8.4-9.5 mg/dL	3.5-5.5 mg/dL	150-300 pg/mL