Bones, Calcium, Phosphate and PTH in kidney failure

NATIONAL RENAL CARE

PATIENT TUTORIAL

Introduction
Bone disease is very important in people with kidney failure. Once serious problems have developed they can't be fully reversed. Thus prevention is better than cure. Blood test helps us to identify problems at an early stage and treatment can be adjusted to reduce the chances of serious problems developing.

Key Points
- Some problems with calcium and phosphate can make you feel ill immediately, but other problems with your bones and heart can develop slowly over years, thus preventative treatment is important to keep you well for years to come
- Blood result discussion with your doctor and renal care giver is important. Optimal Calcium levels are 2.1 – 2.4 mmol/l and optimal Phosphate levels are 1.13 to 1.8 mmol/l
- Understand your diet to ensure you eat enough but not too much calcium and phosphate containing foods
- Regularly take your prescribed medication to reduce and control your phosphate levels with every meal.

This is a complicated topic – why is it important?
Problems with calcium, phosphate and a chemical messenger in the blood called parathyroid hormone (PTH) can occur in anyone with kidney failure. The level of kidney function at which problems start is already when your kidney only functions at 40%. Dialysis normally start when you have 5% or less kidney function left. Sometimes there as symptoms (feeling unwell) but in many cases problems can start without any symptoms causing slow irreversible damage to the bones, the heart or blood vessels over a long period of time. Preventative treatment can reduce the chances of this irreversible damage occurring, but requires a lot of care and energy from yourself and the renal team.

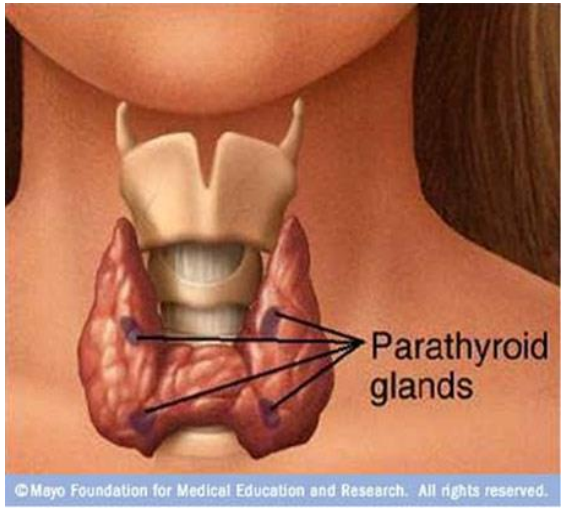
What is calcium?
Calcium is a mineral found throughout the body. It makes up, together with phosphate, the main strength in the bones. Calcium is also used to help power the muscles and is carried around the body in the blood. The blood calcium level must be kept very tightly controlled for the body to work normally, and PTH is important in this. Calcium gets into the body from food and is found particularly in dairy products, green vegetables and eggs.

What is phosphate?
Phosphate is a mineral in the body, and together with calcium makes up most of our bones. Phosphate is also used in the other parts of the body to power muscle and is used in many other chemical reactions. Phosphate gets into the body from food. Dairy products, nuts and meat the three main types of food that can contain a lot of phosphate.

What is PTH and why is it important?
PTH is a hormone (chemical messenger(which is very important in controlling the calcium levels in the blood. The PTH is produces in the parathyroid glands, 4 glands found in the neck behind the thyroid gland. If the calcium blood levels drops, the parathyroid glands produce more PTH, which pulls some calcium from the bones into the blood, normalising the level. In the calcium levels in the blood rises above the normal, PTH secretion falls and the level of calcium in the blood falls back to normal. The normal PTH levels are below 600pg/ml or 60 pmol/L.

What is Vitamin D and why is it important?
Vitamin D is a chemical needed so that calcium can get from food into the body. A little Vitamin D is absorbed from food, but most is made in the skin, in a process that only occurs if the skin is stimulated by sunlight. Even then Vitamin D has to be converted to an active form in the kidneys. Medication like One Alpha and Rocaltrol is forms of activated Vitamin D that will help to control your Calcium levels when very low.

http://www.kidney.org.uk/help-and-info/medical-information-from-the-nkf-/medical-info-calcium-phosphate-index/#1



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What can go wrong with calcium, phosphate, PTH and vitamin D in kidney failure?

If someone developed kidney failure and went onto dialysis the following sequence of events can occur; however preventative treatment can stop many of these problems:

- A fall in the blood level of calcium is the first major change. As the kidneys do not convert Vitamin D into it's active form, calcium does not get into the body from food and the blood level of calcium can fall. The treatment is replace active Vitamin D
- Levels of phosphate in the blood rise, because the kidneys are not excreting (getting rid) of the excess phosphate into the urine. High levels of phosphate can cause severe itching. The treatment is to reduce phosphate levels by diet, longer and more regular dialysis sessions and taking medication know as phosphate binders with every meal
- PTH may be produces in large quantities, stimulated by low calcium levels in the blood. The PTH tries to keep the calcium levels in the blood normal by increasing calcium absorption from food, but also takes calcium out of the bones. Eventually the parathyroid glands work so hard they get out of control and cause persistently high calcium levels. This may require an operation toe remove the glands called a Parathyroidectomy.

High and low PTH – causes, effects and treatment

- Low PTH may occur after surgery to remove the parathyroid glands and causes low calcium levels. . The treatment is to give activated Vitamin D and adjustments to your diet to include more calcium containing foods. You can also be dialysed with a dialysis fluid containing high calcium levels.
- High PTH levels can occur when the parathyroid glands are stimulated. Sometimes PTH can be controlled using Vitamin D. In some people the parathyroid glands keep producing more and more PTH. This can cause high calcium levels and muscular weakness with aches and pains around the shoulders and hip joints. Eventually bone disease with shortening of the fingers and collarbones may occur. The high levels of calcium and phosphate caused by excess PTH can cause chalk to build up in the vessels and heart valves. The treatment in severe cases is surgery to remove the parathyroid glands.

High and low calcium – causes, effects and treatment

- Low calcium levels in the blood can occur in kidney failure when there is not enough Vitamin D available or in people who had surgery to remove their parathyroid glands. Very low calcium levels can cause muscle twitching and spasms, especially in the face and arms. The treatment is to give activated Vitamin D and adjustments to your diet to include more calcium containing foods. You can also be dialysed with a dialysis fluid containing high calcium levels.
- High calcium levels in the blood can be caused by high levels of PTH or by too much calcium getting into the body because of treatment with calcium and Vitamin D tablets. High levels of calcium can cause agitation, gritty eyes and abdominal pain. Calcium crystals can also forms under your skin, in your joints and in your blood vessels. The treatment is to stop Vitamin D tablets, dialysis with a dialysis fluid with low calcium levels and reducing calcium in your diet. In some cases the parathyroid gland must be removed surgically.

High and low phosphate – causes, effects and treatment

- Low phosphate levels are normally seen in patients recovering from illness that affected the appetite of the patient, thus showing signs of malnutrition. It also occurs when a patient had a transplant because the new kidney gets rid of the phosphate more effectively through urine. There is normally no signs and phosphate should be added to the diet and less phosphate binders should be taken while the phosphate levels are low.
- High phosphate levels occur in most people on dialysis. High phosphate levels can cause severe generalised itching. Phosphate can also deposit in the tissues. The treatment is to have longer more frequent dialysis sessions, reduce phosphate intake in diet and taking phosphate binders or increasing the dose of phosphate binders, ensuring phosphate binders are taken with every meal as prescribed by the doctor.

http://www.kidney.org.uk/help-and-info/medical-information-from-the-nkf-/medical-info-calcium-phosphate-index/#1