

## Primary Hyperparathyroidism

Primary hyperparathyroidism is a hormonal or endocrine disorder that causes high blood calcium (hypercalcemia).

### Cause

Primary hyperparathyroidism is most commonly due to a benign overgrowth of parathyroid gland tissue in the neck. The parathyroid glands sit next to the thyroid glands, but have a very different function in the body. Parathyroid glands produce parathyroid hormone (PTH) that controls calcium balance in the body. Most mammals have four parathyroid glands, but some have more than four. With primary hyperparathyroidism, one, or rarely more than one are overactive due to a tumor growth. The overwhelming majority of these tumors are benign, but rarely the parathyroid tumor is malignant.

The remaining unaffected parathyroid glands often shrink or become inactive as a result of the overproduction of parathyroid hormones in the abnormal gland. Eventually, this condition results in increased calcium in the blood to the detriment of bone and liver calcium stores. As the calcium gets higher and higher, other organs can be damaged, including the kidneys, heart, and brain. For this reason, it is important to determine the cause of disorders of calcium metabolism and address them before organ damage occurs.

Over time, if left untreated, serious damage can occur resulting in kidney failure, seizures, or heart dysfunction. Some patients develop bladder stones because the excess calcium in the blood settles in the urinary bladder and forms stones.

### Clinical Signs

The earliest sign of hyperparathyroidism is an increase in thirst and urination, as the kidneys work harder to excrete the extra calcium. If left unchecked, patients can develop other, more serious signs, such as muscular and neuromuscular dysfunction and organ failure. Some families notice a loss of energy, muscle cramping or weakness in their pet. Rarely, patients can have significant problems with heart function. Long standing hypercalcemia will damage the kidneys and cause bladder stones.

### Diagnosis

A diagnosis of hyperparathyroidism is made when a patient has a high blood calcium (specifically, a measurement of ionized calcium is necessary as total body calcium can fluctuate) combined with an elevated parathyroid level. If a patient's ionized calcium is high, the parathyroid hormone should be significantly lower than normal, so patients with high ionized calcium that have a PTH level that is mid-range still very likely have primary hyperparathyroidism. An ultrasound exam of the patient's neck is generally done to confirm the location of the parathyroid tumor and help direct therapy. Normally, parathyroid glands are only 2-3mm (0.2-0.3cm) in size, so it requires specialized ultrasound equipment and an experienced radiologist to locate the abnormal gland. Because hyperparathyroidism and hypercalcemia can cause problems with other organs in the body, additional lab tests (blood and urine) as well as radiology (XRAY) and ultrasound exams may be necessary to determine a patient's overall health.

### Treatment

The recommended treatment for hyperparathyroidism is surgery to remove the abnormal gland(s). There are no consistently effective medical therapies for parathyroid gland tumors. Surgical recovery is generally uneventful,

but in patients with prolonged hypercalcemia, recovery can be complicated. Every patient is monitored closely in the ICU for a few days after surgery to monitor ionized calcium and supplement calcium as needed. In general, patients that have long standing hypercalcemia (bladder stones are often a good indicator that calcium has been high for a long time) will have a precipitous drop in the calcium after surgery and may require longer hospital stays. Patients with long standing hyperparathyroidism have low total calcium stores, because the excess PTH has been keeping calcium in the blood stream, rather than in bone and liver. For this reason, many patients need to go home post operatively on a calcium and Vitamin D supplement.

Calcium is critical in cellular messaging, and hypercalcemia can complicate anesthesia and surgery. In some patients, medical therapy for a few days prior to surgery is necessary. A diuretic (Furosemide) is used in combination with fluid therapy to lower the calcium level to an acceptable level prior to surgery.

### **Prognosis**

The prognosis for patients with uncomplicated hyperparathyroidism is excellent with surgical removal of the offending gland and post operative monitoring. Without surgery, the abnormal gland will likely continue to grow and overproduce parathyroid hormone, causing unrelenting hypercalcemia and eventually severe organ dysfunction.

In rare cases, some patients have a malignant (cancerous) parathyroid tumor that requires some follow up therapy with an oncologist. These patients have a less predictable prognosis depending on how aggressive their tumor is.

### **Long Term Follow Up**

Most patients with hyperparathyroidism are hospitalized for two nights after removal of their parathyroid tumor in order to monitor for drastic changes in the ionized calcium. Going forward, most continue to follow up at Veterinary Specialty Center for monitoring of ionized calcium for several weeks post operatively. The ionized calcium blood test is a specialized test, different than the total calcium that is part of a routine blood screening that can be done by a primary care veterinarian. An ionized calcium test can be done immediately in Veterinary Specialty Center's ICU lab, but most veterinary hospitals do not have this capacity. Because we make immediate adjustments to the dose of calcium and vitamin D supplementation, we want immediate results; we do not want tests to be sent out to an outside lab. For this reason, we recommend that the ionized calcium test be done at Veterinary Specialty Center until we are certain your pet's calcium has stabilized post operatively.

After a patient's ionized calcium stabilizes and/or they are able to come off of supplementation with calcium and Vitamin D, they do not generally need to follow up with Veterinary Specialty Center specialists for care.

### **Prognosis**

The prognosis for animals with DVD is highly variable with the majority of patients never progressing to the stage of CHF. Once the stage of CHF has been reached, the median survival time is 9-12 months and highly dependent on other medical conditions (ex: concurrent kidney disease) and the individual's response to medications. Frequent follow-up consultations (generally every 3-4 months following the 1st episode of CHF) with a board-certified cardiologist to assess kidney values and screen for early CHF help improve both quality of life and longevity.

Since the degenerative process continues regardless of treatment, most patients will experience more than one episode of CHF. The severity of subsequent episodes can often be mitigated with close monitoring for clinical signs of CHF, especially increases in sleeping respiratory rates. At each episode, the medications are often increased or new medications may be added to further decrease the workload on the heart. Between episodes of CHF, the vast majority of patients experience an excellent, near-normal quality of life