

Addison's Disease (Hypoadrenocorticism)

The Pet Health Care Library

The two terms will be used interchangeably through this text

Adrenal Hormones

The adrenal gland is so named because it is located just forward of the kidney (renal gland means kidney). The center of the gland is called the medulla and the outer area is called the cortex. While both areas produce hormones, Addison's disease concerns the hormones produced by the cortex; these hormones are called corticosteroids.



The cortex of the adrenal gland is shown in yellow

Corticosteroids are the hormones that enable us to adapt physiologically to stress. The glucocorticoids (such as cortisol and related synthetics, prednisone and dexamethasone and numerous others) act on the mechanics of sugar, fat, and protein metabolism. They gear the metabolism towards the preparation of burning rather than storing, fuels so as to be ready for a fight or flight situation.

The mineralocorticoids (such as aldosterone and related synthetic fludrocortisone acetate) influence the electrolytes: sodium and potassium. As a general biological rule, where there's sodium or salt, there's water. When the mineralocorticoids circulate as part of the fight or flight preparation, sodium is conserved in anticipation of blood loss so that there will be extra fluid in the vascular compartment (spare blood). When sodium is conserved, potassium is lost as part of the biological balance. This whole picture of fat mobilization, sodium conservation etc. that is part of the fight or flight preparation is far more complex than can be reviewed here but the bottom line is:



The adrenal glands are located just atop the kidney

Corticosteroid hormones are needed to adapt to stressful situations and without these hormones, even small stresses could lead to physiologic disaster.

Hypoadrenocorticism (Addison's Disease)

In animals with Addison's disease, there is a deficiency of the corticosteroid hormones. It is unusual to discover the direct cause of this deficiency unless the patient is taking medications that disrupt adrenal balance (like ketoconazole, Lysodren or trilostane) but, fortunately, the disease can be managed with the administration of corticosteroid hormones even if the cause of the deficiency is unknown.

Clinical Signs

Patients are usually young (age 4-5 years) dogs but any age dog can be affected. (This disease occurs in cats but is very rare.) There is a genetic predisposition for Addison's disease in the standard poodle and bearded collie. Female dogs are affected twice as often as males.

At first signs are vague: listlessness, possibly some vomiting or diarrhea. Ultimately, the disease results in a phenomenon known as the Addisonian crisis. The animal collapses in shock due to its inability to adapt to the caloric and circulatory requirements in stress. Blood sugar may drop dangerously low. Potassium levels soar and disrupt the heart rhythm because there is not enough conserved sodium to exchange for potassium. Heart rate slows, arrhythmias result. The patient

may not survive this episode.

Approximately 30% of dogs with Addison's disease are diagnosed at the time of an Addisonian crisis.

Approximately 90% of the adrenal cortex must be non-functional before clinical signs are observed.

Making the Diagnosis

Because of the numerous symptoms that can be seen with Addison's disease, Addison's disease has earned the medical nickname The Great Imitator. You would think that you could simply look for an increase in potassium and/or drop in sodium on a basic laboratory blood panel, but it turns out spot checks of electrolyte values like this are not reliable enough for a diagnosis of Addison's disease.

Veterinarians are usually presented with a young animal in shock. There is usually no history of trauma or toxic exposure so general treatment for shock is initiated. This consists of rapid administration of fluids (usually lactated ringers solution, which has little potassium and a moderate amount of sodium) plus some glucocorticoids. By coincidence, this also happens to be similar to the specific treatment for Addison's disease so that often the patient simply recovers without the veterinarian really knowing why.

The blood panel will come back showing elevations in the renal parameters (BUN and creatinine) and thus with the elevated potassium is suggestive of acute renal failure, a condition with an extremely poor prognosis. The veterinarian may become suspicious of another diagnosis as the patient will respond well to fluid administration and most renal failure patients do not respond as well.

Addison's disease may appear in more unusual ways. Inability to maintain normal sugar levels (ultimately manifesting as a seizure disorder) may be strongly suggestive of an insulin-secreting pancreatic tumor but before a major abdominal surgery is planned, it is important to test for Addison's disease.

Similarly unexpected, regurgitation of undigested food due to abnormal nerve function in the esophagus (a condition called megaesophagus) can ultimately be caused by Addison's disease.

The only definitive test for Addison's disease is the ACTH stimulation test. The patient receives a dose of ACTH, the pituitary hormone responsible for the release of corticosteroids in times of stress. A healthy animal will show an elevation in cortisol in response to ACTH while an Addisonian has no corticosteroids to respond with. This lack of response is diagnostic for Addison's disease; however, a false positive may be obtained if corticosteroids have been used in the treatment of the crisis prior to the test. Of all the commonly used corticosteroids, only dexamethasone does not interfere with the assay for cortisol; if any other steroid has been used, the test will not be valid for at least a couple of days.

Treatment after the Crisis

The most important aspect of treatment for hypoadrenocorticism is replacing the missing mineralocorticoids hormones. One way to do this is with oral fludrocortisone (Florinef). Florinef is given usually twice a day at a dose determined by the patient's sodium and potassium blood tests. At first, these electrolytes are monitored weekly. When levels seem stable, these blood tests are repeated two to four times per year. Often with time, it will be found that the dose of Florinef needed to control the Addison's disease will increase. This is unfortunate as the medication is relatively expensive. Since Florinef has glucocorticoid activity as well as mineralocorticoid activity, it is not necessary to use additional medications for treatment.

Another way to treat this condition is with an injectable medication called DOCP (brand name Percorten-V). This treatment is given approximately every 25 days. Electrolytes are measured

prior to injections at first but usually testing can eventually be tapered to once or twice a year. There is some feeling among experts that DOCP produces better regulation of electrolytes than does oral Florinef. Some dogs however, require glucocorticoid supplementation (such as a low dose of prednisone).

What is Atypical Addison's Disease?

Approximately one dog in 42 will have a special form of Addison's disease. To understand this form of Addison's disease, we have to add some more details about the adrenal cortex. We have already explained that the adrenal cortex makes corticosteroids: the glucocorticoids that control sugar, fat, and protein use during stress and the mineralocorticoids that control electrolytes (mainly sodium and potassium) during stress. The adrenal cortex has three layers: the zona fasciculata, the zona reticularis, and the zona glomerulosa. The outer two layers make the glucocorticoids and the inner zona reticularis layer makes the mineralocorticoids. Most dogs get Addison's disease when all three layers of the adrenal gland are destroyed and no corticosteroid hormones can be produced. With atypical Addison's disease, the problem is not with the adrenal gland but with the pituitary gland, which is located at the base of the brain. The normal pituitary gland secretes ACTH (adrenocorticotropic hormone), which stimulates the zona fasciculata and zona reticularis (the outer layers of the adrenal cortex) to produce glucocorticoids. Without this hormone, these two areas of the adrenal gland atrophy but the zona glomerulosa remains normal, meaning mineralocorticoid production remains intact. This creates a patient who cannot regulate blood sugar normally but who is not at risk for an Addisonian crisis. Diagnosis is still by ACTH stimulation test and an endogenous ACTH level. Treatment is supplementation of glucocorticoid hormones, such as prednisone. Often these patients ultimately progress to the more typical Addison's disease, complete with electrolyte imbalance.

What is Pacific Rimism?

Dog breeds originating in the Pacific Rim, such as the Akita, Shiba Inu and Jindo commonly have elevated potassium levels on blood tests. This can be confusing when a patient has symptoms that suggest Addison's disease. These patients will have normal ACTH stimulation test results if they do not have Addison's disease.

Whipworm Infection?



Adult whipworm

Whipworm infection has been known to create a syndrome nearly identical to an Addisonian crisis, complete with abnormal sodium and potassium values. These patients will have normal ACTH stimulation tests but because whipworms only periodically shed eggs, fecal testing may not detect whipworm infection. If there is any question about whipworm infection, treatment should be instituted. See details on whipworm infection.

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