Diabetic ketoacidosis (DKA)

Diabetic ketoacidosis, or DKA, is one of the most serious metabolic disorders seen in both human and veterinary medicine. A severe complication of diabetes mellitus, DKA is characterized by an elevated concentration of blood sugar, the presence of substances called ketones in the urine, and reduced concentrations of bicarbonate in the blood. Some dogs and cats with DKA will be affected mildly, but the majority will be seriously ill and may have severe complications such as neurological problems due to brain swelling, acute kidney failure, pancreatitis, and anemia. DKA will lead to death in many cases, but aggressive diagnostics and treatment can be lifesaving.

DKA often develops in dogs and cats with diabetes that had previously been unrecognized or untreated, or when the pet becomes dysregulated. Thus, it is essential to identify diabetes mellitus or the development of additional symptoms in a dog that is known to be diabetic to prevent DKA from occurring.

Symptoms:

The first symptoms of DKA can include increased water drinking, increased urination, poor appetite, vomiting, weight loss, and lethargy. As things get worse, illness becomes more severe, and can lead to kidney failure, seizures, coma and death. Complications may include anemia, electrolyte abnormalities, blood pH problems, clotting disorders, etc.

Diabetic ketoacidosis is probably the most serious complication that can develop in association with diabetes mellitus. Ketones normally form when fatty acids are released from fatty tissue for energy and are transported to the liver to be converted into energy for the body. The liver then makes ketones from the fatty acids. Excessive production of ketones can occur in uncontrolled diabetes mellitus, and as they accumulate, ketosis, and eventually acidosis (a falling of the blood pH), develop. The four major factors that contribute to ketone formation in DKA are insulin deficiency, not eating, dehydration, and increased levels of "stress" hormones.

DKA occurs more commonly in animals with previously undiagnosed diabetes mellitus, but it can also be seen in dogs with established diabetes that are not well regulated. In these dogs and cats, there may be an untreated inflammatory or infectious disease that is contributing. Other pets may develop hormonal problems associated with insulin resistance such as low thyroid function in dogs (hypothyroidism), high thyroid function in cats (hyperthyroidism), excessive growth hormone (acromegaly) in cats, Addison’s disease primarily in dogs or Cushing's disease in either species. Pets may be only mildly affected by DKA, or they may be close to death at the time of diagnosis. DKA develops at an unpredictable rate, and some diabetics may be able to live fairly normal lives for several months with no treatment at all and without falling into DKA. However, once DKA develops, most pets become seriously ill within one week.

The aggressiveness of treatment depends on how sick the animal is. While pets with mild DKA may be successfully treated with intravenous fluids and insulin, dogs with severe manifestations of disease will need more significant intervention. Fluid therapy, potassium, bicarbonate, and phosphorus supplementation can be vitally important. Cats may require a feeding tube to survive. Any accompanying disorders must be identified and treated specifically where possible to enhance resolution of DKA.

Complications during DKA treatment are common, and can include the development of low blood sugar, neurological signs due to brain cell swelling, and severe electrolyte abnormalities. Anemia due to red blood cell breakdown can occur if the serum phosphorus concentration drops too low. Acute kidney failure also is possible.

DKA is one of the most serious metabolic disorders seen in both human and veterinary medicine. Many patients will die from it. However, the majority of patients can pull through a crisis successfully with aggressive diagnostics and treatment. Many general practitioners are accustomed to treating DKA. However, if at any time you wish to take your pet to a referral hospital ICU for 24-hour care, please notify your veterinarian right away.

Diagnosis:

The diagnosis of DK is based on symptoms, the presence of high blood glucose, low blood pH and ketones in the urine. Mild DKA is present when pets with high blood glucose concentrations and ketones in the urine appear relatively healthy, or have only mild symptoms. These dogs do not require extremely aggressive treatment, and should be distinguished from dogs with severe DKA. Dogs with severe DKA have all of the symptoms of mild disease, plus extreme reductions in serum bicarbonate concentration, and often show severe signs of illness.

Your pet will be checked for and treated for urinary tract or other systemic infection as part of the work-up and treatment for DKA. Complete bloodwork will be done, and sometime also, clotting tests, x-rays, ultrasound and/or other tests that are indicated for the particular case. cPLI is an important blood test for dogs, and abdominal ultrasound is an important tests for both dogs and cats with DKA.

Prognosis:

The prognosis for DKA is guarded. As many as five to 10 percent of humans with DKA die from this condition. Death rates for dogs may be as high as 30 to 40 percent.

Treatment:

Relatively healthy dogs with DKA can be treated with insulin injections to help get the serum glucose levels back under control. It may take a few days for serum glucose and urine ketone levels to fall, but aggressive treatment may not be needed as long as the dog's condition is basically stable.

Treatment of sick DKA dogs needs to be more aggressive. Paramount to the treatment of DKA is the gradual replacement of fluid deficits, as well as the maintenance of normal fluid balance. Many dogs will seem substantially better after being treated by intravenous fluids alone. Phosphate and potassium supplementation may also be needed, since both levels can drop to dangerously low levels during the treatment of DKA leading to serious complications such as a red blood cell breakdown that results in anemia. Bicarbonate may be given to help correct acid-base disturbances in the most life threatening cases. Insulin also is vital in the treatment of DKA. In some situations, fluids need to be replaced quickly, while the glucose levels will need gradual adjustment. In the most severe cases, it might be necessary to put the pet in a continuous intravenous drip of insulin.

Pancreatitis is extremely common in DKA, but there is no specific treatment for this disorder. Bacterial infections need to be identified and treated in a timely manner. Antibiotics usually are given even if a bacterial infection has not been confirmed, due to the problems that infections cause in DKA. Acute kidney failure may also accompany DKA, and needs to be treated aggressively with fluids. Drugs may be needed to stimulate urine production if it appears inadequate.

Things begin to improve when the pet is stabilized and eating and drinking on its own. Eventually if things go well, the animal should be able to go home with an insulin regimen designed for at home use, as well as any other treatments necessary to address additional disorders that might be present.

Prevention:

There is no specific method for preventing DKA, but careful treatment and monitoring of diabetic dogs is essential. Recognition of the common signs of diabetes mellitus in a dog--increased thirst and urination, increased appetite, and weight loss--also is important so the diagnosis of uncomplicated diabetes mellitus can be made, and appropriate treatment can be started before DKA develops. The feeding of high fat foods, which can trigger pancreatitis and then lead to DKA, should be avoided. In diabetic dogs, steroids such as prednisone should be used very carefully, if at all, because of the risk of insulin resistance and the frequent association of steroid administration with the development of DKA.

References:

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