

Kidney Failure— Sudden (Acute) Uremia

Basics

OVERVIEW

- “Uremia” is the medical term for excessive levels of urea and other nitrogenous waste products in the blood (it is also known as “azotemia”)
- Sudden (acute) uremia is a clinical syndrome characterized by sudden onset of kidney failure; urea and other nitrogenous waste products build up, leading to clinical signs
- Depending on the underlying cause, it is potentially reversible, if diagnosed quickly and treated aggressively
- The kidney filters the blood and removes various waste products from the body as it produces urine; the kidney is involved in maintaining the normal fluid volume of the body; each kidney is composed of thousands of nephrons (the functional units of the kidney, each consisting of the glomerulus [a tuft of blood capillaries—the “blood filter”] and a series of tubes and ducts, through which the filtered fluid flows, as urine is produced)



SIGNALMENT/DESCRIPTION OF PET

Species

- Dogs
- Cats

Mean Age and Range

- Peak incidence in dogs and cats—6–8 years of age
- Older pets at greater risk

SIGNS/OBSERVED CHANGES IN THE PET

Sudden onset of lack of appetite (known as “anorexia”); listlessness; depression; vomiting (with or without the presence of blood); diarrhea (with or without the presence of blood); bad breath (known as “halitosis”); wobbly, incoordinated or “drunken” appearing gait or movement (known as “ataxia”); seizures; and production of only small amounts of urine (known as “oliguria”)/or no urine (known as “anuria”); observed poison or drug exposure; recent medical or surgical conditions

- Normal body condition and hair coat; depression; dehydration; ulcers in the mouth; inflammation of the tongue (known as “glossitis”) or death of tissues of the tongue; “uremic” breath; low body temperature (known as “hypothermia”) or fever; rapid breathing (known as “tachypnea”); slow heart rate (known as “bradycardia”); inability to feel the urinary bladder during physical examination; kidneys different size—one or both being enlarged, painful, firm

CAUSES

Causes Related to Abnormal Circulation to the Kidneys

- Shock; trauma; blood clots (known as “thromboembolism”); heat stroke; excessive narrowing of the blood vessels (known as “vasoconstriction,” such as following the administration of nonsteroidal anti-inflammatory drugs [NSAIDs]); adrenal gland insufficiency; excessive enlargement or dilation of blood vessels (known as “vasodilation,” such as following the administration of angiotensin-converting enzyme [ACE] inhibitors or medications to decrease blood pressure [known as “antihypertensive drugs”]); significant elevation of blood pressure; prolonged anesthesia; heart failure

Compounds/Medications That Are Toxic to the Kidneys

- Ethylene glycol (found in antifreeze); certain antibiotics (aminoglycosides); antifungal medications (amphotericin B); chemotherapeutic agents (such as cisplatin and doxorubicin); nonsteroidal anti-inflammatory drugs; radiographic contrast agents; heavy metals (such as lead, mercury, arsenic, thallium); insect or snake venom; calcium; grape or raisin ingestion (dogs); and lily ingestion (cats)

Generalized Disease Affecting the Kidneys

- Infectious disease (such as leptospirosis or Lyme disease); immune-mediated disease (such as inflammation and accompanying dysfunction of glomeruli [plural of glomerulus] of the kidney [known as “glomerulonephritis”]; inflammation of the pancreas (known as “pancreatitis”); generalized disease caused by the spread of bacteria in the blood (known as “septicemia” or “blood poisoning”); blood-clotting disorder (known as “disseminated intravascular coagulopathy” or DIC); liver failure; heat stroke; blood transfusion reactions; bacterial inflammation/infection of the lining of the heart (known as “bacterial endocarditis”); bacterial infection/inflammation of the kidney (known as “pyelonephritis”); and cancer (such as lymphoma; “lymphoma” is a type of cancer that develops from lymphoid tissue, including lymphocytes, a type of white blood cell formed in lymphatic tissues throughout the body)
- Blockage or obstruction of one or both ureters (the tubes running from the kidneys to the bladder)

RISK FACTORS

- Preexisting long-term (chronic) kidney disease; dehydration; generalized bacterial infection (known as “sepsis”); low blood volume (known as “hypovolemia”); low blood pressure (known as “hypotension”); advanced age; coexistent disease; low levels of sodium in the blood (known as “hyponatremia”); low levels of potassium in the blood (known as “hypokalemia”); low levels of calcium in the blood (known as “hypocalcemia”); and acidosis (a condition in which levels of acid are increased in the blood)
- Medications (such as the diuretic, furosemide; nonsteroidal anti-inflammatory drugs (NSAIDs); angiotensin-converting enzyme [ACE] inhibitors; certain antibiotics [such as aminoglycosides]); prolonged anesthesia; acidifying diets; trauma; multiple organ disease; and high environmental temperature

Treatment

HEALTH CARE

- Inpatient management; eliminate inciting causes; discontinue kidney toxic drugs; establish and maintain circulation and blood flow; treat life-threatening fluid imbalances, biochemical abnormalities, and uremic toxicities
- If a poison is the likely cause of sudden (acute) uremia and kidney failure, follow appropriate treatment for the specific poison (treatment may include inducing vomiting, flushing of the stomach [known as “gastric lavage”], and administering activated charcoal, cathartics and specific antidotes); early hemodialysis/hemoperfusion (procedure to remove waste products from the blood) can eliminate poisons

- Low blood volume (hypovolemia) or dehydration—correct estimated fluid deficits with normal (0.9%) saline or balanced fluids within 2–4 hours; blood losses may be replaced by blood transfusion; once the pet is hydrated, ongoing fluid requirements are provided

DIET

- Restrict intake of food and water by mouth until vomiting subsides
- Fat and protein stores will be consumed by the body while pet is not eating (anorexia) so it is essential to control vomiting rapidly and provide early nutritional support; resting energy requirements must be provided by 3 days, using moderately protein-restricted diets or feeding special solutions formulated to control excessive nitrogen waste levels (uremia or azotemia) and supply caloric requirements
- Nutrition may be provided by intravenous feeding (known as “parenteral nutrition”) in intractable (uncontrollable) vomiting pets
- Tube feeding (nasal, esophageal, gastric or intestinal placement) may be provided for pets that are not eating (anorexia) and are not vomiting—caloric and protein requirements may be supplied by using prescription kidney diets that have been liquefied in a kitchen-type blender, special liquid diets, or formulated diets

SURGERY

- Surgery may be required for sudden (acute) blockage or obstruction of one or more ureters (the tubes running from the kidneys to the bladder)
- Kidney transplant may provide long-term survival for cats with severe, sudden (acute) nonresponsive kidney injury
- Peritoneal dialysis or hemodialysis can stabilize the patient until the kidney function is restored, or surgery is done

Medications

- Medications presented in this section are intended to provide general information about possible treatment. The treatment for a particular condition may evolve as medical advances are made; therefore, the medications should not be considered as all inclusive

INADEQUATE URINE PRODUCTION

- The veterinarian will ensure the pet has normal blood volume, top up so providing 3% expansion of blood volume then administer medications to remove excess fluid from the body (diuretics), such as mannitol or furosemide (alternative or subsequent to mannitol)
- If diuretic treatments fail to induce increased production of urine within 4–6 hours, they may consider dialysis

ACID–BASE DISORDERS

- Bicarbonate may be given

EXCESS POTASSIUM IN THE BLOOD (HYPERKALEMIA)

- Dehydration will be corrected with potassium-free intravenous fluids
- Discontinuation of any medicines that increase potassium
- Diuretics to flush the system (furosemide for example)
- Possible sodium bicarbonate
- Intravenous dextrose with or without insulin to help drop the potassium levels, and possibly calcium gluconate
- If not able to drop it, dialysis may be indicated

VOMITING

- No food or water (nothing by mouth) will be given while actively vomiting
- Reduce stomach-acid production—famotidine or omeprazole
- Medication to protect the lining of the stomach (known as a “mucosal protectant”)—sucralfate
- Medications to control nausea and/or vomiting (known as “antiemetics”) such as maripotent, ondansetron, or dolasetron to control vomiting as quickly as possible (therefore, oral nutrition)

PERITONEAL DIALYSIS OR HEMODIALYSIS

- “Peritoneal dialysis” is a type of dialysis in which fluids are put into the abdomen and the lining of the abdomen

(known as the “peritoneum”) acts as a filter to remove waste products from the blood—after a certain amount of time, the fluids and waste products are removed from the abdomen; “hemodialysis” is a procedure to remove waste products from the blood

- Dialysis can stabilize the pet until kidney function is restored or until corrective surgery is performed; without dialysis, most pets that produce only small amounts of urine (oliguria) die before kidney repair can occur

Follow-Up Care

PATIENT MONITORING

- Fluid, electrolyte, and acid–base balances; body weight; blood pressure; urine output; and clinical status—monitor 4 times daily during crisis, then daily until release from hospital

PREVENTIONS AND AVOIDANCE

- Greater potential for sudden (acute) kidney injury in aged pets or those with generalized (systemic) disease, generalized bacterial infection (sepsis), trauma, receiving kidney toxic drugs, with multiple organ failure, or those undergoing prolonged anesthesia
- Maintenance of hydration, mild saline volume expansion, and administration of mannitol may be preventive for example, when exposure to a toxin is known but no signs noted yet
- Close monitoring of urine production and for increased levels of urea and other nitrogenous waste products (azotemia) in high-risk pets will be recommended

POSSIBLE COMPLICATIONS

- Seizures; coma; irregular heartbeats (known as “cardiac arrhythmias”); increased blood pressure (hypertension); congestive heart failure; fluid buildup in the lungs (known as “pulmonary edema”); inflammation of the lungs due to the presence of urea and other nitrogenous waste products (known as “uremic pneumonitis”); aspiration pneumonia; bleeding in the gastrointestinal tract; shock due to low blood volume; generalized bacterial infection (sepsis); stopping of the heart and breathing (known as “cardiopulmonary arrest”); and death

EXPECTED COURSE AND PROGNOSIS

- Prognosis depends on cause, extent of kidney damage, coexistent diseases, and multiple organ involvement or organ failure, age of patient and response to therapy
- Average survival rates for both dogs and cats is 50% (range from 20% for ethylene glycol, to 80% for leptospirosis; a bacterial infection)
- Prognosis guarded for non-oliguric (normal urine production) kidney failure than for oliguric (reduced urine production); recovery may occur over 2–6 weeks
- Oliguric kidney failure is difficult to manage and has a poor prognosis without dialysis, tends to be extensive kidney injury; recovery over 4–12 weeks is signaled by sudden return of urine production
- Anuric kidney failure, where urine is not produced at all carries a poor prognosis without dialysis, often incomplete recovery
- Infectious and obstructive causes have a better prognosis for recovery than toxic causes

Key Points

- Poor /guarded prognosis for complete recovery depending on cause
- Potential for complications of treatment, and from the kidney failure
- Prolonged hospitalization and treatment is expensive
- Alternatives to conventional medical management are available; they include peritoneal dialysis or hemodialysis and kidney transplantation
- Leptospirosis has zoonotic potential; “zoonoses” are diseases that can be passed from animals to people so contact with urine should be avoided