SUDDEN (ACUTE) LIVER FAILURE

BASICS

OVERVIEW

- Sudden (acute) loss of more than 75% of functional liver tissue; occurs primarily because of sudden (acute), massive death of liver tissue (known as "hepatic necrosis")
- The liver is the largest gland in the body; it has many functions, including production of bile (a fluid substance involved in digestion of fats); production of albumin (a protein in the plasma of the blood); and detoxification of drugs and other chemicals (such as ammonia) in the body

SIGNALMENT/DESCRIPTION of ANIMAL

Species

- Dogs and cats
- More common in dogs than in cats

SIGNS/OBSERVED CHANGES in the ANIMAL

- Sudden (acute) onset
- Vomiting
- Small intestinal diarrhea—may be bloody
- Enlargement of the liver (known as "hepatomegaly"), with tenderness of the liver on feeling the abdomen
- Bleeding
- Yellowish discoloration to the gums and other tissues of the body (known as "jaundice" or "icterus")
- Brain disorder caused by accumulation of ammonia in the system due to inability of the liver to rid the body of ammonia (known as "hepatic encephalopathy")
- Seizures

CAUSES

Drugs

- Many drugs have been reported to cause sudden (acute) liver failure (such as azole antifungal drugs, azathioprine, nonsteroidal anti-inflammatory drugs [NSAIDs], acetaminophen, diazepam [cats], steroids, methimazole [cats], phenobarbital [dogs], sulfa drugs [dogs], and tetracycline)
- Any drug may be associated with sudden (acute) liver failure

Biological Toxins

- *Amanita* mushrooms, aflatoxins, blue-green algae

Toxins

- Heavy metals (such as lead, zinc, copper)
- Phenols (especially cats)

Infectious Agents and Bacterial Toxins (known as "Endotoxins")

- Intestinal bacteria—*Clostridium perfringens*; *Clostridium difficile*; gram-negative bacteria
- Food poisoning—*Staphylococcus*; *E. coli*; *Salmonella*

Thermal Injury

- Heatstroke
- Whole-body increased body temperature (known as "hyperthermia") treatments for cancer

Low Levels of Oxygen in the Liver (known as "Hepatic Hypoxia")

- Blood clots (known as "thromboembolic disease")
- Shock
- Blood-clotting disorder (known as "disseminated intravascular coagulopathy" or "DIC")
- Sudden (acute) circulatory failure, from any cause

RISK FACTORS

- Administration of any potentially liver-toxic substance or drug
- Exposure to environmental toxins (such as *Amanita* mushroom, food-borne aflatoxins)
- Indiscriminate ingestion of substances that are potentially liver toxic

TREATMENT

HEALTH CARE

- Inpatient—intensive care required
- Control potential bleeding/clotting disorders with vitamin K_1, fresh frozen plasma, or fresh whole blood

- Fluids
- Colloid replacement—colloids are fluids that contain larger molecules that stay within the circulating blood to help maintain circulating blood volume; plasma preferred; hetastarch next best alternative
- Potassium and glucose—supplement as necessary; may decrease severity of signs of hepatic encephalopathy (brain disorder caused by accumulation of ammonia in the system due to inability of the liver to rid the body of ammonia)
- Phosphate—supplement judiciously; low phosphate may aggravate hepatic encephalopathy
- Supplement oxygen, as needed

ACTIVITY
- Restricted activity promotes healing and regeneration of the liver

DIET
- Vomiting—withhold food and water by mouth (so called "NPO") until controlled; use medications to control vomiting (known as "antiemetics")
- Nutrition via the gastrointestinal tract (as with a feeding tube)—small volume, frequent meals to optimize digestion and absorption of nutrients and to minimize formation of intestinal toxins that may contribute to hepatic encephalopathy (brain disorder caused by accumulation of ammonia in the system due to inability of the liver to rid the body of ammonia)
- Nutrition through intravenous route (known as "parenteral nutrition")—may be used as a partial means of providing nutrition (recommended for short-term lack of appetite) to minimize breakdown of muscle (catabolism) or as a total means of providing nutrition (known as "total parenteral nutrition" or "TPN"), which is recommended if the pet has lack of appetite of more than 5 days and providing nutrition via the gastrointestinal tract is not possible
- Diet composition—use normal protein (nitrogen) content, if pet is tolerant; moderate protein restriction in pets with hepatic encephalopathy; strive to maintain a positive nitrogen balance that is essential for liver regeneration
- Supplemental vitamins are essential—water-soluble vitamins (vitamin B complex, vitamin C); vitamin K_1; vitamin E

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.

Drugs to Control Vomiting (known as "Antiemetics")
- Metoclopramide—for mild or infrequent vomiting
- Ondansetron
- Chlorpromazine—for severe vomiting; may be administered by injection under the skin (SC or subcutaneous administration) or into muscle (IM) or administered rectally
- Histamine H_2-blocker—famotidine, if intestinal bleeding is present

Drugs for Hepatic Encephalopathy (brain disorder caused by accumulation of ammonia in the system due to inability of the liver to rid the body of ammonia)
- Lactulose
- Metronidazole

Drugs for Fluid Build-Up in the Brain (Cerebral Edema) Associated with Hepatic Encephalopathy
- Mannitol
- Furosemide—medication to remove excess fluid from the body (known as a "diuretic); increases removal of fluid and reduces production of cerebrospinal fluid; monitor hydration and serum potassium to avoid dehydration and low levels of potassium in the blood (known as "hypokalemia"), which may worsen hepatic encephalopathy (brain disorder caused by accumulation of ammonia in the system due to inability of the liver to rid the body of ammonia)

Drugs for Blood-Clotting Disorder (known as "Coagulopathy")
- Fresh whole blood or fresh frozen plasma—to provide substances necessary for clotting in cases with clinically significant bleeding

Free Radical Scavengers and Antioxidants
- For ongoing liver-cell damage, reperfusion injury, and low levels of oxygen in the tissues (known as "hypoxia")
- Vitamin E
- Vitamin C
- *N*-acetylcysteine—primarily used in the treatment of acetaminophen toxicity
- *S*-adenosylmethionine (SAMe, Denosyl®-SD4); has several effects, including the promotion of liver-cell regeneration

Liver Protectants
- Silibinin (milk thistle), effectiveness reported for treatment of *Amanita* mushroom toxicity and certain other toxins
- Ursodeoxycholic acid—if long-term (chronic) liver injury or very high bile acids persist; bile acids are produced by the liver and are involved in fat digestion

FOLLOW-UP CARE

PATIENT MONITORING

- Temperature, pulse, respiration, and mental status
- High vigilance for infection, especially hospital-related infection (such as caused by use of catheters)
- Body weight—twice daily to guide fluid therapy; body weight and body condition scoring (estimate of weight status [under or overweight] as compared to normal weight) weekly to appraise nitrogen and energy balance
- Serum biochemical tests (acid–base, electrolyte balances [especially potassium and phosphate], and glucose)
- Blood tests specifically related to the liver (liver enzyme activities and bilirubin concentration)—every 2 to 3 days, until improvement

PREVENTIONS AND AVOIDANCE

- Vaccinate dogs against infectious canine hepatitis virus
- Avoid indiscriminate ingestion of drugs or toxins associated with liver toxicity
- Remove potential toxins from environment
- Consider long-term (chronic) use of medications that are potentially liver toxic; discuss use of medications and possible side effects with your pet's veterinarian

POSSIBLE COMPLICATIONS

- Low blood sugar (hypoglycemia)
- Blood-clotting disorder (disseminated intravascular coagulopathy or DIC)
- Uncontrolled gastrointestinal bleeding
- Brain disorder caused by accumulation of ammonia in the system due to inability of the liver to rid the body of ammonia (hepatic encephalopathy)
- Long-term (chronic) liver insufficiency, progressive damage and scarring of the liver (known as "cirrhosis")
- Sudden (acute) kidney failure
- Death

EXPECTED COURSE AND PROGNOSIS

- Prognosis—depends on extent of liver tissue destroyed and effectiveness of supportive care

KEY POINTS

- Sudden (acute) liver failure is a serious condition; some patients die even with optimal treatment
- An underlying cause for the death of the liver tissue (necrosis), such as exposure to a drug or toxin, should be investigated; however, it often will not be confirmed