

**CASE # 50903****JANE DOE**

Ray Butterfield is a 2-year old male neutered Persian presented to the MVS Emergency service with a client complaint of decreased appetite, hiding, depression and rear limb weakness progressing over the previous 5 days. In-house CBC and Chemistries done by the referring veterinarian were within normal limits. Ray was continuing to drink but was refusing all foods offered. He is a strictly indoor cat, current on all vaccinations with a previous history of a urinary tract infection, and FELV/FIV negative. Ray was also found to have bilateral luxating patellas. Ray was admitted to the hospital, with a transfer to the Neurology service the following morning.

The Neurologist felt that ruling-out metabolic diseases was indicated based on the age of the cat and the findings on the neurological exam - if these were normal than a CNS work-up would be indicated.

Blood work was drawn from the jugular vein and submitted for a full chemistry/CBC, a urinalysis was not submitted due to an empty bladder. The blood work showed a slightly lowered BUN and albumin (BUN 11 mg/dl (14-36 mg/dl) Albumin 1.7 mg/dl (2.5-3.9 mg/dl)), with a slightly elevated Total Bilirubin 0.8 mg/dl (0.1-0.4 mg/dl). The lowered BUN with an elevated T. Bili increased the suspicion of liver involvement in Ray's signs.

An abdominal ultrasound was normal, with the liver of subjectively normal size with no abnormal vasculature seen. The Internist did comment that the copper color of Ray's eyes should raise the suspicion for a portosystemic vascular anomaly.

A Bile Acids test was submitted to evaluate liver function as an aid in ruling out a portosystemic vascular anomaly. This procedure consists of drawing a non-hemolyzed, non-lipemic blood sample after a minimum 12 hour fast. The sample was allowed to clot, and was then separated to collect a serum sample. A jugular venipuncture was done to collect the pre bile acids sample. 1 tsp. of Hill's A/D® (this food is used because the laboratories use this food to set the normal values) was given to Ray. The volume of food given is important - if too much is offered the serum will become lipemic thus making

interpretation difficult if not impossible, the recommended food dosage is roughly 1 tsp./10# or 1 tbl/30# body weight. If the patient is willing this can be fed normally; if not, assisted syringe feeding is acceptable. Another sample was collected two hours later; both samples were prepared for submission to an outside laboratory by allowing them to clot and collecting serum.

The Bile Acids test was abnormal, the pre test sample was 2.4 umol/l (0.0-5.0 umol/l) the 2 hour post sample was 38.4 umol/l (1.0-20.0 umol/l). These values indicate that there was an impaired ability by the liver to effectively recover the bile acids used by the gastrointestinal tract, and released back into the bloodstream to be used again. Normally the liver releases bile acids into the duodenum in response to the presence of fat in the chyme. Bile acids help in the breakdown of fats and absorption into the lacteals. The bile acids are sent down to the jejunum where they are recollected and sent via the hepatic vein to the liver for reuse by the body. With impaired liver function, this last step is faulty, causing the liver to not efficiently recollect the bile acids from the hepatic vein, increasing the levels found in the systemic blood system.

Due to Ray's age, copper colored eyes, and abnormal Bile Acids test a recommendation for surgical exploratory was made to the owners. This was scheduled for the next day, and Ray was transferred to the Surgery service. A peripheral intravenous catheter was placed and Lactated Ringers solution was started. Ray had continued to drink even after he had stopped eating, so he was not dehydrated at the time of admittance; thus, fluids were started at a maintenance rate of 1ml/#/hr.

Surgery was started at 1:30 pm the following day. The LRS was continued but the rate was increased to 5x maintenance. The liver was grossly abnormal in color (nutmeg appearance), with the omentum and falciform fat having a "foamy" appearance. No other abnormalities were noted and the hepatic vessels appeared normal, with no shunt vessels seen. Biopsies were taken from the liver, stomach, duodenum, jejunum, ileum, pancreas and mesenteric lymph nodes. These were submitted to an outside pathologist for evaluation. After surgical closure at 3:00 pm, Ray was transferred to Endoscopy/Ultrasound while still under anesthesia for a percutaneous endoscopic gastrostomy (PEG) tube placement. A 22 french Pezzer catheter was placed using standard endoscopic placement technique.

Anesthetic recovery was normal, but prolonged. Oxymorphone had been given intraoperatively for pain management, and a 25-ug Fentanyl patch had been applied at the same time. These are both narcotics and are very effective at pain management but do prolong anesthetic recovery time. Because the oxymorphone and Fentanyl are narcotics, they also cause respiratory depression, interfere with the body's normal ability to thermoregulate, cause gastrointestinal stasis and can stimulate the vomiting center in the brain. When pain management is started intraoperatively, the pain is easier to control than if it is started after the animal has recovered and conveyed to the treatment nurses that they are painful. The oxymorphone is used initially (the first 24-36 hours) because it takes the Fentanyl patch that long to get to full effectiveness. The Fentanyl patch is effective for a full 3 days.

Due to the problem with gastrointestinal stasis associated with narcotics, a continuous rate infusion of metoclopramide at 2 mg/kg/day was started after surgery, prior to feeding. Metoclopramide decreases gastric stasis by increasing motility, decreasing nausea and vomiting. If started prior to the reintroduction of food through the PEG tube, vomiting will be lessened and the cat will be less nauseous when food is started. Cephazolin was also given immediately postoperatively, and switched to Clavamox drops through the PEG tube at 62.5 mg/10#. Though not routinely given after surgery, because the PEG tube is introduced through the mouth, antibiotic treatment is advised for the first 24-36 hours.

Since we would not get the biopsy results back for 5 days, withholding feedings pending the biopsy results was not deemed prudent. Feedings were begun on our "Hepatic Lipidosis Schedule". The day after surgery a continuous rate infusion of Eukanuba Maximum Calorie food was started through the PEG tube. The initial rate was 2 ml/hr (25% of metabolic energy requirements), with stomach residuals being recorded every four hours along with the intravenous fluid rate. By starting the feedings with a CRI instead of bolus feedings, the incidence of vomiting is decreased by decreasing stimulation of the vomiting receptors in the stomach (these can be triggered by stretching associated with gastric distension), this helps to decrease the nausea associated with reintroduction of food and decreases the workload on the treatment nurses.

When calculating the volume of food to be given whether through a feeding tube or orally, the formula is  $(30 \times \text{weight in kilograms}) + 70$ . This will give you the resting energy requirements, to get the metabolic energy requirements (MER) the RER is multiplied by a factor ranging from 1.0-2.0, this is dependent on the present condition of the animal, their activity level and the problem that you are addressing. The MER factor that I use for Hepatic Lipidosis is  $\text{RER} \times 1.25-1.35$ . As there is no research done on the specific caloric needs for the various problems that we see, the best way to assess if you have the correct amount is to monitor the animal and adjust accordingly.

The primary goal of nutritional support is aimed at reversing the protein and fat catabolism that is characteristic of Hepatic Lipidosis. If nutritional support is not aggressively done with Hepatic Lipidosis, the mortality rate is 90%, if support is instituted early and aggressively enough this can be decreased to 10-40%.

Hypophosphatemia occasionally develops within 12-72 hours after reintroduction of food; this can result in a secondary hemolytic anemia. The phosphorus stores within the body can become severely depleted while trying to maintain normal serum phosphorus levels. When food is reintroduced, the body tries to replenish these cellular stores in turn depleting the serum levels. This depletion of serum phosphorus reduces the amount of ATP (adenosine tri-phosphate) available to the red blood cells for energy. The ATP helps to maintain the cellular integrity of the red blood cells, without it they rupture resulting in a hemolytic anemia. By closely monitoring the PCV/TS and phosphorus levels after reintroduction of food, supplementation can be started before a hemolytic crisis has occurred.

The second day after surgery, the feeding CRI was increased to 3 ml/hr (63% MER), and the intravenous fluids were decreased to 8 ml/hr. Decreasing the IV fluids helps to prevent fluid overload when combined with the CRI feeding. The PCV/TS was 40/5.0 and the phosphorus was 4.5 mg/dl (2.4-8.2 mg/dl). At 8 pm the stomach residual had increased to 26 ml, the decision was made to start "exercising" Ray. Stomach residuals will usually come down when the cat is allowed to "exercise" in an empty exam room for 20-30 minutes 3-4 times a day.

Bolus feedings were started on day three at 15-ml q 6 hr followed by a 5-ml water flush after the feeding. This gave a total intake of 60 ml/day, or 52% MER. As the recovery progresses, the size of the feedings will increase as will the time interval between feedings. When the cat is at 75% MER divided into 3 feedings they will be discharged to the care of their owners. The owners will be given direction on how to reach full MER over the next 2-3 days.

On day four the biopsy results were received, Ray had diffuse, moderate, vacuolar hepatopathy consistent with Hepatic Lipidosis. All other biopsy sites were normal.

Hepatic lipidosis is defined as an accumulation of lipid within the hepatocytes leading to hepatomegaly and eventual liver failure. Hepatic lipidosis is the most common hepatopathy in the cat.

The bolus feedings were gradually increased over the next 4 days, with discharge from the hospital occurring 1 week post-operatively. Ray was discharged on Eukanuba Maximum Calorie diet 40 ml three times daily. Typical recovery, defined as the animal resuming full oral feedings without nutritional support through the feeding tube, and able to maintain normal body weight is 8-12 weeks.

Ray's tube was manually removed without incident 10 weeks post-op. No further follow-up is required, though the clients are advised to call with any problems or questions associated with their pets eating. Ray was walking normally after recovery, but the bilateral luxating patellas may need to be addressed in the future. This, combined with his weakness most likely caused the rear leg problems that he had on presentation.