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Sugar Gliders

Description
Sugar Gliders (*Petaurus breviceps* = tight rope walker, short head*)* are one of the newest additions to the world of fad pets. Published information on Sugar Gliders is sparse, but more is coming available as we continue to see them as pets/patients.

A sugar glider is a small marsupial possum found in the treetops of Australia, Tasmania, Indonesia, and Papua-New Guinea. They get their name because of their preference for sweet foods and have a gliding membrane (called the patagium) similar to that of a flying squirrel. They are about the size of a large hamster. They are primarily grey with black stripes and a lighter underside. They are nocturnal and have large eyes for night vision. They have scimitar-shaped claws and fused 2nd and 3rd digits (comb) to assist with climbing. The sugar glider tail is also used as a stabilization device during "gliding". Males have a large patch of crusty alopecia on the top of the head, which is a scent gland. It can easily be mistaken for a scab by unfamiliar clinicians.

Breeding is usually accomplished with trio groupings of 1 male and 2 females. Gestation is only 16 days and the two offspring are very small and altricial. Females have a pouch where the offspring spend the first 3 months of their lives. By the time they leave the pouch, they are nearly independent. They should be offered soft foods and they gradually introduced to solid foods.

Sugar gliders are social creatures, normally living in small family groups. In captivity, they do best when kept with a companion. At the very least, they should be given at least one or two hours of attention each day. Isolation is extremely stressful for social animals.

Diet
Sugar gliders are omnivorous in nature and ideal captive diets have not been developed. Diets recommended by some pet stores or lay productions are often inappropriate and nutritional diseases are common. The list of items that can be included in the diet is very long, but the amounts of each should be controlled to give a balanced diet. A recommendation by exotic clinicians is to use avian pelleted diets, formulated primate diets, lorry nectar, fruits, vegetables, eggs, and insects. Insects should be gut loaded with high calcium diets prior to feeding them to the sugar glider. Palatability is always a factor as sugar gliders will not eat just anything placed in front of them. They love sweet items, but these are easily overdone. Diets used by 3 zoos are listed below. The fact that zoos have used them does not guarantee that they are balanced. A diet that has been used successfully to raise captive sugar gliders is a 1:1 Leadbeater's mix & a commercial insectivore diet (ex. Mazuri brand). This diet can be mixed and refrigerated until served. Sugar Gliders are prone to obesity and their weight and dietary intake should be monitored closely.

Chicago Zoological Park Diet
1 tsp. each
apple, carrot, sweet potato, banana, leaf lettuce
½ hard boiled egg yolk
1 T. Nebraska Feline diet (or Zupreem or Mazuri)
1 dozen Meal Worms

Leadbeater's mix
450 ml water
450 ml honey
3 shelled hard boiled eggs
75 grams high protein baby cereal
3 tsp. vitamin supplement (Vionate)

Taronga Zoo Diet
3 grams each:
apple, banana, corn, grapes/kiwi, sweet potato, orange, pear, melon/pawpaw
1.5 grams dog kibble
1 tsp. fly pupae
2 tsp. Leadbeater's mix

Psittacine Diet
15 pieces psittacine diet, jungle, mixed flavor
1 peeled banana
1 grape, halved
½ inch cube honeydew
½ inch cube papaya
3 adult gut loaded crickets
5 gut loaded meal worm larvae

Housing

The cage should be no smaller than average 20x20x30 inches high. This size of cage is adequate for 1 or 2 sugar gliders. A tall cage is better than a short long one because sugar gliders love to climb. Commercial birdcages often meet these specifications. The wire on the cage should be no bigger than 1 inch by ½ inch. If the cage is to have straight bars wit no crosshatching, then the bars should be no more than ¼ inch apart ("budgie bars"). Screen door mesh does not appear to work well for homemade cages since sugar gliders usually get their claws stuck in it. Make sure the cage is placed in an area where sunlight can penetrate, but do not place cage in direct sunlight. Temperature of the cage should be kept between 65°F and 75°F, which is conveniently similar to the range commonly found in most homes. Nesting boxes are important since sugar gliders are nocturnal and need a place to curl up and sleep during the day. Nesting boxes can be made of wood wicker, or plastic. The entrance hole should be no smaller than 1½ inches in diameter. A wooden birdhouse, plastic hamster house, or a rubber storage container make great nesting boxes.

Alternatively, a cloth pouch with a slit in the front can be tied to the side of the cage as a "sleeping bag". Bedding is usually not needed, however, plain shredded paper (not magazine or newspaper) is acceptable. A variety of food and water bowls/bottles can be used. It is important that the dishes be sanitized daily to prevent buildup of harmful bacteria. Climbing branches should be provided. Make sure that you use nontoxic species of wood. If a type of wood is safe for small birds than it is safe for sugar gliders. Once the sugar glider has stripped off all the bark or they have become soiled, replace them with new ones. Sugar gliders enjoy playing with bird toys such as swings, perches, ladders, and bells. Make sure toys are well assembled and do not have small pieces that can be pulled off and swallowed. Sugar gliders also enjoy solid exercise wheels or exercise balls.

History

The approach to medical care of sugar gliders is similar to that used for more familiar species. Owners of sugar gliders and other exotic pets are just as devoted to their pets. Limits on the use of diagnostic tools and treatments should be by the owner's decisions and risks to the patient not on an assumption of what would be considered too expensive by the owner. As many of the problems encountered are a result of poor husbandry, a thorough history of the day-to-day care of the glider is warranted. A description of the problem, its duration, any changes, and any prior treatments will guide the investigation.

Physical Examination

Many sugar gliders are tame and will climb over the hands, arms, etc. However, it is very difficult to do a proper physical examination with the patient moving all over. Restraint is usually necessary for a complete examination. Handling sugar glides is similar to handling other quick moving mammals, such as hamsters and gerbils. A small hand towel facilitates initial capture. The head must be controlled to avoid being bitten. Sugar gliders can be restrained by the scruff of the head/neck, but a grip along the jaw line with the thumb is more acceptable to the owners.

The physical examination should include visual inspection of the eyes, nose, ears, oral cavity and teeth, skin, pelage, and genitals. The pouch should be inspected in females. The lymph nodes, abdomen, chest, etc. should be palpated. The thorax should be asculted.

First Visit/Annual Examination should consist of the following:

Physical examination
Diet and husbandry review
Dental check
Stool flotation/smear for parasites/protozoa
As indicated:
CBC/chemistry
Additional diagnostic tests
Radiographs to check bone density

Physiologic Data

Weight
Males = 115-160 grams
Females = 90-130 grams
Body length = 5-6 inches with a tail of equal length
Life span = 4-15 years
Body Temperature = 89.6°F
Sexual Maturity
Males = 12-14 months
Females = 8-12 months
Gestation = 16 days
Pouch time = 70 days
Litter size = 2
Litters/year = 2
Pouch has 2 teats
Weaning age = 3-4 months
Independence = 17 weeks

Clinical Pathology
The most familiar diagnostic tests can be used in sugar gliders, although blood collection can be somewhat challenging. About one milliliter or blood can be taken from a full-grown sugar glider. A compete blood count and serum chemical evaluation can be run with this amount of blood by certain laboratories. Cytology, cultures, and biopsies are easily accomplished. Parasitology is used as in other mammals. Both a flotation and direct wet mount should be performed, as protozoa parasites appear to be common. Comparison to other species allows detection of grossly abnormal values in most cases. Blood glucose levels tend to be quite low in marsupials, however. If necessary and feasible, a duplicate sample from a healthy glider can be run for comparison.

Hematologic and Biochemistry Reference Ranges*
There are no published reference ranges for sugar gliders; however, the following values from the Short-nosed Bandicoot (*Isoodon macrourus*) and Barred Bandicoot (*Permaeles gunii*)* may be useful, as these species are similar in metabolism and diet to sugar gliders.

Hbg (g/dl) 14.5-16.1
PCV (%) 44-45
WBC (cells/mm3) 2800-3600
Neutrophils (%) 46.7-53
Lymphocytes (%) 31-34
Monocytes (%) 8-13
Eosinophils (%) 1-9
AST (SGOT) (SF units/L) 35-75
ALT (SGPT) (IU) 43-76

LDH (WU) 800
Protein (g/dl) 4.9-6.4
Albumin (g/dl) 2.75-3.5
Na- (mEq/L) 129-141
K+ (mEq/L) 3.3-4.6
Glucose 50-60 mg/dl
**Fowler ME (ed): Zoo and Wild Animal Medicine 2nd ed.*

Radiography
Radiography and other forms of imaging are used commonly. Both orthopedic and soft tissue diseases can be detected. Most sugar gliders will require anesthesia for quality radiographs to be taken. As visual references for radiographs of sugar gliders are hard to find, it may be advisable for the clinician to offer to take free radiographs of the first normal sugar glider seen for a reference film. Ultrasound can be useful in these small animals to examine heart or abdomen.

Therapy
Once a diagnosis is made, or at least initial diagnostic procedures finished, therapy should be started. Early treatment is crucial to success. The small size of gliders makes them very susceptible to starvation and dehydration. If they are not eating or drinking, they should be forced fed and administered fluids. If shocky or critically dehydrated, fluids should be given intraosseously. A needle can be placed in the femur, in the fashion of an Intramedullary pin, and fluids or drugs administered in this fashion. The fluids are taken up into the circulation so rapidly that this technique is equivalent to the intravenous infusion, which is very difficult in gliders. Less severely ill gliders can be given subcutaneous or oral fluids. Maintenance fluid requirements are
60-100 ml/kg per day. Therefore, a 100 gram sugar glider will need 6-10 ml/day for maintenance plus the deficit. Forced feeding, using avian powder formulas and metal gavage tubes can be accomplished with little practice. The procedure is similar to small rodents. The requirements can be calculated using the following formula:

Basal energy requirements (BER) = 49 * (BW in $kg^{.75}$)
Actual energy requirement (MER) = 1.25 * (BER)

Actual energy requirements will vary from 1-2 times maintenance energy, depending on the medical condition. Emeraid II, a powdered critical care formula for birds is 1.9kcal/ml when mixed according to instructions. Therefore, a 100 gram sugar glider would require 5-10 ml/day for maintenance.

Anesthesia
Certain diagnostic and therapeutics may require anesthesia for restraint and prevention of pain. In most cases, isoflurane gas, administered by mask is the simplest, fastest, and most rapid method. Endotracheal intubation is difficult and requires that the glider be deeply anesthetized, so it would not be recommended for novice clinicians. Injectable anesthetics carry the inherent disadvantage of greater difficulty in controlling depth. The small size of the sugar glider amplifies some of the anesthetic risks. They lose heat much

more rapidly, the tracheal lumen occludes more easily, and cotton tipped applicators should be available to swab out the throat. A small endotracheal tube (5-8 french red rubber tube with tracheal adapter) should be available for emergency intubation. Clear adhesive drapes facilitate monitoring. Most importantly, a technician should be dedicated to the constant monitoring of the patient. The tidal volume is generally too low to move the bag on most systems so respirations cannot be monitored in this way. The low tidal volume also leads to a large amount of dead space within the delivery system; therefore, semi-open non-rebreathing systems should be used in sugar gliders.

Surgery

Surgery of sugar gliders can be enhanced by the use of several types of instrumentations not commonly used in traditional pets. Their small size requires finer instruments, methods of controlling even small amounts of hemorrhage, magnification, and a directed source of light. Microsurgery or ophthalmic instruments are frequently used instruments and should be counterbalanced and have rounded handles to allow them to be manipulated by gentle rubbing between the fingers. There should be no lock mechanism on needle holders as releasing these causes considerable jarring. Delicate surgery should be performed while seated with your wrists supported on the table to minimize motion. Hemorrhage can be controlled by the use of electrocoagulation. Bipolar instrumentation is preferred. Utilization of the CO2 laser may be of benefit to minimize blood loss and help with pain management. Due to the small size of sugar gliders, magnification of the surgical field is advantageous. Optical loupes can be used for many procedures and are reasonably priced. Operating microscopes are another option and will provide greater magnification and lighting. Working under magnification is very different from standard surgery.

Surgical procedures commonly needed in sugar gliders include castration and abscess drainage. A simple scrotal castration technique gives good results. Abscesses are handled in the same way as in other animals.

Common Problems

Metabolic bone disease (Secondary Nutritional Hyperparathyroidism) is common in sugar gliders. The lack of correct information about diets leads to gross deficiencies. Low calcium, improper calcium:phosphorus ratio, and inadequate Vitamin D are responsible for metabolic bone disease. Clinical signs include pain, lameness, paresis, thickening of bones (fibrous osteodystrophy), and pathologic fractures. Radiographs will document the abnormal calcification of the cortical bone. Treatment involves correction of the dietary deficiencies, fluids, parenteral vitamin D, and calcium supplementation. Calcitonin has been utilized in reptile MBD and may be considered in treatment of sugar gliders. The calcitonin hormone speeds the deposition of calcium into the bones. The serum calcium should be checked prior to the use of calcitonin because the deposited calcium will be pulled from the serum. A dose of 50 IU/kg weekly for 3 treatments has been utilized.

Flagellate protozoa parasites have been found in a high number of sugar gliders. This is more so in the wild caught species. Metronidazole has been proven safe and effective in

eliminating this parasite. A fecal flotation and direct exam should be performed on new patients and then annually thereafter.
Bacterial enteritis is routinely diagnosed in poorly managed sugar gliders. Animals that are maintained on an inadequate diet and under constant stress (ex. Excessive handling, inappropriate closure, and temperature fluctuations) will present with a watery diarrhea. When these animals are presented they are often severely dehydrated and emaciated. A CBC, fecal float, and fecal culture & sensitivity should be performed. The sugar glider should be provided supportive care and enrofloxacin (5 mg/kg PO BID). Salmonella is routinely cultured from the feces and clients should be educated on the zoonotic potential.

Preventive Heath Care Program
Client education is the most important key to maintaining a healthy sugar glider. It is essential for proper execution of all other components. Combinations of written, spoken and visual aids are necessary for adequate retention or information. Information about housing, nutrition, sanitation, behavior, and health care should be given to each client. With sugar gliders, some this information will need to be updated with each visit as we learn more about this species.
Nutrition is key to keeping any animal healthy and with exotic animal, where formulated diets are not available; the task is much more difficult. Common sense is important. A diet that would be balanced for more familiar species will not be for sugar gliders.
Parasite control should not be overlooked. Fecal samples should be checked once or twice annually and any parasites treated.
Early detection and treatment of disease is critical. Small "prey" species try to hide any signs of illness or weakness as a mechanism to prevent predation. In captivity, this trait leads to presentation late in the course of the disease. A sugar glider that looks sick is often very sick. A "wait and see what happens" approach is very dangerous in exotic animals. Rapid diagnosis and treatment is essential.