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Veterinary / Exotic and Laboratory Animals / Rodents

Chinchillas

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Chinchillas are slender-bodied, medium-size rodents with short forelimbs and long muscular hindlimbs that give the animal a rabbitlike appearance. The head, eyes, and ears are relatively large, and the bullae are greatly expanded. Chinchillas have long gestation periods and deliver fully furred young with open eyes.

In the wild, chinchillas live in relatively barren areas of the Andes of Northern Chile at elevations of 3,000–5,000 m. Chinchillas live in burrows or rock crevices but are well adapted for running. They dust bathe, are vegetarian, and are active throughout the year. They are gregarious, living in groups of several hundred. All domestic (USA) chinchillas are descendants of 13 individuals brought to the USA in 1927.

Biology

Chinchillas come in a variety of colors. The original chinchilla fur color in the wild was mottled yellow-gray. Through selective breeding, the most common color seen is dark blue grey (the dominant fur color). Other colors have emerged and include the dominant colors of beige, white, and ebony, and the recessive colors of sapphire, violet, charcoal, and velvet. Eye color may be black, pink, or red due to fur color genes.

Ten different sounds comprise the vocal repertoire of chinchillas, depending on the behavioral context. Different sounds are made during exploratory behavior, predator avoidance, sexual behavior, and social behavior, including social contact and agonistic (defensive and offensive) behavior. In addition, chinchillas can raise and lower the tones of the calls they make. All chinchillas have a similar cry that is used commonly from birth.

The female chinchilla has an estrous cycle of 38 days. Females are seasonally polyestrous, and the breeding season is November to May in the northern hemisphere. The gestation period averages 111 days. Generally, the female will have two litters a year with 1 to 6 young (average 2) per litter. Young become sexually mature at 8 mo of age. Chinchillas have a long life span, reported to be up to 20 yr.

Sexing chinchillas (and guinea pigs) can be difficult. In females, a vaginal closure membrane seals the vaginal orifice at all times except estrus and parturition. The vaginal orifice is U-shaped and situated between the anus and the mound-shaped urethral orifice. It is difficult to distinguish when closed and is indicated by a slightly raised, semicircular area. When its closure membrane covers the vaginal orifice, the urethral orifice can be mistaken as a genital opening. The well-developed clitoris of female chinchillas (and guinea pigs) can be manually extruded through the urethral orifice and mistaken for a penis. The vagina is open during estrus. During these times, the vaginal closure membrane dissolves and then repairs. During estrus, there is no vulval swelling. Instead, the perineum changes color, going from a dull pink to a deep red. The perineal color increases dramatically at the time of vaginal perforation and remains intense throughout most of the luteal phase of the estrous cycle.

Male chinchillas do not have a true scrotum. The testes are contained within the inguinal canal or abdomen, and two small, moveable scrotal sacs are next to the anus, into which the caudal epididymis can drop. The external appearance of the scrotal sacs is similar to the nonpendulous scrotum of pigs and cats. The penis is readily apparent below the anus, from which it is separated by an expanse of bare skin. The penis can be manually extruded 1–2 cm when flaccid. The tip of the erect penis extends to the level of the axilla, a distance of ~11 cm.

As with other rodents, the anogenital distance gives the best initial indication of the animal's sex. In males, the anogenital distance is greater. Extrusion of the penis from the urethral orifice will confirm the sex of the chinchilla, as long as the clitoris is not mistaken for a penis. There are two major differentiating features: the penis is significantly larger than the clitoris, and the extruded penis can be separated and distinguished from the prepuce (whereas the extruded clitoris tends to evaginate, and the clitoral prepuce is not apparent).

Husbandry

Chinchillas are very tolerant of cold but sensitive to heat. The ambient temperature range to which chinchillas are adapted is 65°–80°F (18.3°–26.7°C). Exposure to higher ambient temperatures, especially in the presence of high humidity, can result in heatstroke. A good general rule is to add the unit values of the temperature (Fahrenheit) and humidity, and consider any value >150 to be dangerous. For example, 85°F + 65% humidity = 150. Chinchillas will develop matted fur if kept in a warm (>80°F [26.7°C]), humid environment.

Chinchillas are easily housed in either wire mesh-bottom or solid-bottom cages, although solid-bottom cages are recommended for pregnant females about to have young. Wire mesh spacing in cages should be narrow, because tibial fractures commonly occur in young chinchillas that catch a hindleg in wide floor mesh grating. Chinchillas are shy animals and need a place to hide when in captivity. In the wild, chinchillas conceal themselves in rock crevices. Polyvinyl chloride (PVC) plumbing pipes, especially elbow, Y, and T sections, make ideal hiding places. The pipes should be 4–5 in. in diameter and are easy to sanitize by placing in a dishwasher.

Because chinchillas have a habit of dust bathing, a box containing a mixture of silver sand and Fuller's earth (9:1), 2–4 in. deep should be placed in the cage daily. Dust baths should be provided for ~30 min/day. If dust baths are left in the cage for long periods, they become soiled with feces. When chinchillas do not have access to a dust bath in captivity, the fur becomes matted from oily secretions. Dust bathing often causes irritation of the eyes, resulting in conjunctivitis without associated clinical signs of upper respiratory infection. Excessive dust bathing has been reported to result in pulmonary epithelial hyperplasia and granulomas.

Chinchillas have a high requirement for dietary fiber. Their diet should mainly consist of high-quality grass hay. Pelleted chinchilla diets are commercially available and should be used to supplement the diet. Guinea pig or rabbit pelleted diets have also been used successfully to supplement the diet. Like rabbits and guinea pigs, chinchillas produce two types of fecal pellets: one nitrogen-rich intended for cecotrophy, and one nitrogen-poor delivered as fecal pellets.

Urinary calculi, urolithiasis, metastatic renal calcification, and nephritis are reported occasionally. Calculi are typically composed of calcium carbonate. Such conditions are often associated with feeding a diet high in calcium

and low in phosphorus, such as alfalfa hay.

Polygamous breeding colonies are common among chinchilla ranchers, and a system of individual female housing has been devised that allows a single male to serve 12 females. A variety of breeding techniques have been used successfully, and mating is facilitated by observing changes in the vaginal closure membrane and performing vaginal cytology. Pregnant females do not make a nest.

Chinchillas possess well developed and anatomically elaborate male accessory reproductive glands. The secretions from these glands form a hard plug that remains in the female tract after copulation. In chinchillas, the vesicular gland provides the bulk of the accessory gland secretions, and the fluid hardens or gels when mixed with prostatic secretions. A 2–3 in. long, 1-in. diameter, irregularly shaped, firm, waxy plug is often found in the female's cage after mating.

Physical Examination

The chinchilla's overall appearance and behavior should be noted. Sick chinchillas may show weight loss, hunched posture, abnormal gait, scruffy fur, or labored breathing. They may be lethargic or unresponsive to stimulation. Chinchillas should be handled calmly and gently to minimize stress. Docile, nonpregnant animals can be removed from a cage by grasping and lifting the base of the tail while using the opposite hand to support the body. Routine restraint can be accomplished by wrapping a towel around the body. Small chinchillas may be grasped gently around the thorax, taking care not to restrict breathing. Pregnant females should not be handled unless necessary. Pregnancy is detectable by palpation at 90 days gestation and may be determined by regular weighing. By day 42 of gestation, weight gain in pregnant chinchillas will increase rapidly.

A protective reaction in chinchillas known as fur slip results in the release of a large patch of fur, revealing smooth, clean skin underneath. It may also occur with improper handling, fighting, or situations that overexcite a chinchilla. The fur can take several months to regrow and frequently is a different shade. To prevent fur slip, chinchillas should always be handled gently with minimal stress.

Infectious Diseases

Nearly all significant reports on infectious diseases of chinchillas over the past 60 yr come from colonies of chinchillas raised for fur, and most reports of bacterial disease in colonies are ≥30 yr old. Reviews of chinchilla disease often give the false impression that these animals are highly susceptible to infectious disease. However, the incidence of infectious disease in pet chinchillas is low.

Bacterial Infections:

Historically, *Pseudomonas aeruginosa* infections, yersiniosis, and listeriosis occurred frequently among fur-ranched chinchillas. Estimates of fur-ranched chinchilla numbers in the USA in 1954 were >100,000 animals. By the mid-1960s, these numbers were reduced significantly to only a few thousand. Reports since 1980 of yersiniosis and listeriosis in chinchillas come almost exclusively from fur-ranched chinchillas in Hungary, Poland, Slovakia, and Croatia. These four European countries supply almost 50% of the 200,000 chinchilla pelts produced annually worldwide.

Opportunistic bacterial infections in chinchillas can cause disease, localized either to one organ or as septicemia. Affected animals usually are immunocompromised by age, underlying disease, nutritional status, or husbandry-related factors (eg, poor hygiene, poor ventilation, contaminated feed). Members of the family Enterobacteriaceae and *P aeruginosa* have been associated with significant morbidity and mortality in chinchillas. However, Enterobacteriaceae and *P aeruginosa* can also be isolated from clinically healthy animals. Therefore, most of these organisms are not considered primary pathogens.

P aeruginosa infections in pet chinchillas and epizootic outbreaks in fur-ranched chinchillas are the most frequent bacterial diseases reported. Initially, the infection is usually localized to one organ and can be associated with conjunctivitis, enteritis, pneumonia, otitis media and interna, metritis, and abortion. As the infection progresses, systemic spread is common. An acute generalized form with septicemia and sudden death can occur. *P aeruginosa* can be part of the normal intestinal flora in healthy chinchillas and has been isolated from 40% of healthy chinchillas. Stress, concurrent disease, or contaminated drinking water predispose to infection and clinical disease. Conjunctivitis is a common initial sign of *Pseudomonas* infection in chinchillas. Anorexia, lethargy, and decreased fecal output often follow. Characteristic pathologic lesions are miliary necrosis in the internal parenchymal organs and a necrotizing typhlocolitis. Strains of *P aeruginosa* that are multidrug resistant have reduced antibiotic susceptibility and are highly virulent and widespread in chinchillas. Antimicrobial drug selection should be based on culture and susceptibility testing. Generally, *P aeruginosa* is susceptible to fluoroquinolones, third-generation cephalosporins, or aminoglycosides. Topical polymyxin B and gentamicin-containing formulations can be used for empiric treatment because of the low prevalence of isolates resistant to these drugs. Multicomponent *P aeruginosa* vaccines (formalin-killed bacteria, endotoxin-associated protein and/or toxoids) have been used in fur-ranched chinchillas with some success. However, they are not suitable for pet chinchillas because of their variable immunity against different *Pseudomonas* strains, limited immune response of 6–8 mo, and adverse reactions at the local injection site.

The causative agents of yersiniosis, *Yersinia pseudotuberculosis* and *Y enterocolitica* occur worldwide in areas of moderate and subtropical climate, and outbreaks in fur-ranched chinchillas are described. *Y enterocolitica* is the species most frequently isolated from chinchillas. Yersiniosis is an enteric disease that damages epithelium of the ileum, cecum, and colon, resulting in mucosal hemorrhage and ulceration. Lymphoid infiltration results in hypertrophy of Peyer's patches and mesenteric lymph nodes and necrotizing granulomas. Systemic spread results in granulomatous lesions in the lungs, spleen, and liver and death. A chinchilla-type strain of *Y enterocolitica* (biovar 3, antigens or serovar 1, 2a, 3) persists enzootically among chinchilla stock worldwide.

Listeriosis is common in fur-ranched chinchillas but has not been reported in pet chinchillas. The original scientists who described listeriosis in chinchillas claimed that chinchillas are highly susceptible to infection with *Listeria monocytogenes*. It has not been proved, but unfortunately, this claim is often repeated. *L monocytogenes* is an environmental bacterium capable of existing both as an animal pathogen and plant saprophyte. Most cases of listeriosis in animals arise from ingestion of contaminated food, and the disease is common in animals, including chinchillas, fed on silage. Listeriosis is a cecal disease in chinchillas with bloodborne dissemination. The main target organ is the liver, where the bacteria multiply inside hepatocytes. Early recruitment of polymorphonuclear cells lead to lysis of hepatocytes, bacterial release, septicemia, and, in surviving hosts, development of lung, brain, spleen, lymph node, and liver abscesses.

Other recorded infections in chinchillas include clostridial enterotoxemia, salmonellosis, and *Klebsiella* infection. Affected animals display nonspecific septicemic signs such as loss of appetite, respiratory distress, and diarrhea and die within a few days after onset of clinical signs. *Salmonella* epizootics characterized by gastroenteritis and abortion are reported in fur-ranched chinchillas. Case reports of *Salmonella* infection in pet chinchillas have been linked to the presence of pet reptiles or wild birds.

Viral Infections:

There are no species-specific viral diseases described for chinchillas. Chinchillas are susceptible to human herpesvirus 1 (HSV-1) and may play a role as a temporary reservoir for human infections. Two case reports exist that describe spontaneous, herpeslike viral infection in chinchillas. Affected animals displayed conjunctivitis and subsequently showed neurologic signs of seizures, disorientation, recumbency, and apathy. Nonsuppurative meningitis and polioencephalitis with neuronal necrosis and intranuclear inclusion bodies were found on histologic examination. In addition, the eyes displayed ulcerative keratitis, uveitis, retinitis and retinal degeneration, and optic neuritis. The clinical signs, distribution of lesions, and the viral antigen suggest HSV-1 is a primary ocular infection with subsequent spread to the CNS in chinchillas.

Parasitic Infections:

Protozoa:

Historically, group-housed chinchillas in fur ranches and research colonies had a high prevalence of giardiasis. However, the role of *Giardia duodenalis* (synonym *G lamblia*) in causing disease in chinchillas is difficult to establish. *Giardia* is rarely found in fecal samples from wild chinchillas, and healthy chinchillas can harbor *G duodenalis* organisms in low numbers in the small intestine. Experimental infection of healthy chinchillas with *Giardia* cysts failed to induce clinical disease. Predisposing factors, such as stress and poor husbandry, are believed to cause an increase in parasite numbers, resulting in diarrhea and potentially death. Recently weaned animals seem prone to developing clinical signs. Signs of giardiasis in pet chinchillas can include a cyclic sequence of appetite loss and diarrhea, associated with declining body and fur condition. Chinchillas with giardiasis can be treated with metronidazole, albendazole, or fenbendazole. Whether these compounds eradicate *Giardia* cysts completely or only inhibit cyst production is unknown; therefore, treated animals may remain a source of chronic cyst shedding. To prevent reinfection, all animals in contact with infected individuals should be treated, and the environment should be thoroughly disinfected. Wooden cage interior parts such as resting boards should be discarded. *Giardia* cysts remain infectious for up to several weeks in a cool, humid environment.

Toxoplasmosis was commonly found in fur-ranched chinchillas but is now rarely seen. Necropsy lesions include hemorrhagic lungs, an enlarged spleen, and enlarged mesenteric lymph nodes. Chinchillas may also develop focal necrotic meningoencephalitis due to *Toxoplasma gondii*.

Other protozoan infections include *Eimeria chinchilla*, which is seen in fur-ranched chinchillas. Single case reports described in pet chinchillas include hepatic sarcocystosis, *Cryptosporidium* spp gastroenteritis, and *Frenkelia* spp meningitis.

Cestodes and Nematodes:

Pet chinchillas have a low prevalence of nematode and cestode infections. Outbreaks of cerebral nematodiasis caused by the raccoon ascarid *Baylisascaris procyonis* are reported in chinchillas housed outside in high northern American climates. An orbital cyst due to *Taenia coenurus* has been reported in a pet chinchilla with exophthalmos.

Fungal Infections:

There are two reports of *Histoplasma capsulatum* infection in chinchillas. At necropsy, there was pulmonary hemorrhage, bronchopneumonia, and pyogranulomatous splenitis and hepatitis, with the organism seen in numerous giant cells. *H capsulatum* was cultured from timothy hay used for food.

Dermatophytosis is uncommon in chinchillas. *Trichophyton mentagrophytes* is the dermatophyte most commonly isolated, although *Microsporum canis* and *M gypseum* have been incriminated in outbreaks of spontaneously occurring dermatophytosis. Infected chinchillas show small, scaly patches of alopecia on the nose, behind the ears, or on the forefeet. Lesions may appear on any part of the body, and in advanced cases a large circumscribed area of inflammation with scab formation occurs. Although most mycologic studies of chinchillas are based on animals with clinical signs, fungal cultures of fur-ranched chinchillas show a 5% incidence of *T mentagrophytes* in animals with normal skin and a 30% incidence in animals with fur damage.

Diagnosis of dermatophytosis is based on appearance of lesions and isolation of the causative agent by using dermatophyte test medium (DTM). Wood's lamp examination is rarely helpful, because most cases are caused by *T mentagrophytes*, which does not fluoresce under ultraviolet light. Treatment consists of either itraconazole (10 mg/kg/day, PO) or terbinafine (30–40 mg/kg/day, PO) for 4–8 wk. Dermatophytosis is contagious to people and other animals.

Metabolic and Nutritional Disorders

Systemic disease or painful conditions may result in secondary GI problems with nonspecific clinical signs such as anorexia, decreased fecal production, and lethargy. Identifying the underlying cause is critical to improve the outcome and reduce chance of recurrence. The initial diagnostic evaluation should consist of whole body radiographs, fecal parasite examination, fecal cytology, and fecal culture for enteric opportunistic pathogens (eg, *E coli*, *P aeruginosa*). Urinalysis, plasma biochemical analysis, and a CBC help to diagnose non-GI and coexisting metabolic disorders (eg, hepatic lipidosis, ketosis, renal disease) to determine prognosis and therapy. In addition to specific treatment for the primary underlying GI disorder, general treatment guidelines include replacing fluid deficits and maintaining normovolemia by parenteral and enteral fluid therapy, nutritional and caloric support, and analgesia (buprenorphine 0.03–0.05 mg/kg, SC, tid) if a painful condition is suspected.

Cheek tooth crown and root abnormalities are common in chinchillas. Abnormalities related to subclinical dental disease have been reported in one-third of apparently healthy chinchillas presented for routine physical examination. Nutritional (eg, less abrasive diet in captivity) and genetic causes have been proposed as predisposing factors for development of dental disease. Tooth elongation and its secondary complications, affecting the reserve or the clinical crown or both, are the underlying cause of most clinical signs. Chinchillas are often able to eat and maintain good body condition until severe complications such as soft-tissue trauma from sharp dental spikes or periodontal abscessation have developed. A history of reduced food intake, changed food preferences toward more easily chewed feed items, weight loss, reduced fecal output, saliva-stained skin and fur with crusting and alopecia of the perioral area, wetting and crusting of the chin ("slobbers") and forefeet, epiphora, poor fur condition, and fur chewing are indicative of dental disease. On clinical examination, palpable irregularities of the ventral borders of the mandible and overgrown or irregular occlusal surfaces of the incisor teeth may be found.

A thorough examination of the oral cavity under general anesthesia is required, because 50% of intraoral lesions can be missed when examining the mouth in a conscious chinchilla. Endoscopic-guided intraoral examination is the preferred method. Cheek teeth often show coronal elongation, formation of sharp spikes buccally on the edges of the occlusal surfaces, and widened interproximal coronal spaces containing feed and fur. Loss of tooth substance or brown discoloration of occlusal and interproximal tooth surfaces is often seen. Erosions of the buccal mucosa, gingival hyperplasia, and gingival pocketing are common secondary findings. Radiography is a helpful tool to check tooth position and overgrowth of the roots. CT scans of the skull are useful in early diagnosis of malocclusion.

The prognosis for chinchillas with dental disease depends on the severity of disease, the animal's general condition, and owner compliance. Repeated intraoral examinations and treatments under general anesthesia are necessary to control complications and to maintain an acceptable quality of life for the animal. Treatment consists of removing spikes, reducing elongated crowns, and removing impacted debris in gingival pockets. Instilling doxycycline gel in deep gingival and periodontal pockets reduces periodontal inflammation. Animals with significant periodontal infection can be treated with penicillin G benzathine (50,000 IU, SC, every 5 days). Extraction of cheek teeth should be limited to severely diseased and mobile cheek teeth. Analgesia is essential after any dental procedure (buprenorphine 0.03–0.05 mg/kg, SC, tid; meloxicam 0.3–0.5 mg/kg, PO or SC, once or twice daily). Chinchillas in advanced stages of dental disease should be fed soft, leafy grass hay, vegetables, moistened pellets, and "critical-care" formulas offered on a dish.

Chinchilla anatomy precludes the ability to vomit. Choking may be observed when the entrance to the trachea is occluded by a large piece of food or bedding or in postpartum females that eat their placentas. Aspiration of tiny particles from the foreign body can irritate the lower respiratory tract and precipitate a suffocating, edematous response leading to drooling, retching, coughing, and dyspnea as the chinchilla attempts to dislodge the foreign body. If untreated, choking may lead to asphyxiation and death. Megaesophagus, which leads to regurgitation and aspiration pneumonia, is described. Affected chinchillas show recurring pneumonia despite treatment. Contrast radiographs are used for diagnosis.

Gastric ulcers are common in young chinchillas and are frequently caused by feeding coarse, fibrous roughage or moldy feeds. Clinically affected animals may be anorectic or asymptomatic. Lesions may only be noted at necropsy, with gastric mucosal ulcers and erosions covered by thick, black fluid. Prevention includes decreasing dietary roughage and feeding a commercial pelleted diet.

Bloat, or tympany, can result from sudden dietary changes, especially overeating. Bloat has been reported in lactating females 2–3 wk postpartum and may be related to hypocalcemia. Gas production from the bacterial flora in static bowel loops rapidly accumulates within 2–4 hr. Affected animals are lethargic and dyspneic, with a painful, distended abdomen. They may roll or stretch while attempting to relieve their discomfort. Treatment may require passage of a stomach tube or paracentesis to relieve gas build-up. Lactating females may respond favorably to calcium gluconate administered IV slowly to effect.

Diarrhea and soft feces are common. Besides infectious causes (eg, parasites, bacteria), inappropriate feeding of fresh green feed high in simple carbohydrates or sudden changes in diet will result in dysbacteriosis and cause soft feces. Owners may describe feces smeared on the cage resting board and the presence of fecal-stained perianal fur. On clinical examination, the chinchilla may show no signs or, in severe cases, be anorectic, dehydrated, and depressed. Infectious causes are excluded based on the history and by appropriate diagnostic testing. Systemic parenteral antimicrobial therapy (enrofloxacin 10 mg/kg, SC, diluted bid) should be used to treat predominately gram-negative opportunistic pathogens in chinchillas with severe dysbacteriosis, when an infectious cause is suspected but unconfirmed, or when the animal is in a compromised general condition. Oral drug administration should be avoided, because absorption and effectiveness of oral drugs are decreased when GI function is abnormal. Once an animal is eating and GI function is improved, the oral route can be used. Intestinal secondary yeast overgrowth, caused by *Cyniclomyces guttulatus* (previously *Saccharomycopsis guttulata*) that lines the stomach, is often seen in chinchillas with soft feces. However, increased numbers of this yeast in chinchillas is considered secondary, rather than a cause, promoted by an underlying gastroenteric disease process.

Constipation is more common than diarrhea. Chinchillas may strain to defecate and produce no fecal pellets or have a reduced output of smaller, thin, hard fecal pellets that may be stained with blood. Abdominal palpation reveals firm cecal ingesta and a tense abdomen. Intestinal intussusception is a critical differential diagnosis for absence of fecal pellets. A sudden change in diet, an inappropriate diet of insufficient dietary fiber and roughage, or infectious causes can result in dysbacteriosis, gastroenteritis, ileus, and consequently constipation. Dehydration, anorexia, dental disease, and uterine compression in gravid females may also result in constipation. Chronic cases may lead to rectal prolapse, intestinal torsion, cecal impaction, or colonic flexure. To provide relief, the GI tract should be rehydrated. Enteral fluid therapy (100 mL/kg/day, PO, divided into 4–5 doses) will stimulate the gastrocecal reflex and rehydrate dehydrated ingesta. Chinchillas with abdominal pain may resist enteral fluid therapy, and buprenorphine (0.03–0.05 mg/kg, SC, tid) and parenteral fluid therapy will be required.

Pathologists often see fatty liver without clinical signs or other histologic lesions in routine necropsies of chinchillas. This is most likely due to prolonged anorexia before death.

A few cases of apparent type II diabetes mellitus have been described in overweight chinchillas. Clinical signs may include poor appetite, lethargy, and weight loss. Diagnosis is based on a history of polydipsia and polyuria, hyperglycemia (≥200 mg/dL), and glucosuria. Chinchillas and other hystricognath rodents (eg, guinea pigs, degus, tuco-tucos) are unusual in that their insulins exhibit a very low biologic potency relative to pig insulin, yet the receptor-binding affinity is significantly higher, indicating that the efficacy of their insulin on receptors is ~2-fold lower than that of pig insulin. Hypoglycemia is always a great risk when treating diabetes with recombinant human insulin or porcine insulin. Treatment involves reducing obesity and feeding a diet high in protein, low in fat, and high in complex carbohydrates.

Traumatic Injuries

The predator avoidance mechanism known as fur slip, in which a chinchilla releases a large patch of fur, thus enabling it to escape, should not be confused with the vice of fur chewing. Chinchillas may chew each other's fur, resulting in a moth-eaten coat. Clinically, hair loss is seen along the shoulders, flanks, sides, and paws. The affected areas appear darker because the underfur is exposed. Mothers often transmit the vice to offspring. The higher incidence of fur chewing in commercial herds may be evidence of maladapted displacement behavior. Some clinicians claim affected chinchillas suffer from malnutrition and chew their fur for dietary requirements. Multiple food factors are probably involved in this type of malnutrition, and the exact cause requires further dietary studies.

During breeding, bite wounds that abscess are often seen in group-housed animals. Culture of the abscesses often yields *Staphylococcus* spp. Female chinchillas are larger than males and more aggressive. They are highly selective in their choice of males for mating and will keep "unsuitable" males at bay by urination, kicking, and biting. Bite wounds often result in the loss of pieces of ears and toes. Older females commonly kill a young male housed in the same cage.

The chinchilla's large, delicate ear pinnae are easily traumatized, most often from bite wounds. Therapy includes cleaning the traumatized area and applying topical antibiotics. Suturing large ear lacerations is usually not effective and not recommended. If damage is severe, ear tissue may require significant debridement or partial surgical removal. Trauma can result in rapid hematoma development, with blood and serum filling the space between skin and cartilage. Hematomas should be lanced, and contents gently removed to avoid further damage to the ear. The skin over the hematoma must remain in contact with the underlying cartilage and should be immobilized by sutures if necessary.

Traumatic fractures of the tibia are commonly seen and associated with the animal catching its hindlimb in a cage bar. The tibia is a straight bone longer than the femur, with little soft-tissue covering; the fibula is virtually nonexistent. Tibial fractures are either transverse or short spiral and generally are associated with bony fragments. Tibias of chinchillas are thin and fragile, and surgical repair can be difficult; complications are common. Soft,

padded bandages and lateral splints usually do not provide adequate stability for tibial fractures to heal. External fixation and intramedullary pins, alone or in combination, have been recommended for surgical stabilization of tibial fractures in chinchillas. Restricted exercise in a single-level enclosure, ideally without cage bars, is necessary. The prognosis for tibial fractures is guarded, and complications after surgical fixation are common and include bone-pin loosening and infection, nonunion, necrosis of the distal limb, and self-mutilation. Hindlimb amputation should be considered if surgical fracture stabilization fails or is not indicated. Chinchillas usually adapt very well after amputation.

Reproductive and Iatrogenic Disorders

In chinchillas, the fine structure of the interhemal membrane of the placental labyrinth is hemomonochorial, consisting of a single layer of syncytial trophoblasts. In this respect, the placental labyrinth is similar to that of the guinea pig, another hystricognath rodent. Female chinchillas may experience an unusual puerperal disorder of trophoblastic emboli, resulting in pulmonary embolism.

Chinchillas usually give birth early in the morning and only rarely after midnight. Dystocia is usually associated with the presentation of a single, oversized fetus or malpresentation of one or more kits. Uterine inertia has also been reported as a cause of dystocia. Chinchillas respond well to cesarean section.

Male chinchillas that groom excessively frequently produce small amounts of urine or strain to urinate; repeated cleaning of the penis may mean the animal has a fur ring. This is a ring of hair around the penis and under the prepuce that eventually stops the penis from going back into the prepuce. In severe cases, an engorged penis is seen protruding 4–5 cm from the prepuce, resulting in paraphimosis. This painful condition may cause urethral constriction and acute urinary retention. Chronic paraphimosis may culminate in infection and severe damage to the penis, affecting breeding ability. Getting fur from a female during copulation is the most common cause of fur ring. However, the fur may come from other males or the same animal, because the condition is also seen in group-housed and single-housed males not exposed to females. Males should be examined for fur rings at least four times a year; active stud males should be examined every few days. In some male chinchillas, the penis will hang out of the prepuce all the time and is not engorged. In these cases, the condition is not caused by fur-ring but by excitement brought on by separation from a mate or exhaustion because of too many females in the same cage. Fur rings can be cut or gently rolled off the penis after applying a sterile lubricant. Occasionally, sedation or anesthesia may be required to remove the fur ring.

Neoplastic Disorders

Despite a life span reported up to 20 years, references on neoplasia in chinchillas are rare. Postmortem examinations of 1,005 fur-ranched chinchillas before 1949 and another 1,000 fur-ranched chinchillas ranging in age from <6 mo to 11 yr between 1949 and 1952 did not list neoplasia as a cause of death. Between 1994 and 2003, 325 chinchillas were presented for clinical investigation at a major university veterinary hospital. Tumors were diagnosed in only three animals (1%). During the same period, the incidence of neoplasia was higher in rabbits and rodents than in chinchillas (guinea pigs, 7%; rats, 34%; and rabbits, 6%). Single reports of tumors in chinchillas include neuroblastoma, carcinoma, lipoma, hemangioma, malignant lymphoma, hepatic carcinoma, and lumbar osteosarcoma.

Miscellaneous Disorders

Age-related Disorders:

Aged chinchillas may develop posterior cortical cataracts and asteroid hyalosis.

Cardiac Disease:

Heart murmurs ranging from mild to moderate are often heard in young chinchillas. Reports of cardiac disease in chinchillas are scarce, and the significance of heart murmurs in young, clinically healthy chinchillas remains unknown. There have been anecdotal reports of cardiomyopathy, ventricular septal defect, and mitral and tricuspid valve insufficiencies. Echocardiography is used to differentiate innocent from pathologic murmurs.

Foot Disorders:

Foot disorders predominantly affect the hind feet. Lesions can include hyperkeratosis and erythema; less commonly, deep infections or open lesions of the plantar aspect of the feet can develop. In mild cases, environmental improvements and application of glycerin or petroleum-based ointment often resolve the hyperkeratosis and erythema. In severe cases, lesions are surgically debrided, followed by open-wound management and bandaging until healing is complete.

Zoonotic Risk

The major zoonotic risk from chinchillas is potential transmission of *Giardia*. Studies have indicated the existence of seven genetic groups (or assemblages) within *Giardia*, two of which (A and B) are found in both people and animals, whereas the remaining five (C-G) are host-specific. Most chinchilla infections occur with assemblage B. However, genotyping within assemblages A and B of animal species *Giardia* to determine zoonotic potential has not been done. Therefore, *Giardia*-infected chinchillas could be a potential reservoir of zoonotic transmission.

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