Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Anorexia

BASIC INFORMATION

DEFINITION

Anorexia is a symptom defined by the lack of spontaneous feeding behavior for an abnormal period of time. Weight loss is usually a consequence of lack of nutrients when associated with anorexia.

SYNONYMS

Dysorexia, inappetence, poor appetite, weight loss, cachexia, underweight, reduced body condition

SPECIAL SPECIES CONSIDERATIONS

- Any condition that can lead to pain or that causes discomfort can alter the feeding behavior of guinea pigs.
- Guinea pigs are grazing animals; therefore, high-quality grass hay should always be offered free-choice.
- Guinea pigs digest fibers more efficiently than rabbits and tend to eat more slowly.
- Guinea pigs lack the enzyme L-gluconolactone oxidase that is needed to synthesize vitamin C. Therefore, vegetables rich in vitamin C should be included in the diet.
- Temporary anorexia occurs 12-24 h before parturition in pregnant guinea pigs.

EPIDEMIOLOGY

SPECIES, AGE, SEX

- An apparent wasting syndrome characterized by anorexia, weight loss, and death in 3-4-week-old guinea pigs due to an enteric coronavirus infection has been reported.
- Older female guinea pigs are prone to ovarian cysts, which can lead to anorexia due to abdominal distension and compression of the gastrointestinal (GI) tract.
- Adult guinea pigs fed an inappropriate diet are possibly predisposed to develop acquired dental disease.

GENETICS AND BREED PREDISPOSITION Peruvian and long hair breeds may be predisposed to gastric trichobezoars.

RISK FACTORS

- Vitamin C–deficient diet
- Fiber-deficient diet
- Pregnancy

ASSOCIATED CONDITIONS AND DISORDERS

- Dermatologic conditions (pododermatitis [see Pododermatitis], poor fur condition)
- Dental disease (see Dental Disease)
- Ovarian cysts (see Ovarian Cysts)
- Hyperthyroidism (see Hyperthyroidism)
- Neoplasia

CLINICAL PRESENTATION

HISTORY, CHIEF COMPLAINT

- Reduced appetite
- Weight loss
- Lethargy

PHYSICAL EXAM FINDINGS

- Dehydration
- Cachexia
- Poor fur quality, bilateral alopecia
- Cheek teeth malocclusion
- Incisor malocclusion
- Absence of food in the oral cavity
- Pain during jaw manipulation
- Tachypnea
- Cervical, facial, or abdominal mass
- Abdominal distention
- Abdominal tympany
- Abdominal pain

ETIOLOGY AND PATHOPHYSIOLOGY

- Any stressful or painful condition can prevent normal feeding behavior.
  - Digestive/dietary causes:
    - Dental disease
    - Hypovitaminosis C (see Hypovitaminosis C)
    - GI ileus
    - GI tympany (see Intestinal Disorders)
    - Gastric dilatation and volvulus (see Gastric Dilatation and Volvulus)
    - GI obstruction (e.g., foreign body, neoplasia)
    - Enteritis/dysbacteriosis
  - Nondigestive causes:
    - Dehydration
    - Physical or emotional stress
    - Pain (i.e., arthritis, urolithiasis, otitis media)
    - Urinary disorders (e.g., renal insufficiency, urolithiasis)
    - Respiratory disorders (see Respiratory Tract Disease)
    - Metabolic disorder: ketoacidosis, hepatic lipidosis
    - Neoplasia (e.g., thyroid neoplasia, lymphoma)
    - Infectious causes (e.g., lymphadenitis)
    - Pregnancy

DIAGNOSIS

INITIAL DATABASE

- Full dietary history
- Full environment history
- Full toxin exposure history
- Complete intraoral examination under general anesthesia, preferably endoscopy-guided
- Whole body radiographs: evaluate for disorders of the GI and urinary tracts.
- Urine analysis: hematuria and/or pyuria can occur in patients with hepatic lipidosis, diabetic ketonuria, or aciduria.
- Complete blood count: usually normal, but leukocytosis, anemia, and hemoconcentration may be seen.
- Serum biochemistry: azotemia, increased liver enzymes, hypoglycemia, hyperglycemia, hypoproteinemia, hypoalbuminemia, hyperbilirubinemia may be seen.

ADVANCED OR CONFIRMATORY TESTING

- Abdominal ultrasound to assess:
  - GI tract (gut motility, obstruction)
  - Reproductive and urinary tracts (e.g., ovarian cysts, uterine disease, urolithiasis)
  - Liver
- Hormonal panel: thyroid hormones

TREATMENT

THERAPEUTIC GOALS

- Correct dehydration.
- Alleviate pain.
- Restore gut motility.
- Treat primary underlying disorder (e.g., dental disease, organ disease, neoplasia).
- Restore normal appetite.
- Restore normal body weight and condition.

ACUTE GENERAL TREATMENT

- Fluid therapy
- Nutritional support (unless obstruction is suspected)
  - Syringe feeding
  - Nasogastric tube placement: allow emptying of the air out of the stomach in case of gastric dilatation; always empty air out of stomach before providing enteral nutrition.
- Pain relief
  - Buprenorphine 0.03-0.05 mg/kg SC q 6-12 h
  - Meloxicam 0.3-0.5 mg/kg PO, SC q 24 h (contraindications: dehydration, kidney disease)
- Antibiotics
  - Enrofloxacin 10-20 mg/kg PO, IM, SC, q 12-24 h

  - Chloramphenicol 30-50 mg/kg PO, SC, IM q 8 h
  - Trimethoprim-sulfa 30 mg/kg PO SC q 12 h
  - Metronidazole 20 mg/kg PO q 12 h
- Prokinetics (contraindications: intestinal obstruction or perforation)
  - Rehydration and nutritional support will resolve hypomotility in most cases. The use and possible benefits of prokinetic drugs in guinea pigs are controversial.
  - Metoclopramide 0.2-1 mg/kg PO, SC, IV q 4-6 h
  - Cisapride 0.5 mg/kg PO q 12 h
  - Trimebutine 1.5 mg/kg PO q 8 h
  - Ranitidine: 2-4 mg/kg PO, IM, SC, IV q 8-12 h
- Antifoaming agents
  - Simethicone 70 mg/kg q 1 h × 2-3 treatments
- Vitamin C 50-100 mg/kg PO, SC q 24 h for treatment of deficiencies, 10-30 mg/kg PO for maintenance

CHRONIC TREATMENT

- Treatment of dental disease
- Nonsteroidal antiinflammatory drugs for chronic pain
- Dietary correction
- Vitamin C supplementation

DRUG INTERACTIONS

It has been suggested that administration of cisapride and ranitidine together results in enhanced intestinal contractility. The clinical efficacy of this combined treatment in guinea pigs is unknown.

POSSIBLE COMPLICATIONS

- Hepatic lipidosis
- Hypovitaminosis C
- Sepsis

RECOMMENDED MONITORING

- Activity level
- Appetite
- Fecal output
- Urine output
- Body weight

PROGNOSIS AND OUTCOME

Prognosis is fair to poor depending on the origin.

CONTROVERSY

- The use of prokinetic drugs is controversial, as the clinical efficacy of any of the recommended drugs has not been demonstrated in guinea pigs. The dosages and dosing frequency used are extrapolated from other species. Most guinea pigs with GI stasis will respond to appropriate supportive care, including fluid therapy, analgesia, and nutritional support alone, making the use of prokinetic drugs discretionary.
- Probiotics are sometimes included in the treatment plan.

PEARLS & CONSIDERATIONS

COMMENTS

- After stabilization of the patient and restoration of GI motility, the goal should be to identify and treat the primary underlying cause of anorexia. This will improve the case outcome and reduce the risk of recurrence of clinical signs.
- Experimentally, audiovestibular system diseases (e.g., otitis media, otitis interna) in guinea pigs result in anorexia that has been attributed to central nervous system leptin (an adipocyte peptide involved in regulation of food intake) disturbance.

PREVENTION

- Provide high-quality grass hay.
- Ensure appropriate dietary vitamin C intake.

CLIENT EDUCATION

Discuss the importance of an appropriate diet.

SUGGESTED READINGS

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Theus M, et al: Successful treatment of gastric trichobezoar in a Peruvian guinea pig *(Cavia aperea porcellus)*, J Exotic Pet Med 17:2, 2008.

CROSS-REFERENCES TO OTHER SECTIONS

Cheilitis
Dental Disease
Gastric Dilatation and Volvulus
Hyperthyroidism
Hypovitaminosis C
Intestinal Disorders
Ovarian Cysts
Pododermatitis
Respiratory Tract Disease

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Cheilitis

BASIC INFORMATION

DEFINITION

Cheilitis or inflammation of the lips is a disorder described in guinea pigs. It presents as inflammation and hyperkeratosis of the mucocutaneous junction of the lips.

SYNONYMS

Scabs around the mouth, lip sores

EPIDEMIOLOGY

SPECIES, AGE, SEX

- The disease appears to be specific to guinea pigs.
- There is no sex predilection.
- Affected animals are usually 1 to 5 years of age.

CONTAGION AND ZOONOSIS Guinea pig cheilitis has been suggested to be contagious.

CLINICAL PRESENTATION

HISTORY, CHIEF COMPLAINT

- Nonhealing scabs and ulcers around the mouth of one or more guinea pigs
- Lesions tend to wax and wane over several weeks but never completely resolve.
- Despite the presence of these lesions, affected guinea pigs continue to eat normally in most cases.

PHYSICAL EXAM FINDINGS

- In the early stage of the disease, crusts aggregate at the lip commissures, then eventually spread along the lips and the philtrum.
- Mild form
  - Multiple scabs, particularly on the corners of the lips
  - The guinea pig is still in good health and is eating normally at this stage.
- Severe form
  - Generalized inflammation and scabbing of the lips
  - Lesions may involve the oral mucosa and affect food intake
  - Reduced body condition

ETIOLOGY AND PATHOPHYSIOLOGY

- Etiology unknown, but likely multifactorial
- Coarse, fibrous hay or sharp pieces of pelleted feed may cause trauma to the corners of the mouth, allowing bacteria and fungi to gain entry opportunistically via abrasions.
- Common opportunistic organisms isolated from cheilitis lesions include *Staphylococcus* spp. and *Candida albicans*, among others.
- Nutritional deficiencies have been suggested: vitamins A, B, and C (see Hypovitaminosis C); fatty acid, protein; mineral and trace elements (Mg, Zn, Mn).

DIAGNOSIS

DIFFERENTIAL DIAGNOSIS

- Trauma
- Ringworm
- *Trixacarus caviae*
- Allergic dermatitis

INITIAL DATABASE

- Cytology
  - Impression smears
  - Tape preparations
  - Hair plucks
  - Skin scrapings

ADVANCED OR CONFIRMATORY TESTING

- Histopathologic examination
  - Large colonies of bacteria are often seen in association with the lesions.
  - Infiltration with neutrophils, lymphocytes, and macrophages may be seen.
  - Thickened, hyperkeratotic epidermis
  - Segmental erosions and ulcers
- If clinical signs are mild, histopathologic examination may not be required.

TREATMENT

THERAPEUTIC GOAL

Resolution of lip lesions

ACUTE GENERAL TREATMENT

- Topical therapy
  - 10% povidone-iodine or 0.125% chlorhexidine solution will reduce bacterial and fungal components and improve oral hygiene. Lesions should be gently cleansed twice daily.
    - Crusty exudates should be manually removed from the mucocutaneous junction.
  - Topical ointment
    - Consider wound healing ointments that contain zinc and vitamin A.
    - Consider ointments containing antibiotics and antifungal drugs.
    - Do not use ointment containing bacitracin (e.g., BNP ointment) because it will cause potentially fatal dysbacteriosis.
  - Continue topical therapy (antiseptic cleansing and topical ointment) for 7 days after visual resolution of the lesions. Systemic antibiotics are not necessary in most cases.
- Analgesia: meloxicam 0.3 mg/kg PO q 24 h
- Nutrition and supportive care
  - Ensure adequate vitamin C (100 mg/kg PO q 24 h).
  - Reduce stress and provide a clean, quiet, and comfortable environment.
- Husbandry
  - All food bowls and drinkers should be disinfected. Washing the items in a dishwasher or soaking for 10 minutes in a dilute chlorine solution can achieve this.
  - Wired hutches should be scrubbed with a suitable disinfectant.

CHRONIC TREATMENT

If the guinea pig presents with the severe form of cheilitis, treatment may be required for 3-4 weeks and lesions may recur.

POSSIBLE COMPLICATIONS

- Self-mutilation, subsequent bleeding, and secondary infection of lesions can be avoided by
  - Trimming nails
  - Avoiding coarse hays and other abrasive foods, which may rub against the lip lesions during prehension.

RECOMMENDED MONITORING

- Return for an examination 1 week after initial diagnosis and then again 1 week after resolution of clinical signs.
- If lesions are not responding to therapy, a biopsy should be obtained for histopathologic examination and tissue submitted for bacterial and fungal culture and sensitivity.
- The clinician should warn owners that recurrence of the lesions is possible.

PROGNOSIS AND OUTCOME

Guinea pig cheilitis has a low mortality rate. If the owner focuses on oral hygiene, the prognosis for the affected guinea pig is excellent. Generally, after the appropriate treatment plan is begun, healing of lesions occurs within 2-3 weeks.

SUGGESTED READINGS

Richardson V: Diseases of domestic guinea pigs, Oxford, 2000, Blackwell Publishing, pp 78–79.

Smith M: Staphylococcal cheilitis in the guinea-pig, J Small Anim Pract 18:47–50, 1977.

CROSS-REFERENCES TO OTHER SECTIONS

Hypovitaminosis C

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EDITOR: **CHRISTOPH MANS**

SMALL MAMMALS: GUINEA PIGS

Dental Disease

BASIC INFORMATION

DEFINITION

Disorders affecting the dentition and associated structures

SPECIAL SPECIES CONSIDERATIONS

- Dental formula: 2(I1C0P1M3) = 20
- Incisor teeth and cheek teeth grow continuously throughout life (elodont).
- Incisor teeth and cheek teeth have a long crown (hypsodont) and no anatomic root (aradicular).
- Each tooth can be divided into a *clinical crown* (above the gingival sulcus)

and the *reserve crown* (subgingival part).
- Incisor teeth in guinea pigs are white.
- The ratio of mandibular to maxillary incisor teeth length is 3:1.
- Premolar and molar cheek teeth are anatomically identical in guinea pigs and therefore can be referred to as *cheek teeth 1-4* (CT1-4).
- Guinea pigs have curved cheek teeth, resulting in oblique occlusal planes of about 30 degrees to the horizontal plane.
- The occlusal surface of each cheek tooth is roughened owing to the presence of enamel ridges.
- The presence of food material in the oral cavity is normal in guinea pigs and needs to be distinguished from pathologic food impaction or retention secondary to dental disease.

EPIDEMIOLOGY

SPECIES, AGE, SEX Acquired dental disease is more common in guinea pigs >2 years of age.

GENETICS AND BREED PREDISPOSITION Suspected, but not proven

RISK FACTORS
- Low-fiber diets leading to insufficient wear of continuously growing teeth
- Trauma
- Vitamin C deficiency

ASSOCIATED CONDITIONS AND DISORDERS Exophthalmos, facial abscesses, hepatic lipidosis, diarrhea, weight loss

CLINICAL PRESENTATION

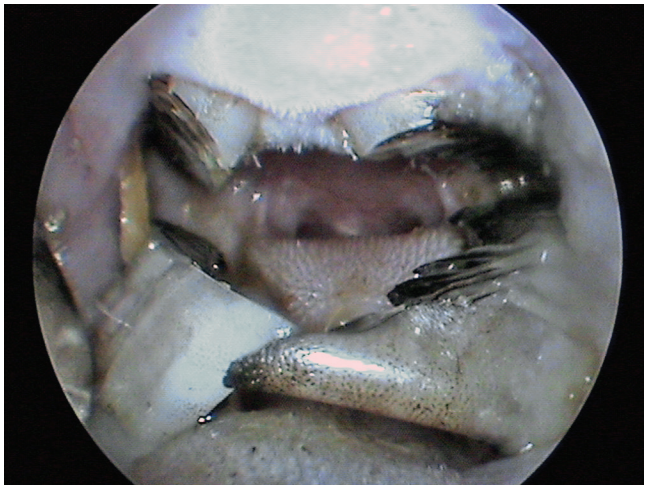
DISEASE FORMS/SUBTYPES
- Incisor teeth disorders
- Cheek teeth disorders
- Periapical abscesses

HISTORY, CHIEF COMPLAINT
- Reduced food intake
- Reduced fecal output
- Weight loss
- Poor coat condition
- Lethargy
- Diarrhea
- Wet or stained fur around the mouth

PHYSICAL EXAM FINDINGS
- General loss of condition
- Poor coat condition
- Lethargy
- Tympany
- Diarrhea
- Small and irregular fecal pellet
- Malocclusion of incisor teeth
- Fractured incisor teeth
- Soiled or wet fur around mouth
- Cheilitis
- Facial abscesses
- Exophthalmia
- Intraoral examination (general anesthesia required)
  - Coronal elongation of cheek teeth (CT)
  - Tongue entrapment secondary to coronal elongation of mandibular CT1-CT2
  - Sharp enamel points or spurs leading to buccal and lingual mucosal erosions and discomfort
  - Change in occlusal surface plane
  - Food impaction

ETIOLOGY AND PATHOPHYSIOLOGY

- Incisor teeth disorders
  - Incisor malocclusion occurs commonly secondary to cheek teeth malocclusion.
  - Trauma (e.g., excessive chewing on cage bars or cage furnishings, iatrogenic)
- Cheek teeth disorders
  - Malocclusion, coronal elongation, and sharp enamel spur formation are currently believed to occur secondary to insufficient tooth wear because of feeding of inappropriate diets.
  - In captivity, diets are often significantly lower in fiber compared with diets of wild guinea pigs. Ingestion of less abrasive food requires less mastication, resulting in less dietary abrasion of the cheek teeth and consequent elongation of clinical and reserve crowns.
  - Other nutritional causes such as abnormal calcium and/or vitamin D metabolism have been suggested but not proven in guinea pigs.
- Periapical abscesses
  - Infections involving the apex will often result in formation of abscesses.
  - Periapical abscesses can become evident as facial swelling or as exophthalmos if infection involves the maxillary cheek teeth (see Intestinal Disorders).



Dental Disease Typical dental appearance of a guinea pig with severe overgrowth of the mandibular cheek teeth. Note the bridging effect, which traps the tongue underneath. Also, note the approximate 30-degree angle of the occlusal surfaces, which is normal in guinea pigs. Oral assessment with an endoscope facilitates the exam significantly.

DIAGNOSIS

DIFFERENTIAL DIAGNOSIS

- Weight loss
  - Systemic disease (i.e., metabolic, infectious, organ failure)
  - Gastrointestinal disease (see Intestinal Disorders)
  - Hypovitaminosis C (see Hypovitaminosis C)
  - Hyperthyroidism
- Diarrhea
  - Gastrointestinal disease
- Anorexia (see Anorexia)
  - Systemic disease (i.e., metabolic, infectious, organ failure)
  - Hypovitaminosis C
  - Pain
- Poor coat condition
  - Ectoparasites
  - Hypovitaminosis C
  - Endocrine disorders (i.e., ovarian cysts, hyperthyroidism)
- Exophthalmia (see Ocular Disorders)
  - Buphthalmia
  - Retrobulbar cyst or neoplasia
- Facial swelling
  - Neoplasia
  - Foreign body–induced abscess

INITIAL DATABASE

- Complete intraoral examination under general anesthesia
  - Endoscopic guided intraoral examination (stomatoscopy) is preferred for a complete intraoral examination.
  - Use magnification and focal illumination if stomatoscopy cannot be performed.

- Imaging
  - Skull radiographs (five views: lateral, left and right oblique, ventrodorsal, rostrocaudal)
- CT scan of head: preferred over skull radiographs
- Fine-needle aspiration and cytologic examination of facial swellings. Aerobic bacterial culture and sensitivity if purulent material is revealed.
- Complete blood count and biochemistry profile may be normal. Rule out concurrent diseases that will affect the prognosis.

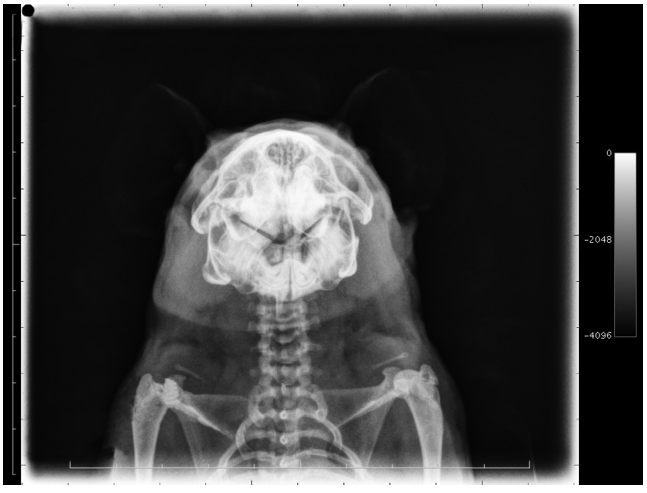
TREATMENT

THERAPEUTIC GOALS

- Resolve intraoral soft tissue trauma and associated pain.
- Restore normal occlusion if possible.
- Recover the animal's ability to eat unaided.

ACUTE GENERAL TREATMENT

- Provide supportive care as needed:
  - Fluid therapy 60-100 mL/kg/d SC, PO, IV
  - Nutritional support: syringe-feed with high-fiber diet for herbivores (e.g., Oxbow Critical Care for Herbivores, 50-80 mL/kg PO q 24 h, divide into 4-5 feedings) or with crushed and soaked pellets
  - Analgesia
    - Buprenorphine 0.02-0.05 mg/kg SC q 6-8 h
    - Meloxicam 0.3-0.5 mg/kg PO or SC q 24 h once adequately hydrated
- Treatment of cheek teeth malocclusion
  - General anesthesia required
  - Specialized equipment required
    - Use low-speed dental drill, a diamond burr, cheek dilators, and a mouth gag.
    - Use appropriate magnification and illumination; preferably, a rigid endoscope or otoscope is used.
  - Avoid iatrogenic damage to soft tissue during dental procedures.
  - Shorten elongated clinical crowns:
    - Remove sharp enamel spurs, which lead to soft tissue trauma buccally and lingually. Maxillary cheek teeth form spurs buccally; mandibular cheek teeth overgrowth often leads to tongue entrapment in guinea pigs.
    - Restore the physiologic oblique occlusal plane, which is about 30 degrees to the horizontal plane, slanting from buccal to lingual.
    - Do not attempt to extract cheek teeth unless severely diseased and severely mobile, secondary to periodontal infection or fracture. Cheek teeth extraction in guinea pigs is technically challenging and often is not feasible clinically.
- Treatment of incisor teeth malocclusion
  - Sedation or general anesthesia required
  - Specialized equipment required
    - Use a low-speed diamond or carbon cutting blade or a high-speed dental drill.
  - Avoid iatrogenic damage to the soft tissue during incisor teeth trimming.
    - Use a tongue depressor or spatula to protect the lips and tongue during trimming.
    - Do not use nail clippers or scissors to trim incisor teeth.
    - Avoid excessive shortening of the clinical crowns because this will lead to temporary functional loss of the incisor teeth. The normal ratio of the length of mandibular to maxillary incisor teeth is 3:1.
- Antibiotic therapy
  - Indicated only if evidence of periodontal or periapical infection exists
  - Periodontal and periapical infections are mixed anaerobic-aerobic infections normally caused by the physiologic oral bacterial flora.
  - Ensure appropriate coverage against anaerobic bacteria.
  - Trimethoprim-sulfa 30 mg/kg PO q 12 h. Combine with metronidazole for improved anaerobic coverage
  - Enrofloxacin 10-20 mg/kg PO q 12-24 h. Combine with metronidazole for anaerobic coverage
  - Metronidazole 20-30 mg/kg PO q 12 h. Combine with trimethoprim-sulfa or enrofloxacin for aerobic coverage
  - Chloramphenicol 30-50 mg/kg PO q 12 h
  - Azithromycin 30 mg/kg PO q 24 h



Dental Disease Rostrocaudal view of a normal guinea pig skull. Note the distinct occlusal plane of visible molar teeth; with overgrown cheek teeth, this line disappears. *(Photo courtesy Jörg Mayer, The University of Georgia, Athens.)*

CHRONIC TREATMENT

- Repeated corrections of cheek teeth and incisor teeth malocclusion under general anesthesia
- Tooth extraction (fractured or severely diseased teeth)
  - Rarely indicated in guinea pigs and technically very challenging
  - Consider referral to a specialist if extractions might be indicated.
- Periapical abscess treatment
  - Several techniques have been reported.
  - Consider referral to a specialist if periapical abscess treatment is necessary.
- Nutritional support
  - Nutritional support: syringe-feed with high-fiber diet for herbivores (e.g., Oxbow Critical Care for Herbivores, 50-80 mL/kg PO q 24 h, divided into 4-5 feedings) or crushed and soaked guinea pig pellets until the animal is eating sufficient amounts of food unaided
- Vitamin C 50-100 mg/kg PO, SC q 24 h for treatment of deficiencies; 10-30 mg/kg PO for maintenance
- Analgesia
- Antibiotic therapy

DRUG INTERACTIONS

- Do not administer cephalosporins, penicillins, erythromycin, or clindamycin orally.
- Do not administer meloxicam to dehydrated animals.

POSSIBLE COMPLICATIONS

- Incomplete extraction of elodont teeth may result in regrowth if germinative

tissue is not completely removed during extraction.
- Iatrogenic damage to the teeth, tongue, or buccal mucosa

RECOMMENDED MONITORING

- Food intake
- Fecal output
- Body weight

PROGNOSIS AND OUTCOME

- Good to fair for animal with no secondary complications and if client is compliant with recommended treatment
- Guarded for periapical abscesses, dependent on location, extent of disease, and animal's general condition
- Poor if animal is in poor body condition or is suffering from systemic disease, or if client is not compliant with recommended treatments

PEARLS & CONSIDERATIONS

COMMENTS

Congenital dental disease is rare in rodents; most dental disease is acquired.

PREVENTION

Provision of an appropriate diet that is high in fiber and allows for appropriate wear of the cheek teeth

CLIENT EDUCATION

- Educate owners about appropriate dietary requirements of guinea pigs.
- Owners must be informed that repeated and often lifelong treatment of dental malocclusion under general anesthesia is required.

SUGGESTED READINGS

Capello V, et al: Small mammal dentistry. In Carpenter JW, et al, editors: Ferrets, rabbits and rodents: clinical medicine and surgery, ed 3, St Louis, 2012, WB Saunders, pp 452–471.

Jekl V, et al: Quantitative and qualitative assessments of intraoral lesions in 180 small herbivorous mammals, Vet Rec 162:442–449, 2008.

CROSS-REFERENCES TO OTHER SECTIONS

Anorexia
Hypovitaminosis C
Intestinal Disorders
Ocular Disorders

AUTHOR: **CHRISTOPH MANS**

EDITOR: **THOMAS M. DONNELLY**

SMALL MAMMALS: GUINEA PIGS

Gastric Dilatation and Volvulus

BASIC INFORMATION

DEFINITION

Acute and generally fatal syndrome in which the stomach fills with gas and fluid, followed by rotation on its mesenteric axis

SYNONYMS

Bloat, gastric tympany, gastric torsion

EPIDEMIOLOGY

SPECIES, AGE, SEX No age or sex association has been reported.

GENETICS AND BREED PREDISPOSITION No breed or genetic association has been identified.

RISK FACTORS Risk factors are unknown. Sudden diet changes and diets high in concentrate (e.g., pelleted diets), as well as gastrointestinal stasis and painful conditions, have been presumed to be possible risk factors.

ASSOCIATED CONDITIONS AND DISORDERS Gastrointestinal stasis, any cause of pain

CLINICAL PRESENTATION

DISEASE FORMS/SUBTYPES Gastric tympany without volvulus

HISTORY, CHIEF COMPLAINT
- Acute onset of depression
- Sudden death
- Reluctance to move
- Abdominal distention
- Inappetence

PHYSICAL EXAM FINDINGS
- Depression
- Painful body posture
- Gas-filled, tympanic cranial abdomen
- Pain may be noted on abdominal palpation.
- Dyspnea
- Cyanotic or pale mucous membrane
- Signs consistent with hypovolemic shock: tachycardia, weak pulses, pale mucous membranes, dyspnea, hypothermia

ETIOLOGY AND PATHOPHYSIOLOGY

- The cause of gastric dilatation/volvulus (GDV) in guinea pigs is not fully understood. Gastrointestinal stasis, pain, or a sudden change in the diet may contribute to development of the syndrome.
- Guinea pigs cannot vomit owing to a well-developed cardiac sphincter. With mechanical or physical outflow obstruction from the stomach, swallowed saliva and gastric fluids quickly accumulate. Fermentation of the stomach content produces a large amount of gas.
- Gastric gas accumulation usually precedes volvulus in guinea pigs.
  - In cases of gastric volvulus, rotation of the stomach on its mesenteric axis from 180 to 540 degrees has been reported.
- Distention of the stomach leads to reduced venous return to the heart by compression of the vena cava and portal veins. The consequences of reduced venous return are decreased cardiac output, decreased arterial blood pressure, and myocardial ischemia. Hypovolemic shock and cardiovascular failure are common consequences.
- Ischemia of the stomach wall due to reduced perfusion predisposes to gastric necrosis and perforation.
- Pressure on the diaphragm leads to reduced ventilation. Reduced cardiac output leads to reduced lung perfusion. Both mechanisms lead to tissue hypoxia.
- Cardiovascular shock can also be caused by endotoxemia.

DIAGNOSIS

DIFFERENTIAL DIAGNOSIS

- Patients with advanced gastrointestinal stasis can mimic clinical signs of GDV.
- Gastric tympany and dilatation without volvulus

- Gastrointestinal obstruction
- Any painful condition can cause depression and reluctance to move. Common painful conditions in guinea pigs are dental disease (see Dental Disease), trauma, urinary calculi (see Urolithiasis), and disorders secondary to hypovitaminosis C (see Hypovitaminosis C).
- Common causes of dyspnea and tachypnea in guinea pigs include pneumonia (see Respiratory Tract Disease), pleural effusion, pulmonary edema, and metabolic acidosis.
- Cardiovascular shock can be caused by hypovolemia, sepsis, or endotoxemia.

INITIAL DATABASE

- Provide supportive care before diagnostic testing if patient is hypovolemic or in shock.
- Abdominal radiographs: large, gas-filled stomach silhouette positioned on the right side of the cranial abdomen. The distended stomach can occupy a large portion of the abdomen. In some cases, the stomach may be displaced caudally with intestines visible cranial to the stomach. Generally, little gas accumulation is noted in the intestine distal to the stomach. Free abdominal gas suggests gastric perforation.
- Complete blood count/biochemistry abnormalities vary with the degree of shock and secondary metabolic and systemic disorders.

ADVANCED OR CONFIRMATORY TESTING

Confirmation of GDV is made by surgical exploration. Because of the poor prognosis associated with GDV in guinea pigs, a thorough discussion with clients should occur before proceeding.

TREATMENT

THERAPEUTIC GOALS

- Stabilize patients in shock and correct hypovolemia.
- Provide analgesia.
- Perform decompression of the stomach and correction of volvulus.
- To date, no successful treatment of GDV in guinea pigs has been reported, and because of the poor prognosis, euthanasia should be discussed with the client.

ACUTE GENERAL TREATMENT

- Place an intravenous or intraosseous catheter. Administer isotonic crystalloids (60 mL/kg/h; 90 mL/kg/h if in shock) to correct hypovolemia. Monitor patient closely during fluid administration.
- Provide oxygen if patient is hypoxemic.
- Opioids are recommended for mediation of visceral pain: buprenorphine (0.03-0.05 mg/kg SC, IM, IV, IO q 6-12 h), hydromorphone (0.1 mg/kg SC, IV, IO q 8 h), and fentanyl (0.5 µg/kg/h CRI IV, IO).
- Gastric decompression can be attempted by orogastric tube or by percutaneous trocarization. Both procedures carry risks. Use a well-lubricated open-ended flexible rubber tube for orogastric intubation. If a tube cannot be passed successfully into the stomach, percutaneous trocarization with a hypodermic needle can be attempted. Percutaneous trocarization carries the risk of stomach rupture.
- Upon patient stabilization and gastric decompression, surgical intervention is indicated. The patient needs to be placed in dorsal recumbence with the cranial part of his body elevated to decrease the pressure of the stomach on the lungs. The volvulus is reduced, and the integrity of the stomach is assessed. In cases of necrosis of the stomach, a gastrectomy could be attempted. To prevent recurrence, a gastropexy is performed by suturing the serosa of the stomach to the abdominal wall. No successful outcome after surgical treatment of GDV in guinea pigs has been reported.

CHRONIC TREATMENT

- Pain management
- Fluid and nutritional support

DRUG INTERACTIONS

- Gastric motility agents (e.g., metoclopramide) are contraindicated in cases of uncorrected GDV but might be indicated after surgical correction.
- Nonsteroidal antiinflammatory drugs (NSAIDs) should be avoided in hypovolemic patients, especially in patients in shock.

POSSIBLE COMPLICATIONS

- Metabolic and electrolyte abnormalities
- Cardiac arrhythmias
- Necrosis of the stomach due to ischemia
- Gastric ulceration
- Gastrointestinal ileus
- Anorexia

RECOMMENDED MONITORING

- Behavior consistent with pain
- Appetite
- Fecal output

PROGNOSIS AND OUTCOME

- The prognosis is poor.
- No reports have described successful treatment of guinea pigs diagnosed with GDV.

CONTROVERSY

In many cases of GDV, guinea pigs die with no prior clinical signs.

PEARLS & CONSIDERATIONS

COMMENTS

- Sudden death and collapse due to cardiovascular failure are common in guinea pigs diagnosed with GDV. Therefore, initial stabilization is critical.
- Correction of hypovolemia should be performed before abdominal radiographs are taken.

CLIENT EDUCATION

Avoid sudden diet changes, as well as diets high in simple carbohydrates and starch.

SUGGESTED READINGS

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Mitchell EB, et al: Gastric dilatation-volvulus in a guinea pig *(Cavia porcellus)*, J Am Anim Hosp Assoc 46:174–180, 2010.

Pignon C, et al: Diagnostic challenge: gastric dilatation and volvulus in a guinea pig, J Exotic Pet Med 19:189, 2010.

CROSS-REFERENCES TO OTHER SECTIONS

Dental Disease
Hypovitaminosis C
Respiratory Tract Disease
Urolithiasis

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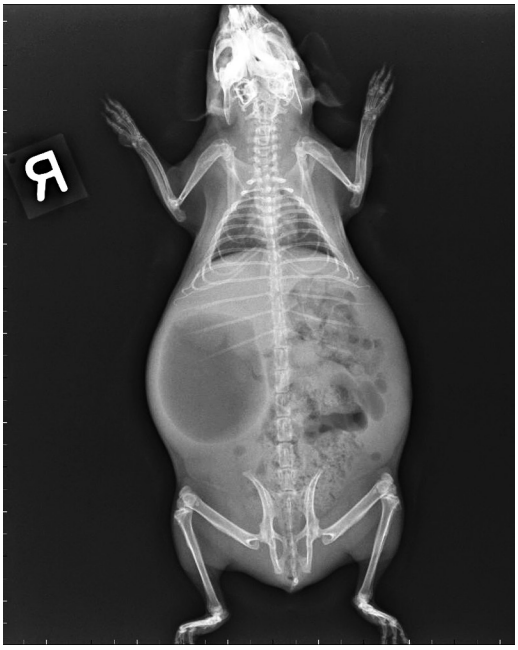

Gastric Dilatation and Volvulus Guinea pig gastric dilatation and volvulus.

SMALL MAMMALS: GUINEA PIGS

Hyperthyroidism

BASIC INFORMATION

DEFINITION

A clinical syndrome characterized by continued excessive secretion of thyroid hormones by the thyroid gland

SYNONYM

Thyrotoxicosis

EPIDEMIOLOGY

SPECIES, AGE, SEX

- Guinea pigs of all ages can be affected, but most cases are seen in patients older than 3 years.
- No sex predilection is known.
- The prevalence of thyroid pathology in guinea pigs in one study was 4.6%.

CLINICAL PRESENTATION

HISTORY, CHIEF COMPLAINT

- Weight loss
- Reduced body condition
- Normal or increased appetite
- Polydipsia and polyuria
- Hyperactivity, nervousness
- Soft feces or diarrhea
- Alopecia

PHYSICAL EXAM FINDINGS

- Poor body condition
- Poor fur condition and alopecia over the dorsum and inguinal area
- Palpable thyroid gland(s)
- Tachycardia, heart murmur, arrhythmia
- Hyperesthesia
- Soft feces or diarrhea

ETIOLOGY AND PATHOPHYSIOLOGY

- Excessive thyroid hormone (thyroxine and triiodothyronine) production and secretion can be caused by thyroid hyperplasia, adenoma, and carcinoma. In one retrospective study, 55% of all thyroid pathologies were adenocarcinomas.
- Excessive circulating thyroid hormones lead to an increase in metabolic rate and exacerbate effects on the sympathetic nervous system.

DIAGNOSIS

DIFFERENTIAL DIAGNOSIS

- Endoparasites can cause weight loss and abnormal soft feces.
- Renal disease can cause polydipsia and polyuria and weight loss.
- Ovarian cysts can cause alopecia and weight loss (see Ovarian Cysts).
- Dental disease can cause weight loss.

INITIAL DATABASE

- Serum biochemistry profile: rule out renal disease
- Serum thyroxine (T_4) measurement: reference range, 1.1-5.2 µg/dL (14.2-66.9 nmol/L)
- Ultrasound examination of the thyroid can be performed to detect any anatomic changes in the gland. Because the location is very superficial, high-frequency transducers (at least 10 MHz) should be used.
- Fine-needle aspiration and cytologic examination of palpable thyroid masses is performed under ultrasound guidance.

ADVANCED OR CONFIRMATORY TESTING

- Nuclear scintigraphy appears to be the most precise diagnostic tool that can be used to document the function of a potentially abnormal thyroid gland.
- Trial therapy of methimazole can be attempted because response to medical treatment is usually very fast and obvious (weight gain, behavioral changes within 48 hours).

TREATMENT

THERAPEUTIC GOAL

Restore normal thyroid hormone levels and eliminate clinical signs.

ACUTE GENERAL TREATMENT

- Hyperthyroidism is a chronic disease. Therefore, urgent acute treatment usually is not required.
- Medical treatment
  - Methimazole 0.5-2 mg/kg PO q 12-24 h: most cases respond to q 24 h dosing
  - Carbimazole 1-2 mg/kg PO q 24 h
  - These drug dosages are extrapolated from feline doses and have been successful in anecdotal cases. The appropriate dose has to be determined by repeat assays of thyroid hormone level and by following the clinical signs.
  - Therapy is expected to be lifelong.
- Surgical treatment
  - Thyroidectomy is potentially curative if the neoplastic thyroid gland is not invading surrounding tissues. Surgery remains technically difficult, and risk of removing the parathyroid glands during the procedure is a concern.
  - Ectopic thyroid tissue may not be removed during thyroidectomy unless radionuclide imaging has allowed presurgical identification.
  - Medical treatment should be initiated several weeks before thyroidectomy is performed.
- Radioactive treatment
  - Iodine-131 (I-131) 1 mCi/animal SC once
  - I-131 is considered the best treatment option in other species for long-term control and possible cure of hyperthyroidism.
  - Special handling facilities and post-therapy isolation for several days to weeks are required.

CHRONIC TREATMENT

Medical treatment required is lifelong, and dose and frequency need to be adjusted depending on clinical signs and thyroid hormone levels.

POSSIBLE COMPLICATIONS

- Malignant thyroid neoplasm invades the tissues locally and in other species can lead to metastasis in the lungs.
- Methimazole has been described to induce side effects in cats and dogs such as vomiting, anorexia (see Anorexia), depression, eosinophilia, leukopenia, and lymphocytosis. To date, no side effects have been described in guinea pigs.

RECOMMENDED MONITORING

Recheck of the patient, including physical examination and measurement of blood levels of T_4 hormones, should be performed every 2 weeks until clinical signs are improving and/or thyroid hormone levels are within the reported reference range. Then rechecks should be performed every 3 months.

PROGNOSIS AND OUTCOME

- If no signs of malignancy (invasion of local tissue or lung metastasis) are noted, the prognosis is good.
- Medical therapy is not curative, and discontinuation of medical therapy will result in relapse of clinical signs.

CONTROVERSY

Percutaneous ethanol ablation of thyroid tumors has been reported in guinea pigs but is not recommended.

PEARLS & CONSIDERATIONS

COMMENTS

Hyperthyroidism is an uncommon syndrome in guinea pigs. However, it might be currently underdiagnosed owing to the limited amount of available literature.

CLIENT EDUCATION

It is important to weigh the guinea pig on a regular basis. In some breeds such as Peruvian, it is difficult for the owner to monitor the body condition.

SUGGESTED READINGS

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Mayer J, et al: Thyroid scintigraphy in a guinea pig with suspected hyperthyroidism, Exot DVM 11:25, 2009.

Muller K, et al: Serum thyroxine concentrations in clinically healthy pet guinea pigs *(Cavia porcellus)*, Vet Clin Pathol 38:507–510, 2009.

CROSS-REFERENCES TO OTHER SECTIONS

Anorexia
Ovarian Cysts

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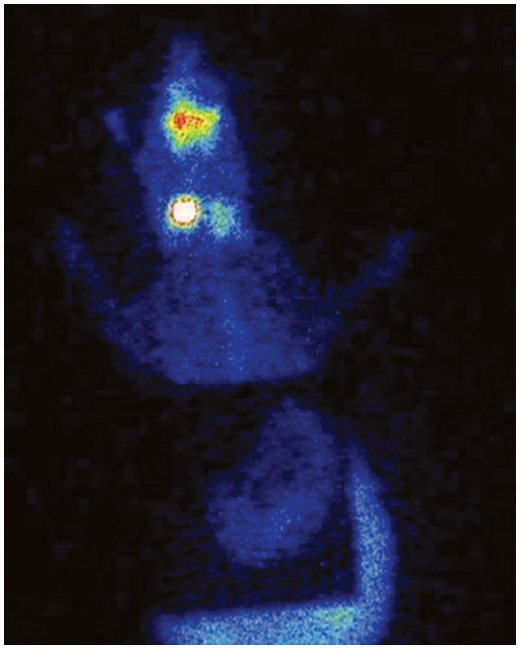

Hyperthyroidism Scintigraphy in a guinea pig with hyperthyroidism. Note the increased pattern of uptake of the right thyroid (*white spot on the left*).

Hypovitaminosis C

BASIC INFORMATION

DEFINITION

Clinical disease resulting from vitamin C (ascorbic acid) deficiency. Subclinical vitamin C deficiency will lower the guinea pig's resistance to many other disease processes.

SYNONYMS

Scurvy, scorbutus, hypovitaminosis C

SPECIAL SPECIES CONSIDERATIONS

Guinea pigs, like humans, lack the enzyme L-gulonolactone oxidase, which is required in the synthesis of ascorbic acid from glucose. Guinea pigs therefore have an absolute requirement for vitamin C in their diet.

EPIDEMIOLOGY

SPECIES, AGE, SEX Guinea pigs of all breeds and age are affected. Guinea pigs need approximately 10 mg vitamin C/kg body weight daily for maintenance and 30 mg vitamin C/kg body weight daily for pregnancy. The vitamin C requirement for sick, or convalescent guinea pigs is higher.

ASSOCIATED CONDITIONS AND DISORDERS

- Vitamin C deficiency will reduce the guinea pig's resistance to disease and will predispose to and cause a variety of disorders:
  - Dental disease
  - Swollen joints (knee joints)
  - Lameness
  - Poor fur condition
  - Secondary bacterial infection
  - Delayed wound healing
- Sub-clinical scurvy (vitamin C at 0.5 mg/kg BW for 16 weeks) causes a marked increase in serum cholesterol, LDL-cholesterol, VLDL-cholesterol, triglycerides, and total lipids.
- If the guinea pig has concurrent vitamin E deficiency it will exhibit a progressive paralysis, probably caused by oxidative injury in the central nervous system.

CLINICAL PRESENTATION

DISEASE FORMS/SUBTYPES

- Acute or subclinical
- Subclinical vitamin C deficiency is more common and generally underdiagnosed

HISTORY, CHIEF COMPLAINT

- Anorexia
- Weight loss
- Lethargy
- Diarrhea
- Poor fur quality
- Lameness
- Teeth grinding
- Vocalization from pain

PHYSICAL EXAM FINDINGS

- Cachexia
- Inability to move jaw freely
- Dental malocclusion
- Swollen knee joints, lameness
- Hypersalivation
- Gingival bleeding
- Hematoma formation
- Poor hair coat
- Diarrhea
- Chronic nonhealing skin wounds
- Elevated resting body temperature
- Hematuria

ETIOLOGY AND PATHOPHYSIOLOGY

- Guinea pigs have an absolute dietary requirement for vitamin C.
- Vitamin C is necessary for collagen synthesis. Lack of dietary vitamin C intake will lead to defective type IV collagen, laminin, and elastin synthesis, which compromises blood vessel integrity and results in gingival and joint hemorrhage. An impaired clotting mechanism, as indicated by increased prothrombin time, also contributes to hemorrhage.
- Periodontal ligament integrity is also compromised by defective collagen synthesis, which leads to loose teeth and progressive malocclusion.
- Vitamin C deficiency lowers the delayed type hypersensitivity response, decreases T-lymphocytes, and impairs leukocyte chemotaxis and bactericidal activity.
- Vitamin C-deficient guinea pigs usually die within 3-4 weeks from anemia and widespread hemorrhages or from secondary bacterial infections. Affected animals begin to lose weight after ~10 d. Loss of weight continues until death.

DIAGNOSIS

DIFFERENTIAL DIAGNOSIS

Depending on predominant clinical signs, vitamin C deficiency is a differential for many commonly seen disorders in guinea pigs, such as anorexia, weight loss, dental disease, skin and fur disorders, and secondary bacterial infection.

INITIAL DATABASE

- Radiographs will show enlarged costochondral junctions of the ribs and epiphyses of the long bones.
- Total lipids may be elevated (serum cholesterolemia > 60 mg/dL and serum triglycerides > 30 mg/dL).
- Patient may be anemic.
- Serum levels of ascorbic acid can be measured but are rarely used clinically.

TREATMENT

THERAPEUTIC GOALS

- Correct the vitamin C deficiency.
- Treat secondary complications.

ACUTE GENERAL TREATMENT

- The daily requirement of vitamin C for healthy guinea pigs is 10 mg/kg although some references suggest 15-25 mg/kg. Guinea pigs diagnosed with vitamin C deficiency can receive 50-100 mg/kg daily. No risk of overdose is present because any excess is excreted via the kidneys.
- Nutritional support for anorexic patients
- Analgesia if arthralgia present
  - Meloxicam 0.3-0.5 mg/kg PO, SC q 24 h
- Secondary infections should be treated appropriately.

CHRONIC TREATMENT

- Long-term vitamin C supplementation
  - Via the drinking water at a concentration of 200-400 mg/L: water should be changed daily because aqueous solutions may lose up to 50% of vitamin C in 24 hours. Aqueous solutions of vitamin C will more rapidly deteriorate in metal, hard water, or heat and are more stable in neutral to alkaline solutions.
  - Vitamin C as tablet or liquid.
  - Fresh red and green pepper, cabbage, kale, and oranges are high in vitamin C and should be offered daily.
  - Commercial guinea pig pellets contain fortified levels of vitamin C that exceed maintenance requirements. The stability of vitamin C in diets varies with composition of the diet, storage temperature, and humidity. The feed content of vitamin C is reduced by dampness,

heat, and light. In fortified diets approximately one-half of the initial vitamin C may be oxidized and lost 90 days after the diet has been mixed and stored above 22°C.

PROGNOSIS AND OUTCOME

- Poor if the main presenting signs are anorexia, salivation, and inability to move the jaw
- Better for lameness and reluctance to move
- Good for conditions arising from subclinical deficiency

CONTROVERSY

Supplementation should be provided with vitamin C only, not with a multivitamin. Using a multivitamin preparation at the correct rate for vitamin C may result in accidental overdose of other vitamins.

PEARLS & CONSIDERATIONS

COMMENTS

Vitamin C supplementation should be considered for any diseased guinea pig.

PREVENTION

Ensure adequate dietary vitamin C intake.

CLIENT EDUCATION

- Do not use commercial guinea pig diets older than 3 months after date of milling/production.
- Clients should not rely on dry feed mixes that include vitamin C; a fresh food source of vitamin C must be given daily.
- Offer small quantities of vitamin C–rich fresh vegetables and fruits daily.
- Soluble vitamin C can be added to the drinking water daily; this is particularly useful over winter and during times of stress.
- Vitamin C should be given to any sick or convalescent guinea pig.

SUGGESTED READINGS

Burk RF, et al: A combined deficiency of vitamins E and C causes severe central nervous system damage in guinea pigs, J Nutr 136: 1576–1581, 2006.

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Hickman DL, et al: Morbidity and mortality in a group of young guinea pigs. Subclinical hypovitaminosis C, Lab Anim (NY) 32:23–25, 2003.

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National Research Council (US), Subcommittee on Laboratory Animal Nutrition. Nutrient Requirements of Guinea Pigs. In Nutrient requirements of laboratory animals, ed 4, Washington, DC, 1995, National Academy of Sciences, pp 103–124.

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SMALL MAMMALS: GUINEA PIGS

Intestinal Disorders

BASIC INFORMATION

DEFINITION

Common disorders affecting the intestine of guinea pigs that can be classified as having primary noninfectious and infectious causes.

SYNONYMS

Diarrhea, tympany, bloat, dysbacteriosis, dysbiosis, gastroenteritis, enteritis

SPECIAL SPECIES CONSIDERATIONS

- Guinea pigs are herbivorous hindgut fermenters and are coprophagic. Ingestion of cecotrophs from the anus occurs several times daily.
- The digestive tract of guinea pigs allows digestion of a dry, high-fiber diet. Digestion of fiber occurs in the voluminous cecum and in the sacculated ascending colon. The volume of the cecum accounts for up to 65% of the volume of the entire gastrointestinal tract.
- Normal intestinal flora consists predominantly of Gram-positive coccoid bacteria, anaerobic bacteria, and lactobacilli. Any disturbance in the normal intestinal microflora can lead to overgrowth of opportunistic pathogens, which can result in septicemia endotoxemia and enterotoxemia.
- Guinea pigs, like humans, lack the enzyme L-gulonolactone oxidase, which is required in the synthesis of ascorbic acid from glucose. Guinea pigs therefore have an absolute requirement for vitamin C in their diet.
- Guinea pigs should be fed predominantly high-quality grass hay. Supplemental commercial guinea pig pellets should be offered. Vitamin C should be supplemented daily in the form of fresh vegetables (e.g., red pepper). Treats such as dried or fresh fruits and vegetables should be offered only occasionally; preference should be given to items low in carbohydrates. Fresh water must be available at all times.

EPIDEMIOLOGY

RISK FACTORS

- Inappropriate diet
- Vitamin C–deficient diet
- Sudden diet changes
- Dental disease
- Inappropriate oral antibiotic therapy
- Systemic disease
- Stress
- Pain
- Poor sanitation

CONTAGION AND ZOONOSIS

- *Salmonella* spp.
- *Rodentolepis nana*
- *Giardia duodenalis*
- *Cryptosporidium wrairi*

ASSOCIATED CONDITIONS AND DISORDERS

- Dental disease
- Hypovitaminosis C
- Septicemia, endotoxemia

CLINICAL PRESENTATION

DISEASE FORMS/SUBTYPES

- Enteritis/Diarrhea
- Tympany

HISTORY, CHIEF COMPLAINT

- Any systemic disease or painful or stressful condition may result in secondary gastrointestinal problems with nonspecific clinical signs, such as anorexia, lack of fecal output, and lethargy.
- General complaints may include the following:
  - Anorexia (see Anorexia)
  - Lethargy
  - Depression
  - Weight loss
  - Poor general condition
  - Poor coat condition
  - Teeth grinding
  - Sunken eyes

- Enteritis/diarrhea
  - Soft feces or diarrhea
  - Fecal staining around anus
  - Distended abdomen
  - Rapid breathing
- Tympany
  - Distended abdomen
  - Hunched body posture
  - Rapid breathing

PHYSICAL EXAM FINDINGS

- Unspecific findings can include the following:
  - Depression and lethargy
  - Dehydration
  - Cachexia
  - Poor coat condition
  - Perianal staining
  - Hunched body posture
- Enteritis/diarrhea
  - Perianal fecal soiling
  - Malodorous, soft fecal material
  - Tympanic intestine on abdominal palpation
  - In severe cases, animals can become endotoxemic, septicemic, and/or suffer from metabolic disturbances; therefore, animals may become increasingly depressed and might progress into shock.
- Tympany
  - Severity of clinical signs changes with progression and degree of tympany.
  - Distended and tense abdomen
  - Hunched body posture or lateral recumbence in advanced cases
  - If animal is in shock (hypovolemic, septic), clinical findings can include hypothermia, tachypnea, tachycardia, severe depression, and pale mucous membranes.

ETIOLOGY AND PATHOPHYSIOLOGY

- Gastrointestinal disease can have a variety of infectious and noninfectious causes.
- Dysbacteriosis is defined as a condition caused by an imbalance of the normal flora of the gastrointestinal tract. Dysbacteriosis is present in most cases of gastrointestinal disease in guinea pigs.
- Enteritis/dysbacteriosis/diarrhea
  - Dietary causes are considered more common in guinea pigs: overfeeding of fresh green feed or items high in simple carbohydrates (treats, grains); sudden changes in diet, etc.
  - Iatrogenic: antibiotic-induced dysbacteriosis secondary to oral administration of inappropriate antibiotics or ingestion of topical antibiotic, such as ointments used for topical wound management (e.g., triple antibiotic ointment), is also common in guinea pigs. Antibiotics such as cephalosporins, penicillins, clindamycin, and erythromycin should not be administered orally because of their predominant Gram-positive spectrum, which will lead to disturbance of the normal intestinal flora, followed by dysbacteriosis, septicemia, endotoxemia, enterotoxemia, and usually death.
  - Dental disease: dental malocclusion and intraoral pain can lead to improper chewing and selective food intake, with preference given to food items for which less chewing activity is necessary and that consequently are lower in fiber content; this may lead to dysbacteriosis and diarrhea
  - Primary gastrointestinal infections in guinea pigs are rare. Secondary infections with opportunistic pathogens are common and develop secondary to an initial disturbance of the intestinal flora, leading to dysbacteriosis and overgrowth of opportunistic pathogenic bacterial, parasitic, or fungal organisms.
  - Bacterial
    - *Escherichia coli, Pseudomonas aeruginosa, Listeria monocytogenes, Citrobacter freundii, Clostridium difficile, Clostridium perfringens*: overgrowth secondary to these organisms leads to enteritis, septicemia and endotoxemia, or enterotoxemia and is frequently fatal. Infection occurs usually by contaminated food; immune suppression and poor sanitation contribute to the development of clinical disease.
    - *Salmonella typhimurium, Salmonella enteritidis*: uncommon infection usually caused by contaminated feed; high mortality; immune suppression predisposed to development of clinical signs, including diarrhea, depression, and abortion
  - Parasitic
    - *Eimeria caviae*: strictly host specific; asymptomatic infection common, but immune suppression and poor sanitation can lead to clinical disease. Recently weaned guinea pigs are commonly affected. Clinical signs include watery diarrhea.
    - *Balantidium caviae, Entamoeba muris, Trichomonas caviae, Giardia duodenalis*: considered nonpathogenic but can cause enteritis in rare cases, if the guinea pig is immune compromised or is suffering from dysbacteriosis (i.e., secondary to dental disease). Organisms in low numbers may be seen during routine fecal examination of healthy animals.
    - *Cryptosporidium wrairi*: can cause cachexia and diarrhea, poor coat condition, and death in young or immune compromised guinea pigs by causing small intestinal enteritis; infection via ingestion of oocysts. Immune competent animals develop immunity and recover from infection within 4 weeks.
    - *Nematodes*: *Paraspidodera uncinata*: pinworm that resides in the large intestine and usually does not cause clinical symptoms. Due to its direct life cycle, heavy infections can occur if sanitation is poor and if the guinea pig is immune compromised
    - *Cestodes*: *Rodentolepis nana* (previously *Hymenolepis nana*) is rare in guinea pigs and is often asymptomatic. It does not require an intermediate host; therefore, large numbers of parasites can reside in the host, causing disease. Heavy infection will result in anorexia, diarrhea, weight loss, poor fur condition, and possible death.
  - Fungal
    - *Cyniclomyces guttulatus* (previously *Saccharomycopsis guttulata*): this yeast organism is part of the normal gastrointestinal flora. Overgrowth and diarrhea can be seen in cases of dysbacteriosis due to another (primary) cause, such as sudden diet change. Overgrowth is always considered a secondary problem; therefore, the primary cause should be identified.
- Tympany (see Gastric Dilatation Disease)
  - Secondary to dysbacteriosis, intestinal obstruction, or torsion
  - Severity of clinical signs changes with progression and degree of tympany.
  - Distended and tense abdomen
  - Hunched body posture or lateral recumbence in advanced cases
  - If animal is in shock (hypovolemic, septic), clinical findings can include hypothermia, tachypnea, tachycardia, severe depression, and pale mucous membranes.

DIAGNOSIS

DIFFERENTIAL DIAGNOSIS

Chronic diarrhea, weight loss, and poor coat condition: dental disease, hyperthyroidism (see Hyperthyroidism) and hypovitaminosis C (see Hypovitaminosis C)

INITIAL DATABASE

- Full dietary history
- Full husbandry history
- Consider the following tests based on clinical presentation:
  - Fecal flotation

- Fecal wet mount
- Fecal cytologic examination
- Whole-body radiographs
- Biochemistry profile: may be normal. Hyperglycemia, dehydration, and azotemia may be evident. Rule out concurrent diseases that will affect the prognosis (e.g., hepatic lipidosis, ketoacidosis, renal insufficiency).
- Complete blood count: hemoconcentration, anemia, leukocytosis, or leukopenia
- Urine analysis: ketonuria, low pH (normal urine pH 8-9), glucosuria

ADVANCED OR CONFIRMATORY TESTING

- Dental examination: rule out intraoral lesions (see Dental Disease)
- Fecal culture for enteric opportunistic pathogens (e.g., *Escherichia coli*, *Salmonella* spp.): interpretation may be difficult
- *Cryptosporidium* antigen ELISA

TREATMENT

THERAPEUTIC GOALS

- Rehydration and relief of discomfort
- Restoration of gastrointestinal motility and normal appetite
- Treatment of secondary infections and complications
- Treatment of primary underlying causes if possible

ACUTE GENERAL TREATMENT

- If animal is anorexic, dehydrated, or in discomfort, provide supportive care as needed:
  - Fluid therapy
    - Maintenance fluid rate: 60-100 mL/kg/d SC, PO, IV, IO
    - Replace fluid deficits and maintain normovolemia.
  - Nutritional support
    - Syringe-feed with high-fiber diet for herbivores (e.g., Oxbow Critical Care for Herbivores, 50-80 mL/kg PO q 24 h, divided into 4-5 feedings) or crushed and soaked pellets.
    - Vitamin C (50-100 mg/kg PO, SC q 24 h) for treatment of deficiencies; 10-30 mg/kg PO for maintenance
  - Analgesia: buprenorphine 0.02-0.05 mg/kg SC q 6-8 h
  - Antibiotic therapy
    - Not necessary if guinea pig is in stable condition, bright, alert, and is still eating
    - Consider antibiotics for treatment of predominantly Gram-negative opportunistic pathogens in guinea pigs with severe dysbacteriosis, and when an infectious cause is suspected but unconfirmed and the animal is in a compromised general condition.
    - Give antibiotics by injection (SC, IM, IV) and avoid the oral route in debilitated patients, patients with impaired gastrointestinal function, and in animals suspected to be septicemic.
    - Trimethoprim-sulfa 30 mg/kg PO q 12 h
    - Chloramphenicol 30-50 mg/kg PO, SC, IM, IV q 8 h
    - Metronidazole 20-30 mg/kg PO, IV q 12 h
    - Enrofloxacin 10-20 mg/kg SC, PO q 12-24 h
  - Antiparasitic therapy
    - Treat in-contact animals.
    - Clean and disinfect the environment to prevent reinfection: regular bedding changes and cage cleaning; discard cage furnishings that cannot be disinfected (e.g., wood-based furnishing)
    - Metronidazole 20-30 mg/kg PO q 12-24 h for 5 days for treatment of *Trichomonas*, *Entamoeba*, etc.
    - Fenbendazole 20-50 mg/kg PO q 24 h for 5 days for treatment of nematodes, as well as *Trichomonas*, *Entamoeba*, etc.
    - Trimethoprim-sulfa 30 mg/kg PO q 12-24 h for 5-10 days for treatment of *Eimeria*
    - Toltrazuril 10 mg/kg PO q 24 h for 3 days for treatment of *Eimeria*
    - Praziquantel 5-10 mg/kg SC, PO q 10 d for treatment of cestodes
    - No specific and effective treatment is available for *Cryptosporidium wrairi*.
  - Antifungal therapy
    - Nystatin 100,000 IU/kg PO q 8 h for 5 days if *C. guttulatus* overgrowth is high, or if no response to treatment of primary cause with dietary changes is seen
  - Tympany
    - Depends on degree of tympany: mild cases should be treated with supportive care (see earlier). Severe cases require aggressive cardiovascular support: oxygen, intravenous/intraosseous fluid therapy, and parenteral antibiotic therapy. After patient is stabilized, diagnose and treat the underlying cause.
    - Decompression via an orogastric tube placed under sedation. Trocarization carries risks that might outweigh the possible benefits
    - Antifoaming drugs such as simethicone 70 mg/kg q 1 h × 2-3 treatments have been recommended. Clinical efficacy is questionable, particularly in advanced cases of tympany.

CHRONIC TREATMENT

- Vitamin C 10-30 mg/kg PO for maintenance
- Dietary correction

POSSIBLE COMPLICATIONS

- Hepatic lipidosis
- Hypovitaminosis C
- Endotoxemia, enterotoxemia
- Sepsis

RECOMMENDED MONITORING

- Activity level
- Appetite
- Fecal output
- Urine output
- Body weight

PROGNOSIS AND OUTCOME

- Prognosis is generally better if an underlying primary cause can be identified and successfully treated.
- Good-fair: acute diarrhea if animal is still eating and is in good body condition, and if no inappropriate antibiotics have been administered orally
- Fair-poor: if animal is suffering from systemic disease or is cachexic, depressed, and dehydrated

CONTROVERSY

Use of prokinetic drugs in guinea pigs is controversial; clinical efficacy has not been demonstrated for any of the recommended drugs. Prokinetic drugs are contraindicated in cases in which an infectious process or an obstruction cannot be ruled out. Most guinea pigs with suspected underlying gastrointestinal hypomotility will respond to appropriate supportive care alone, including fluid therapy, analgesia, and nutritional support, making use of prokinetic drugs unnecessary.

PEARLS & CONSIDERATIONS

COMMENTS

After stabilization of the patient and restoration of normal gastrointestinal motility, the goal should be to identify and treat the primary underlying cause to improve the case outcome and reduce the risk of recurrence of clinical signs.

PREVENTION

- Most gastrointestinal disorders in guinea pigs are directly or indirectly husbandry and diet related. Adequate client education regarding nutritional needs and basic quarantine actions for newly acquired guinea pigs, including examination of feces and

regular health checks, will prevent most gastrointestinal disorders in guinea pigs.
- Do not administer oral antibiotics such as cephalosporins, penicillins, erythromycin, and clindamycin. Do not use topical ointments that contain bacitracin (e.g., triple antibiotic ointment) because of risk of ingestion by chinchillas. Oral administration or accidental ingestion of these antibiotics can lead to dysbacteriosis, endotoxemia, enterotoxemia, and death.

CLIENT EDUCATION

Guinea pigs should be fed predominantly high-quality grass hay. Supplemental commercial guinea pig pellets should be offered. Vitamin C should be supplemented daily in the form of fresh vegetables (e.g., red pepper). Treats such as dried or fresh fruits and vegetables should be offered only occasionally; preference should be given to items low in carbohydrates. Fresh water must be available at all times.

SUGGESTED READINGS

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CROSS-REFERENCES TO OTHER SECTIONS

Anorexia
Dental Disease
Gastric Dilatation Disease
Hyperthyroidism
Hypovitaminosis C

AUTHOR: **CHRISTOPH MANS**

EDITOR: **THOMAS M. DONNELLY**

Neurologic Disorders

BASIC INFORMATION

DEFINITION

Neurologic disorders are a group of symptoms related to abnormalities of the neurologic system, including the central and peripheral nervous system, characterized by mechanical noncoordination of the patient.

SYNONYMS

Ataxia, head tilt, torticollis, vestibular syndrome, paresis, paralysis, incoordination, seizure, fits, tremor, epilepsy, twitching

EPIDEMIOLOGY

SPECIES, AGE, SEX
- Recently introduced young individuals are prone to sarcoptic mange.
- Hypocalcemia can occur in females 1 week before or after parturition.
- Newborns that have suffered a difficult birth can exhibit brain damage.

CONTAGION AND ZOONOSIS
- *Streptococcus pneumoniae*, *Streptococcus zooepidemicus,* and *Bordetella bronchiseptica* are frequently isolated from the inner ear of guinea pigs.
- Lymphocytic choriomeningitis (LCM) (see Lymphocytic Choriomeningitis Virus, Sec. VI), a zoonotic virus transmitted by contaminated feces, through urine, or from a bite. Mice are the main reservoirs; this virus rarely causes clinical disease in pet guinea pigs.

ASSOCIATED CONDITIONS AND DISORDERS
- Hypovitaminosis C (see Hypovitaminosis C)
- Trauma

CLINICAL PRESENTATION

DISEASE FORMS/SUBTYPES
- Seizures
- Head tilt
- Leg paresis/paralysis

HISTORY, CHIEF COMPLAINT
- Seizures
  - Spontaneous cluster of seizures
  - Scratching
  - Tremor
  - Polypnea
- Head tilt
  - Torticollis
  - Nystagmus
  - Falling on side
  - Rolling over
- Leg paresis/paralysis
  - Lameness of one or both legs
  - Pododermatitis
  - History of trauma

PHYSICAL EXAM FINDINGS
- Head tilt
- Nystagmus (rare in vestibular guinea pigs)
- Normal consciousness or depression
- Painful response upon palpation of the limbs
- Painful response upon palpation of the spine
- Proprioceptive deficits (proprioceptive test can be difficult to perform in stressed guinea pigs)
- Abnormal withdrawal reflex
- Lack of deep pain

ETIOLOGY AND PATHOPHYSIOLOGY

- Seizurelike crisis can be caused by sarcoptic mange in guinea pigs.
- Seizures can be caused by a metabolic disease or an intracranial disease.
- Insulinomas and hypoglycemia have been repeatedly reported as the cause for seizures in guinea pigs.
- Head tilt is commonly caused by middle ear infection that has progressed to the inner ear.
- Paralysis may be secondary to hypovitaminosis C due to intramuscular hemorrhage.
- Chronic median and ulnar nerve compression at the level of the metacarpals can lead to forelimb paresis and weakness.
- LCM virus is an Arenavirus transmitted transplacentally, by inhalation, by ingestion, or through direct contact with urine, saliva, or feces. The major hosts are mice.

DIAGNOSIS

DIFFERENTIAL DIAGNOSIS

- Seizures
  - Infectious: sarcoptic mange *(Trixacarus caviae)*, toxemia, sepsis, LCM virus
  - Metabolic: insulinoma, liver failure, renal failure, ketosis, hypocalcemia, hypoglycemia
  - Toxic
  - Traumatic
  - Neoplastic
- Vestibular syndrome
  - Otitis media and interna
  - Parasitic *(Encephalitozoon cuniculi)*
- Paralysis
  - Trauma
  - Vitamin C deficiency
  - Median and ulnar neuropathy
  - Infectious (LCM virus)

INITIAL DATABASE

- Full dietary history
- Full history for potential exposure to toxins or mice (natural LCM virus reservoir)
- Skin scraping/skin cytologic exam: rule out sarcoptic mange
- Skull radiographs: assess for soft tissue opacity within the tympanic bullae or bony changes in the wall of the tympanic bullae, which are suggestive of otitis media
- Complete blood count: leukocytosis
- Biochemistry: hypoglycemia, hyperglycemia, hypocalcemia, increased liver enzymes and/or total bilirubin, azotemia

ADVANCED OR CONFIRMATORY TESTING

- MRI or CT scan: tympanic bulla abnormalities, intracranial lesions, anatomic/congenital defects
- If hypoglycemic: measure serum insulin levels to rule out insulinoma
- Cerebrospinal fluid (CSF) tap: cytology, bacterial culture
- LCM virus PCR (serum, CSF, biopsy and necropsy specimens), serology (IFA: serum, CSF)
- Electromyography (EMG): spontaneous activity potential, slow nerve conduction

TREATMENT

THERAPEUTIC GOALS

- Alleviate neurologic symptoms until recovery.
- Provide supportive care.

ACUTE GENERAL TREATMENT

- For seizures or head tilt: stop the cluster of seizures and restore balance
  - Benzodiazepines: midazolam 0.5-2 mg/kg SC, IM; diazepam 0.5-3 mg/kg IV or intrarectal. Repeat administration, if no effect.
  - Dextrose 50% 1-2 mL/kg IV, IO, PO. Dilute for IV/IO administration.
  - Calcium gluconate 50-100 mg/kg, IM (diluted), slow IV, or IO
  - Meclizine 12.5-25 mg/kg PO q 12 h in case of vestibular disease
- Antibiotic therapy
  - Trimethoprim-sulfa 30 mg/kg PO, IM q 12 h
  - Enrofloxacin 10-20 mg/kg IM, SC, PO, IV q 12-24 h
  - Chloramphenicol 30-50 mg/kg PO, SC, IM, IV q 8 h
- Trauma or painful condition
  - Buprenorphine 0.02-0.05 mg/kg SC, IM, or IV q 6-8 h
  - Meloxicam 0.3-0.5 mg/kg SC, IM, or IV q 24 h
- Nutritional support: critical care formula for herbivores: 50-80 mL/kg/d
- Fluid therapy: 100 mL/kg/d SC, IV, IO
- Hypovitaminosis C: vitamin C 100 mg/kg PO, SC, IM
- Sarcoptic mange
  - Ivermectin 0.2-0.5 mg/kg SC, PO q 7-14 d
  - Selamectin 15-30 mg/kg spot-on q 14-28 d

CHRONIC TREATMENT

- Vitamin C supplementation: 50-100 mg/kg PO q 24 h
- Nutritional support: critical care formula for herbivores: 50-80 mL/kg/d
- Fenbendazole 20 mg/kg PO for 28 days, in cases of positive *E. cuniculi* serologic testing
- Prolonged antibiotic therapy
- Seizure management: phenobarbital
- Pain management
- Surgery to relieve compression of median and ulnar nerves. Lesion occurs under the transverse cartilaginous bar, which supports the footpad.

POSSIBLE COMPLICATIONS

- Anorexia
- Hypovitaminosis C secondary to anorexia
- Decubitus wounds

RECOMMENDED MONITORING

- Neurologic status
- Fecal output

PROGNOSIS AND OUTCOME

Fair to poor depending on the cause

CONTROVERSY

Use of steroids is controversial.

PEARLS & CONSIDERATIONS

CLIENT EDUCATION

Although mice are the main hosts of LCM virus, guinea pigs are susceptible to LCM virus, and strict hygiene rules should be followed.

SUGGESTED READINGS

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Boot R, et al: Otitis media in guinea pigs: pathology and bacteriology, Lab Anim 20: 242–248, 1986.

Burk RF, et al: A combined deficiency of vitamins e and c causes severe central nervous system damage in guinea pigs, J Nutr 136: 1576–1581, 2006.

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CROSS-REFERENCES TO OTHER SECTIONS

Hypovitaminosis C
Lymphocytic Choriomeningitis Virus (Section VI)

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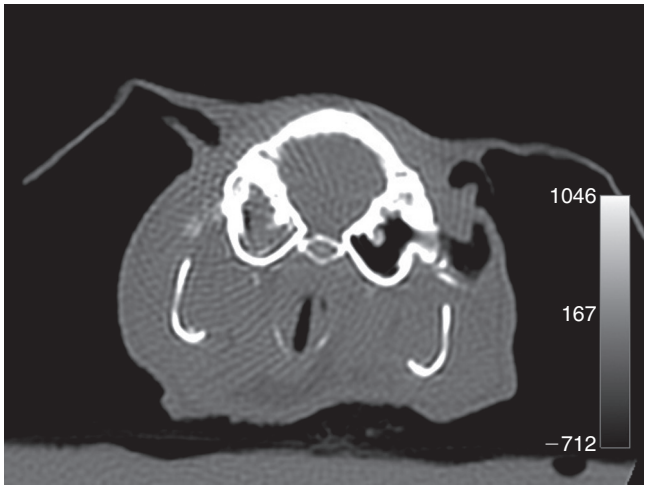

Neurologic Disorders Guinea pig neuro-otitis. Computed tomography image of the head of a guinea pig, which presented with left-sided head tilt. Note the soft tissue opacity within the left middle ear (arrow) consistent with otitis media. Compare the left middle ear with the black, air-filled appearance of the right middle ear.

SMALL MAMMALS: GUINEA PIGS

Ocular Disorders

BASIC INFORMATION

DEFINITION

Ocular disorders are characterized by any morphologic or anatomic abnormalities of the globe, including lesions of the eye itself, as well as of adjacent structures.

SYNONYMS

Corneal ulcer, eye discharge, epiphora, eye redness, conjunctivitis, uveitis, cataract, exophthalmos, fatty eye

SPECIAL SPECIES CONSIDERATIONS

- The menace reflex cannot be assessed in guinea pigs because they will not blink.
- Guinea pigs have a limited tear film, a rudimentary nictitating membrane, and a paurangiotic retina.

EPIDEMIOLOGY

SPECIES, AGE, SEX

- Cataracts can occur in animals as young as 9-10 months.
- Young animals from 1-4 weeks of age are most commonly affected by *Chlamydophila caviae.*
- Old animals frequently have an intraocular ectopic bone formation called *osseous choristoma.*

GENETICS AND BREED PREDISPOSITION

- *Listeria* spp. keratitis has been reported in hairless guinea pigs.
- "Fatty eye," a conjunctival lipid deposition, is more common in Self White, Black, Cream, and Rex breeds.
- Congenital defects (anophthalmos, cataracts) have been reported in Roan x Roan guinea pigs, and microphthalmia may be associated with all white-coated animals.
- Lens luxation secondary to cataracts has been described in Abyssinian guinea pigs.
- Corneal ulceration can occur by distichiasis and entropion in Texel guinea pigs.

RISK FACTORS

- Straw beddings and sharp pieces of plant material can traumatize the eye or can serve as foreign bodies.
- Inappropriate nutrition enhances the risk of dental malocclusion.

CONTAGION AND ZOONOSIS

- Conjunctivitis can be caused by *Chlamydophila caviae* and is contagious.
- Healthy carrier animals of *C. caviae* are common, and all in-contact animals of the collection should be treated.
- *C. caviae* is considered specific to guinea pigs; to date, the zoonotic potential is unknown and no cases in humans have been reported.

ASSOCIATED CONDITIONS AND DISORDERS

- Dental disease
- Hypovitaminosis C (see Hypovitaminosis C)
- Otitis media

CLINICAL PRESENTATION

DISEASE FORMS/SUBTYPES

- Corneal ulcer
- Eye discharge
- Conjunctivitis
- Exophthalmos

HISTORY, CHIEF COMPLAINT

- Eye discharge
- Abnormal white spot in the eye
- Sticky eye
- Blepharospasm
- Redness
- Third eyelid prolapse

PHYSICAL EXAM FINDINGS

- External aspect
  - Blepharospasm
  - Eye discharge
  - Exophthalmos
- Cornea
  - Opacity of the corneal surface
  - Ulceration
  - Foreign body
- Conjunctiva
  - Chemosis
  - Lipid deposit in the conjunctiva
- Intraocular
  - Mineral deposit on iris
  - Lens opacity (senile or diabetogenic cataracts)
- Assess the blinking response (palpebral and corneal reflexes).
- Assess the retropulsion of the globe.

ETIOLOGY AND PATHOPHYSIOLOGY

- *C. caviae* is a Gram-negative organism that replicates in the epithelial cells of the conjunctiva in guinea pigs. The infection is usually self-limiting.
- Osseous choristoma or heterotopic bone formation can occur in older animals, corresponding to mineralization of the ciliary body. The cause remains unknown.
- Exophthalmos is most commonly associated with periapical tooth abscess of the maxillary cheek teeth.

DIAGNOSIS

DIFFERENTIAL DIAGNOSIS

- Blepharitis
  - Dermatophytes *(Trichophyton mentagrophytes)*, mainly in young animals
  - Hypovitaminosis C
- Eye discharge
  - Infectious (see Conjunctivitis)
  - Lacrimal duct obstruction
  - "Pea eye" protrusion of portions of the lacrimal glands
  - Dental disease
  - Hypovitaminosis C
- Corneal ulcer
  - External irritation
    - Foreign body
    - Trichiasis
    - Entropion
  - Tears deficiency
    - Keratoconjunctivitis sicca
    - Facial paralysis (secondary to otitis media)
    - Anesthesia
- Corneal abnormalities
  - Corneal edema
  - Corneal dermoid
  - Lymphosarcoma
  - Lipid or mineral deposit
- Conjunctivitis
  - Vitamin C deficiency
  - Infectious disease
    - *C. caviae*
    - *Streptococcus* spp.
    - *Bordetella bronchiseptica*
    - *Candida albicans*
  - Allergic conjunctivitis
  - "Fatty eye" (conjunctival lipid deposit)
- Intraocular abnormalities
  - Cataract
  - Osseous choristoma
- Exophthalmos
  - Periapical abscess of maxillary cheek teeth
  - Trauma
  - Neoplasia

INITIAL DATABASE

- Full husbandry and dietary history
- Ophthalmic exam (including fundus examination)
  - Schirmer test (3.8 ± 1.3 mm/min)
  - Fluorescein test
  - Intraocular eye pressure (normal value, 16.5 ± 3.2 mm Hg)
- Conjunctival cytologic exam: intracytoplasmic inclusion body may be seen in epithelial cells infected by *C. caviae*, if stained with Macchiavello or Giemsa stain

- Skull radiographs
- Dental examination (under general anesthesia, preferably endoscopy-guided)

ADVANCED OR CONFIRMATORY TESTING

- *Chlamydophila* PCR from conjunctival swab
- CT/MRI scan: screening for retrobulbar mass effect, sinusitis, lacrimal duct obstruction
- Complete blood count: leukocytosis
- Biochemistry: hyperglycemia
- Occular ultrasound: screening for retrobulbar mass

TREATMENT

THERAPEUTIC GOALS

- Protect the integrity of the eye surface.
- Limit and stabilize intraocular damage.

ACUTE GENERAL TREATMENT

- Eye lubricant
- Topical antibiotic
  - Ciprofloxacin ophthalmic drops/ointment q 4-12 h
  - (Oxy-) tetracycline ophthalmic drops/ointment q 4-6 h
  - Tobramycin ophthalmic drops q 4-6 h (ineffective against *Chlamydophila*)
  - Gentamicin ophthalmic drops/ointment q 4-6 h (ineffective against *Chlamydophila*)
- Topical analgesia
  - Flurbiprofen drops q 4-6 h
  - Diclofenac drops q 4-6 h
  - Atropine drops/ointment (0.5%-1%) q 4-6 h
- Systemic analgesia
  - Buprenorphine 0.02-0.05 mg/kg SC q 6-8 h
  - Meloxicam 0.3-0.5 mg/kg PO, SC q 24 h
- Anticollagenase therapy in cases of deep corneal ulcer
  - *N*-Acetylcysteine topical drops q 2-6 h
  - Autologous serum eye drops q 4-6 h
- Steroidal therapy in cases of suspected allergic conjunctivitis without corneal ulceration
  - Prednisolone ophthalmic drops q 4-6 h
- Blepharitis secondary to dermatophytosis
  - Systemic antifungal therapy
    - Terbinafine 20-30 mg/kg PO q 24 h
    - Itraconazole 5-10 mg/kg PO q 24 h
  - Topical antifungal therapy
    - Enilconazole (1:40 emulsions as spray or moist wipe)

CHRONIC TREATMENT

- Antibiotic treatment
  - Enrofloxacin 20 mg/kg PO q 12-24 h
  - Metronidazole 20-30 mg/kg PO q 12 h
- Nonsteroidal antiinflammatory
  - Meloxicam 0.3-0.5 mg/kg q 24 h PO
- Dental procedure in cases of tooth root involvement; enucleation is often required in cases of retrobulbar abscesses.
- Provide vitamin C 100 mg/kg PO q 24 h.
- Keratectomy in cases of recurrent ulcer
- Enucleation

DRUG INTERACTIONS

Topical drops should not be mixed and should be given at least at 20-minute intervals.

POSSIBLE COMPLICATIONS

- Panophthalmia
- Corneal perforation

RECOMMENDED MONITORING

- Corneal edema and ulceration
- Exophthalmos

PROGNOSIS AND OUTCOME

Excellent to poor according to the cause

CONTROVERSY

Schirmer tear test values are controversial in this species; normal values ranging from 0.36 ± 1.1 mm/min to 3.8 ± 1.3 mm/min have been published in various studies.

PEARLS & CONSIDERATIONS

PREVENTION

- Provide soft and dust-free bedding.
- Provide food rich in vitamin C.

SUGGESTED READING

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Williams D, et al: Ocular disease in the guinea pig *(Cavia porcellus)*: a survey of 1000 animals, Vet Ophthalmol 13(Suppl):54–62, 2010.

CROSS-REFERENCES TO OTHER SECTIONS

Conjunctivitis
Hypovitaminosis C

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EDITOR: **CHRISTOPH MANS**

Ovarian Cysts

Client Education Sheet and Additional Images Available on Website

BASIC INFORMATION

DEFINITION

Ovarian cysts may be unilateral or bilateral, may contain clear serous fluid, and may grow up to 2-4 cm in diameter.

SYNONYM

Cystic ovaries

SPECIAL SPECIES CONSIDERATIONS

Multiple ovarian cysts are usually present on the ovaries of female guinea pigs older than 1 year. As female guinea pigs age they develop more and bigger cysts. Although no statistically significant correlation has been noted between reproductive history and the prevalence of cysts, breeding records may indicate reduced fertility in affected females older than 15 months.

EPIDEMIOLOGY

GENETICS AND BREED PREDISPOSITION Ovarian serous cysts are a normal component of the cyclic guinea pig ovary. Alterations in the inhibin-follicle–stimulating hormone system appear to modulate the development and incidence of serous cysts.

RISK FACTORS

- The presence of ovarian cysts is associated with a higher incidence of cystic endometrial hyperplasia, mucometra, endometritis, and fibroleiomyoma.

ASSOCIATED CONDITIONS AND DISORDERS Uterine leiomyomas are often seen in conjunction with serous cysts.

CLINICAL PRESENTATION

HISTORY, CHIEF COMPLAINT Owners may see anorexia (see Anorexia), alopecia, depression, and signs related to the urinary tract, such as dysuria, anuria, and occasionally hematuria.

PHYSICAL EXAM FINDINGS

- Clinical examination generally reveals palpable abdominal masses.
- Alopecia in guinea pigs with ovarian cysts is rare; the reported incidence is <5% (see Skin Diseases).

ETIOLOGY AND PATHOPHYSIOLOGY

- In guinea pigs, three types of ovarian cysts are observed:
  - Serous cysts (cystic rete ovarii)
  - Follicular cysts
  - Parovarian cysts
- These cysts can be differentiated only histologically.
- The most common ovarian cysts are serous cysts. In one study, serous cysts were present throughout the estrous cycle, with an overall incidence of 64%.
  - Serous cysts are cystic rete ovarii. Serous cysts are lined with a simple cuboidal-to-columnar epithelium composed of cells bearing solitary cilia or tufts of cilia. Cells of these cysts do not have the ultrastructural characteristics of steroid-synthesizing cells, nor do they possess 3β-hydroxysteroid dehydrogenase activity. Thus, serous cysts appear incapable of steroidogenesis and do respond to surges of luteinizing hormone, similar to a follicular cyst.
- Follicular cysts occurred in 22% of guinea pigs in one study. Follicular cysts always coincide with serous cysts but are less common during diestrus.
  - Follicular cysts are derived from preovulatory follicles that fail to ovulate. The aberrant follicular structure reaches ovulatory size, fails to ovulate, and alters normal ovarian cyclicity. Traditionally, follicular cysts (in cattle and horses) are considered as large anovulatory, follicular structures that lack a functional corpus luteum. The wall is lined by flattened granulosa cells separated from thecal cells.
- Parovarian cysts are rare
  - A parovarian cyst is a cyst of the epoophoron or parovarium, a vestigial structure associated with the ovary, consisting of a cranial group of mesonephric tubules and a corresponding portion of the mesonephric duct.

DIAGNOSIS

DIFFERENTIAL DIAGNOSIS

Other causes of abdominal masses in guinea pigs include splenic hematoma, splenic and uterine hemangiomas, uterine fibroma, and ovarian teratoma.

INITIAL DATABASE

- Complete blood count and biochemistry profile: usually unremarkable
- Imaging
  - Diagnosis of ovarian cysts by plain radiography is difficult because of the similar opacity of ovarian cysts and abdominal neoplasms.
  - Ultrasonography allows imaging of the inner structure of the masses. Ultrasonographic features of fluid-filled cysts >2 cm in diameter include compartmentalization and connection to the ovary.

ADVANCED OR CONFIRMATORY TESTING

Always perform histopathologic examination on excised ovarian cysts to evaluate for the presence of ovarian neoplasia.

TREATMENT

THERAPEUTIC GOALS

The usual treatment of choice for cystic ovaries in guinea pigs is surgical removal of the reproductive tract. In certain cases, surgery might not be a suitable option owing to the high anesthetic risk status of the patient. Ultrasound-guided aspiration of the cyst provides an adequate temporary solution in these cases. However, aspiration usually needs to be followed by medical and/or surgical treatment to prevent rapid reaccumulation of fluid.

ACUTE GENERAL TREATMENT

- A diagnosis of ovarian cyst does not indicate the type of ovarian cyst. Although surgery is the definitive treatment, hormonal therapy may be attempted when ovarian follicular cysts are present. If cysts fail to shrink in response to treatment, they were not follicular cysts, and surgery becomes the preferred method of treatment.
- Follicular cysts
  - Human chorionic gonadotropin (hCG) at a dose of 1000 IU/guinea pig IM repeated in 7-10 days can be used to treat follicular ovarian cysts in guinea pigs. However, at this dosage, the volume is approximately 1 mL, which is a large volume to be given to a guinea pig. Furthermore, hCG will stimulate an antibody response, making the second and third doses potentially less effective, and possibly stimulating an allergic reaction following subsequent injections. In humans, hCG injection can cause local irritation, edema, and pain.
  - An alternative drug that may be used to treat follicular ovarian cysts is gonadotropin-releasing hormone (GnRH). Veterinary uses of GnRH typically include treating ovarian cysts in cattle and inducing estrus in cats. GnRH is a neuropeptide, so it does not stimulate an immune response. A dose of 25 μg/animal q 2 wk for 2 injections is effective. The commercially available form of GnRH (Cystorelin, Merial) is available in a multidose vial for injection at a concentration of 50 μg/mL. The 0.5-mL volume of the injection is significantly less than that recommended for hCG, making it tolerable for the small patient.
- Serous and parovarian cysts
  - Perform surgery.

DRUG INTERACTIONS

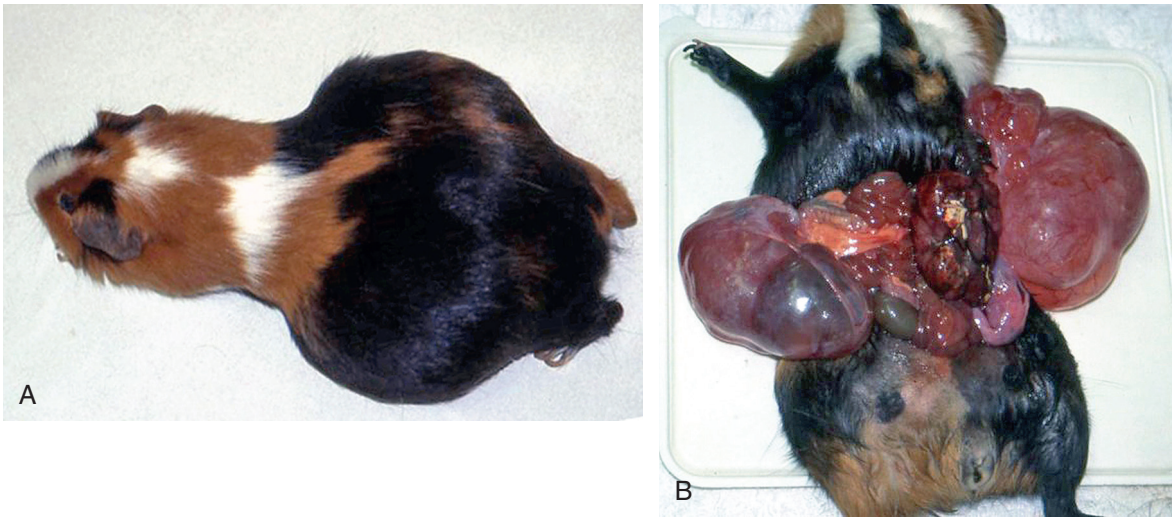
- GnRH is used for the treatment of ovarian follicular cysts in dairy cattle. Preparations of hCG, luteinizing hormone (LH), and progesterone are used to treat ovarian follicular cysts in cattle, but treatment outcomes are highly variable.
- Ovarian follicular cysts are nonovulated follicles with incomplete luteinization. Historically, cystic ovaries in cattle and horses have responded to an exogenous source of LH such as hCG. GnRH initiates release of normal physiologic levels of endogenous LH to cause luteinization of the follicular cyst wall. It then degenerates as a corpus luteum (i.e., goes to corpus albicans and then atresia).
- Ovulation of a follicular cyst in response to GnRH treatment usually does not occur. However, luteinization of follicular cysts following GnRH treatment does occur.

RECOMMENDED MONITORING

If hCG or GnRH fails to cause degeneration of the ovarian cyst, the guinea pig probably has serous cysts (cystic rete ovarii) or may even have a parovarian cyst. Surgical removal of the reproductive tract then becomes the de facto treatment of choice.

PROGNOSIS AND OUTCOME

- Good
- Advanced age, ovarian-hypophyseal imbalance, and ovarian cysts appear to favor development of ovarian



Ovarian Cysts A, Female guinea pig with bilateral abdominal swellings caused by ovarian cysts. **B,** Image of the same guinea pig in **A** showing large fluid-filled cysts on both ovaries. *(Courtesy Virginia C.G. Richardson.)*

neoplasia. Limited reports have described ovarian neoplasms in guinea pigs; most tumors are ovarian teratomas or granulosa cell tumors. These tumors do not appear to metastasize.

PEARLS & CONSIDERATIONS

COMMENTS

Guinea pig gonadotrophin-releasing hormone (gpGnRH) has a lower biological activity compared with other mammalian species' GnRH due to its unique two amino acid substitutions. This structural change is accompanied by affinity changes in the gpGnRH receptor. Consequently, treatment with GnRH agonists (e.g., deslorelin) that selectively bind to and activate other mammalian species GnRH receptors, may not cause GnRH stimulation in guinea pigs. To date, one report describes no reduction in ovarian cyst size with deslorelin implants.

PREVENTION

Early neutering of female guinea pigs will prevent ovarian cysts and uterine disorders, including neoplasia.

SUGGESTED READINGS

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CROSS-REFERENCES TO OTHER SECTIONS

Anorexia
Skin Diseases

AUTHORS: **THOMAS M. DONNELLY AND VIRGINIA C.G. RICHARDSON**

EDITOR: **CHRISTOPH MANS**

SMALL MAMMALS: GUINEA PIGS

Perineal Sac Impaction or Rectal Impaction

BASIC INFORMATION

DEFINITION

Fecal matter and a thick sebaceous secretion accumulate in the perineal sac especially of older male guinea pigs. Whether this accumulation is normal or abnormal is debated. However, in older, obese male guinea pigs, the accumulation is excessive, and owners object to the smell. Sometimes the perineal sac becomes inflamed. The result is known as *perineal sac impaction*, although older texts incorrectly call the condition *rectal impaction*. The latter term is incorrect because the anus is located deep within the caudal part of the perineal sac, and the rectum is not involved.

SYNONYMS

- Perineal sac: circumanal skin fold(s)
- Perineal sac impaction: anal fold dermatitis

SPECIAL SPECIES CONSIDERATIONS

- In the guinea pig, two distinct scent-producing areas—the prominent sebaceous gland located mid-dorsally above the caudal vertebrae and the perineal gland located within the perineal sac (circumanal skin fold)—are known. Both gland areas are much more highly developed in males than in females.
- Material from the perineal gland is deposited during the perineal drag—a behavior pattern in which an animal moves its perineal region across a surface. This behavior deposits olfactory communicants and is a form of scent marking. Both male and female guinea pigs engage in this behavior, but it is more common in males.

- Males scent mark when the environment is altered, during male–male aggressive encounters, and during courtship activities.
- Perineal dragging is most common when the environment is changed because the chemicals (pheromones) deposited during scent marking serve to familiarize a new environment and to mark the home range or territory. Scent marking may repel other males, may attract females, or may serve both functions.
- Urine and bacteria are responsible for components of biologically significant odors of guinea pig perineal scent marks.

EPIDEMIOLOGY

SPECIES, AGE, SEX

- The perineal scent gland is testosterone dependent. The perineal sac is much less developed in females and castrated males.
- Perineal scent gland sebum production increases dramatically at 4-5 weeks, when circulating testosterone levels are increasing.
- Sebum production is dependent on rank—dominant males produce more sebum.

RISK FACTORS

- Obesity, improper feeding, coarse straw bedding, and unsanitary conditions are often associated with perineal sac impaction.
- When guinea pigs are group housed, the condition is seen more frequently in the dominant male guinea pig.

ASSOCIATED CONDITIONS AND DISORDERS Balanoposthitis (inflammation of the penis and prepuce) due to impaction of sebaceous secretions and hairs within the prepuce is often seen in male guinea pigs with perineal sac impaction.

CLINICAL PRESENTATION

HISTORY, CHIEF COMPLAINT Many owners object to the odor and dropping of malodorous fecal pellets and discharge.

PHYSICAL EXAM FINDINGS

- In the deep part of this mucocutaneous area are many sebaceous scent glands that produce a thick, oily malodorous secretion that mixes with keratin and feces.
- Perineal pruritus and discharge may be seen.

ETIOLOGY AND PATHOPHYSIOLOGY

- Feces and sebaceous material accumulate in the perineal sac.
- Foreign objects such as bedding (e.g., straw, hay, wood shavings) and the animal's hairs can accumulate in the perineal sac, hardening the contents and causing true impaction.
- Inflammation and pruritus follow.

DIAGNOSIS

DIFFERENTIAL DIAGNOSIS

- Perineal abscessation
- Perineal neoplasia

INITIAL DATABASE

Examination of perineal sac and contents is usually diagnostic.

TREATMENT

THERAPEUTIC GOAL

Prevent chronic accumulation of perineal sac contents.

ACUTE GENERAL TREATMENT

- Normal check and cleaning of this area, as well as proper husbandry, are enough to prevent or correct this problem.
- Gentle removal of perineal sac contents and regular cleaning with a cotton-tipped applicator and oil are sufficient to keep the area clean.
- If the perineal sac is inflamed, careful cleaning with diluted chlorhexidine solution and application of silver sulfadiazine cream is recommended.
- Correct sanitary problems if guinea pig husbandry is poor.
- Advise owners to avoid coarse bedding (e.g., straw, hay, wood shavings).

CHRONIC TREATMENT

Castration (see Castration, Sec. II) will reduce the size of the perineal sac and will reduce the quantities of sebaceous secretions.

POSSIBLE COMPLICATIONS

Risk of scrotal panniculitis.

PROGNOSIS AND OUTCOME

With regular cleaning of perineal sac and good husbandry, prognosis is excellent.

PEARLS & CONSIDERATIONS

COMMENTS

Whether the perineal sac is impacted or whether accumulation of feces and sebaceous secretions has occurred in the boar is not well established. The important aspect of this condition is that owners object to the smell and to scent marking, which leaves impacted feces smeared on the perineal area of the boar.

PREVENTION

- Weekly cleaning of perineal sac with cotton-tipped applicator and oil
- Good husbandry

CLIENT EDUCATION

Material from the perineal glands is placed on the substrate during the perineal drag. The guinea pig squats and pulls its hindquarters forward, dragging the perineum across the ground. When males "rump" (lift one or rarely both hind legs over the back or rump of a female), material from the perineal gland is placed on the female.

SUGGESTED READINGS

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CROSS-REFERENCES TO OTHER SECTIONS

Castration (Section II)

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EDITOR: **CHRISTOPH MANS**

Pododermatitis

Client Education Sheet and Additional Images Available on Website

BASIC INFORMATION

DEFINITION

Pododermatitis is a chronic inflammation of the palmar or plantar footpads. In simple cases, it involves ulceration of the footpad; in complex cases, cellulitis, synovitis, tendonitis, and osteomyelitis of footpad structures may be noted.

SYNONYM

Bumblefoot, sore hocks

EPIDEMIOLOGY

RISK FACTORS Pododermatitis is a common condition seen in obese guinea pigs housed on wire or abrasive floors. Poor sanitation is a predisposing factor and contributes to pododermatitis in guinea pigs not housed on abrasive or wire floors.

CONTAGION AND ZOONOSIS

- *Staphylococcus aureus* is frequently involved in the disease process and probably enters the foot through a cutaneous wound from wire or abrasive flooring.
- Awns and straw in the bedding can cause foot punctures.
- Inflammation can progress to osteoarthritis and systemic amyloidosis secondary to chronic staphylococcal infection.

ASSOCIATED CONDITIONS AND DISORDERS Inflammation of associated footpad structures, including tendonitis, synovitis, and osteomyelitis

CLINICAL PRESENTATION

DISEASE FORMS/SUBTYPES

- Ulcers are often graded according to severity:
  - Grade I lesions affect the epidermis and the superficial dermis.
  - Grade II lesions extend to the subcutis. Ulcer edges are often undermined.
  - Grade III lesions extend to the deep fascia.
  - Grade IV lesions involve the underlying bone.

HISTORY, CHIEF COMPLAINT

- The owner may notice swollen paws, lameness, and reluctance to move.
- Poor cage cleaning, housing of patient in wire-bottomed cage or cage with traumatic, rough surfaces
- Coarse straw bedding can also cause abrasion and penetrating footpad injuries.

PHYSICAL EXAM FINDINGS

- Patients are often obese and sedentary.
- Wide range of clinical signs:
  - Nonspecific findings such as anorexia, depression, or weight loss
  - Specific findings such as lameness of affected limb(s)
  - No overt clinical signs; ulceration may be an incidental finding on clinical examination
- Affected footpads show erythema (mild), blistering (moderate), and ulceration (severe); ulcerated lesions are covered by dry scab.

ETIOLOGY AND PATHOPHYSIOLOGY

Pressure-induced ischemia and inflammation from a variety of factors such as obesity, coarse bedding, penetrating footpad injury, and chronic wet bedding from poor husbandry produce abnormally thickened footpad epithelium and/or a footpad wound. Prolonged pressure compresses capillary circulation, causing tissue damage or necrosis and producing an ulcer. Chronic active inflammation (granulomatous cellulitis) spreads in the footpad and the paw.

DIAGNOSIS

DIFFERENTIAL DIAGNOSIS

Lesions of bumblefoot are unique and should not be confused with other conditions.

INITIAL DATABASE

- Complete blood count (CBC)/Biochemistry
  - Often unremarkable; the main purpose of the CBC is to determine whether an infectious process is occurring. Leukocytosis, typically characterized by lymphocytosis, may be seen. Long-standing cases of chronic pododermatitis can develop systemic amyloidosis secondary to chronic staphylococcal infection. In such animals, kidney and liver parameters may be abnormal.

ADVANCED OR CONFIRMATORY TESTING

- Histopathologic examination
  - Interpretation of biopsies from a footpad with pododermatitis may be misleading to pathologists who do not routinely examine rodent tissues.
  - The exuberant nature of the chronic-active inflammation may cause it to be mistaken for a fibrosarcoma.
- Bacteriology
  - Swab cultures do not effectively reveal the infecting organism because they collect only surface-contaminating organisms.
  - Tissue biopsy and culture, fluid aspiration cultures, and bone biopsy may be better alternatives for culturing the infecting organism.
- Imaging
  - Untreated chronic pododermatitis can progress to osteoarthritis and rarely to osteomyelitis. Radiographs of the affected paw (two views) are useful in revealing the extent of inflammation before treatment, during monitoring of treatment, and when a prognosis is needed. Osteoarthritic and osteomyelitic footpads have poorer prognoses.

TREATMENT

THERAPEUTIC GOALS

- Resolution of inflammation and infection in the paw
- Reepithelialization of the footpad

ACUTE GENERAL TREATMENT

- Surgery
  - Surgical treatment is often unsuccessful because an abscess to be excised or drained is rarely present. The lesion is a diffuse cellulitis that infiltrates surrounding tissue.
  - Cutting the tissue generally results in severe bleeding.

CHRONIC TREATMENT

- Nursing care
  - Good management of the ulcer is critical for healing. However, treatment is prolonged (may take 3-6 months) and is labor-intensive. Healing requires dedication by the owner to commit time in caring for the ulcer.
- Wound cleansing
  - Weigh benefits of cleaning against trauma to the tissue bed caused by cleaning. The affected paw should be soaked in a warm saline solution before the wound dressing is applied.
  - In the initial phases of treatment when the footpad ulcer can be considered an infected chronic wound, it is appropriate to use cleansers and disinfectants until the infection has resolved.
  - Most wound disinfectants may slow wound healing because they are cytotoxic to fibroblasts, reduce

WBC viability, and decrease phagocytic efficiency. Therefore, only use wound disinfectants (e.g., chlorhexidine, povidone iodine) in infected wounds.

- Wound dressing
  - Apply a hydrogel or hydrocolloidal wound dressing over the entire ulcer.
  - Hydrogel wound covers (e.g., gauze, sheet) are preferable initially compared with hydrogel wound filler because hydrogel wound covers do not have to be changed every day. In addition, hydrogel wound fillers contain large amounts of propylene glycol, which can sting when applied to raw tissue.
  - Use hydrogels on wounds with minimal or no exudate; use hydrocolloids on wounds that are draining low to moderate amounts of exudate.
  - Unless the wound is obviously infected, do not apply a topical antimicrobial.
  - Protective padding should be applied over primary wound dressing.
  - The combined wound dressing, padding, and adhesive bandage should not be so thick that the patient cannot use its leg.
  - In early stages of wound dressing, daily assessment and redressing of the wound may be required.
  - Redressing of the wound may be adjusted to twice weekly or once weekly once the patient has adapted to the wound dressing.
- Antibiotics
  - Long-term antibiotic administration throughout the course of treatment is essential. Treatment may be required for as long as 2-6 months. Enrofloxacin 10-20 mg/kg PO q 12-24 h and ciprofloxacin 10-20 mg/kg PO q 12-24 h are safe and effective antibiotics in guinea pigs.
  - Antibiotics may have to be reassessed for efficacy during the course of treatment.
- Analgesia
  - Analgesia is essential. Any swelling in the footpad is extremely painful.
    - Meloxicam 0.3-0.5 mg/kg PO, SC q 24 h
    - Buprenorphine 0.03-0.05 mg/kg SC q 6-12 h

RECOMMENDED MONITORING

- Regularly review wound management and reassess the choice of dressings.
- Measure and record the diameter of the ulcer at each dressing to assess progress. Consider using a digital camera to take pictures that can be used to assess progress.

PROGNOSIS AND OUTCOME

With time, ulcerated lesions generally heal and reepithelialize; however, some healed lesions are predisposed to ulcerate again. Often, affected paws remain swollen after healing. These guinea pigs may need to wear a permanent soft boot on the affected paw.

CONTROVERSY

- Use of laser therapy (phototherapy)
  - Some clinicians recommend the use of low-level laser therapy to accelerate healing. The efficacy of such treatment has not yet been proved.

PEARLS & CONSIDERATIONS

COMMENTS

- Most hydrocolloids react with wound exudate to form a gel-like covering that protects the wound bed and maintains a moist wound environment.
- The clinician should focus on a wound dressing material that is able to hydrate dry wounds without macerating the skin around the wound, and that can, if necessary, actively pull (as opposed to absorb passively) exudate from exuding wounds.

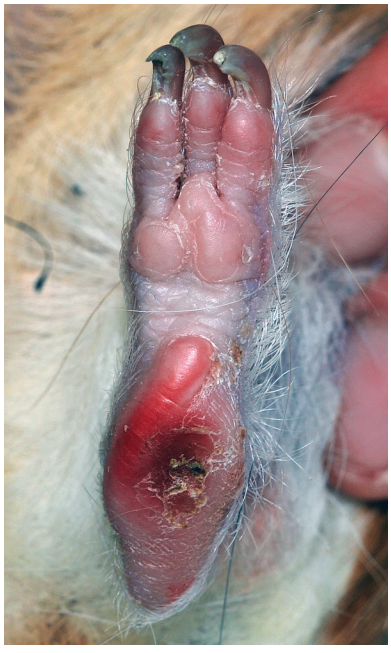
PREVENTION

- Reduce weight of obese guinea pigs.
- Remove wire or abrasive flooring.
- Remove straw or hay bedding.
- Clean animals' living quarters daily. Guinea pigs will defecate and urinate in their living quarters. Unless their housing is cleaned daily, guinea pigs will stand in wet, fecal contaminated bedding.

CLIENT EDUCATION

- Warn owners that chronic pododermatitis is a slow healing condition that may require 2-6 months to heal.
- Clients need to revisit their veterinarian regularly for reassessment and redressing of the wound. Even with

Pododermatitis Grade 3 pododermatitis of the palmar aspect of the left fore limb in a guinea pig. Note the deep ulceration and the marked soft tissue swelling.



Pododermatitis Grade 1 pododermatitis of the plantar aspect of the left hind limb in a guinea pig.

experienced clients, do not let the revisit period exceed 2 weeks.
- Most clients cannot reassess and redress the wound suitably. Redressing requires at least two experienced persons.
- If the guinea pig is overweight, encourage the client to reduce the pet's weight.

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SMALL MAMMALS: GUINEA PIGS

Pregnancy and Parturient Disorders

BASIC INFORMATION

DEFINITION

Diseases associated with pregnancy and the postpregnancy period

SYNONYMS

Dystocia, pregnancy toxemia

SPECIAL SPECIES CONSIDERATIONS

- Guinea pigs have a bicornuate uterus with a short uterine body (12 mm long), a single cervix, and a vaginal closure membrane that seals the vaginal orifice but is absent during estrus and at parturition.
- Females are sexually mature by 1-2 months.
- Guinea pigs are nonseasonally polyestric, and the duration of each estrus cycle is 15-17 days. Estrus lasts for about 6-11 hours, and ovulation is spontaneous.
- Gestation period averages 68 days (59-72 days), and litter size ranges from 1-13, but most litters consist of 2-4 pups.

EPIDEMIOLOGY

SPECIES, AGE, SEX Female guinea pigs of any age

RISK FACTORS
- First breeding after 7 months of age
- Poor husbandry
- Obesity
- Poor nutrition

CLINICAL PRESENTATION

DISEASE FORMS/SUBTYPES
- Dystocia
- Pregnancy toxemia
- Uterine torsion

HISTORY, CHIEF COMPLAINT
- Lethargy
- Inappetence
- Difficult or prolonged pregnancy or birthing

PHYSICAL EXAM FINDINGS
- Vaginal discharge
- Partially birthed fetus
- Prolapsed vagina/uterus
- Animals suffering from pregnancy toxemia stop eating and initially are depressed, then become comatose and usually die within 5-6 days if the condition is not recognized early.
- In cases of uterine torsion, one may find signs of shock, lateral recumbence, dyspnea, and/or seizures.

ETIOLOGY AND PATHOPHYSIOLOGY

- Dystocia
  - Guinea pigs have a high perinatal mortality.
  - Dystocia and stillbirths are related to large fetuses, subclinical ketosis, and fusion of the symphysis pubis.
  - If females are bred after 7 months of age, the symphysis pubis often fuses and does not separate during parturition.
- Pregnancy toxemia
  - Although clinical signs are similar, two forms of pregnancy toxemia have been recognized: the fasting/metabolic form and the circulatory or preeclampsia form. Both occur in late pregnancy.
  - Metabolic pregnancy toxemia occurs in obese sows, especially females in their first or second pregnancy. The disease is caused by increased energy demands due to fetal growth, leading to a negative energy imbalance and increased fat mobilization. Changes in feeding routine, obesity, and stress may be predisposing factors.
  - The circulatory or preeclampsia form is due to uteroplacental ischemia. The gravid uterus compresses uterine and other blood vessels, resulting in significant reduction of blood to the uterine vessels. Placental necrosis, hemorrhage, ketosis, and death follow. If suspected, emergency cesarean section and/or ovariohysterectomy is required to save the sow's life.

DIAGNOSIS

DIFFERENTIAL DIAGNOSIS

- Pyometra
- Endometritis (see Uterine and Vaginal Disorders)
- Cystic ovaries (see Ovarian Cysts)
- Other causes of shock, including hypovolemic or endotoxemic or septic shock
- Rectal prolapse
- Mammary gland neoplasia

INITIAL DATABASE

- If a female strains continually for longer than 20 minutes or fails to produce pups after 2 hours of intermittent straining, consider dystocia.
- Careful examination is performed to assess how much separation of the symphysis pubis is present. At least the width of the index finger is needed to permit passage of the fetus.
- Abdominal radiographs
- Abdominal ultrasound
- Complete blood count, biochemistry panel, urinalysis

TREATMENT

THERAPEUTIC GOAL

- Stabilization of the patient
- Resolution of dystocia

ACUTE GENERAL TREATMENT

- If animal is anorexic (see Anorexia), dehydrated, or in discomfort, provide supportive care as needed:
  - Fluid therapy
    - Maintenance fluid rate: 60-100 mL/kg/d SC, PO, IV, IO
    - Replace fluid deficits and maintain normovolemia.
    - For cases of constipation, use the enteral (oral) route to rehydrate intestinal contents.
  - Nutritional support
    - Syringe-feed with high-fiber diet for herbivores (e.g., Oxbow

Critical Care for Herbivores, 50-80 mL/kg/d PO divided into 4-5 feedings) or crushed and soaked pellets.
    - Vitamin C 50-100 mg/kg PO, SC q 24 h for treatment of deficiencies, 10-30 mg/kg PO for maintenance
  - Analgesia
    - Buprenorphine 0.02-0.05 mg/kg SC q 6-8 h
    - Meloxicam 0.3-0.5 mg/kg PO q 24 h
  - Dystocia
    - If adequate separation of the pubic symphysis has occurred, oxytocin injection (1-2 units IM) can be given. If the fetus is stuck, application of a water-based lubricant in the vagina might aid in pup removal. If conservative treatments fail to resolve dystocia within a reasonable amount of time, a cesarean section is necessary. The uterus should be opened close to the bifurcation of the horns.
    - If the patient presents in shock, stabilize patient before treatment of dystocia is initiated.
  - Pregnancy toxemia
    - Treatment is rarely successful in advanced cases. Aggressive treatment is necessary and involves administration of IV/IO fluids and dextrose, nutritional supplementation, and emergency cesarean section if patient is hypertensive, from compression of blood vessels by gravid uterus.

POSSIBLE COMPLICATIONS

- Endometritis
- Pyometra
- Shock

RECOMMENDED MONITORING

- Vaginal discharge
- Appetite
- Fecal output
- Urine ketones

PROGNOSIS AND OUTCOME

- Uncomplicated dystocias have a good prognosis for recovery.
- Pregnancy toxemia and uterine torsion have a poor prognosis for recovery.

PEARLS & CONSIDERATIONS

COMMENTS

Breeding guinea pigs necessitates frequent check-ups, as in any other species. Inform the client regarding the need for prefarrowing testing, including radiographs and ultrasound, to assess the number and viability of the litter. These exams are also important for assessing the body condition and discussing diet choices.

PREVENTION

- Appropriate diet and avoidance of obesity
- First breeding by 3-5 months of age is recommended to avoid fusion of the pelvic symphysis before the first parturition. Fusion of the pelvic symphysis occurs in nulliparous guinea pigs by 7-8 months of age.

CLIENT EDUCATION

- Breeding guinea pigs necessitates frequent check-ups, as in any other species.
- Appropriate diet and prevention of obesity will reduce the risk of pregnancy toxemia.

SUGGESTED READINGS

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CROSS-REFERENCES TO OTHER SECTIONS

Anorexia
Ovarian Cysts
Uterine and Vaginal Disorders

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Respiratory Tract Disease

BASIC INFORMATION

DEFINITION

Pneumonia in guinea pigs is caused by two main bacterial pathogens: *Bordetella bronchiseptica* and *Streptococcus pneumoniae*, as well as by guinea pig adenovirus (GPAdV).

SPECIAL SPECIES CONSIDERATIONS

Guinea pigs are obligate nasal breathers; therefore, even upper respiratory disease alone can cause significant dyspnea.

EPIDEMIOLOGY

SPECIES, AGE, SEX

- *S. pneumoniae* is more common in young or pregnant guinea pigs.
- *B. bronchiseptica* is more common in young guinea pigs.

RISK FACTORS

- All pathogens
  - Stress (overcrowding, transport, pregnancy)
  - Inappropriate ventilation and bedding
  - Hypovitaminosis C (see Hypovitaminosis C)
- *B. bronchiseptica*
  - Being housed with rabbits that naturally carry this bacteria as part of their normal respiratory flora

CONTAGION AND ZOONOSIS

- *S. pneumoniae*
  - Alpha-hemolytic *Streptococcus*—Gram-positive diplococcus
  - Capsular types 4 and 19 found in guinea pigs
  - Transmission may occur via respiratory aerosol, by direct contact, or during birth.
  - Can be carried in >50% of nonclinical animals
  - *S. pneumoniae* isolates of guinea pigs appear to be a specialized clone/serotype for this species. Human pneumococcal isolates do not appear to infect guinea pigs, and guinea pig isolates do not appear to infect humans.
- *B. bronchiseptica*
  - Transmission is via respiratory aerosol, direct contact, and fomites.
  - Short Gram-negative rod or coccobacillus
  - Incubation 5-7 days
  - Can be carried in >20% of nonclinical animals

- Guinea pig adenovirus
  - DNA virus
  - Transmitted via respiratory aerosol or direct contact
  - Incubation period 5-10 days

GEOGRAPHY AND SEASONALITY

Pneumonia epizootics in winter months have been described in research settings.

CLINICAL PRESENTATION

DISEASE FORMS/SUBTYPES

- With both *S. pneumoniae* and *B. bronchiseptica*, animals can have no apparent clinical signs or can have severe respiratory disease and/or acute death.
- The dominant pattern of GPAdV infection appears to be transient but clinically silent with mild lesion development. Guinea pigs with clinical respiratory signs, including pneumonia and death, may represent a more obvious but less common expression of age-related susceptibility or lowered resistance due to as yet uncharacterized stressors or variables (e.g., immunosuppression, viral strain variance and anesthetic gas irritation).

HISTORY, CHIEF COMPLAINT

- Labored breathing
- Nasal discharge
- Sneezing
- Lethargy
- Decreased appetite
- Acute death
- Abortion
- Lameness
- History of newly introduced guinea pig into household or contact with rabbits

PHYSICAL EXAM FINDINGS

- Dyspnea
- Tachypnea
- Cyanosis
- Rales
- Oculonasal discharge
- Collapse, tachycardia, poor peripheral pulses if in septic shock
- Torticollis and/or nystagmus if otitis media present
- Arthralgia if arthritis present

ETIOLOGY AND PATHOPHYSIOLOGY

- Because both *B. bronchiseptica* and *S. pneumoniae* can be carried in subclinical animals, other factors such as stress, immune suppression, and hypovitaminosis C are necessary for development of clinical disease.
- *B. bronchiseptica*
  - Bacteria attach to ciliated respiratory epithelial cells, causing ciliostasis and inflammation leading to decreased clearance of other organisms and particulate matter.
  - Can lead to middle ear and uterine infection as well
- *S. pneumoniae*
  - Initially, this bacterium becomes established in the upper respiratory tract, where it is protected from phagocytosis by a polysaccharide capsule.
  - Once established, the bacterium activates an alternate complement pathway, leading to pathologic changes in the respiratory epithelium.
  - Bacteremia can lead to septic arthritis if concurrent hypovitaminosis C is present.
  - Can lead to middle ear infection
- Guinea pig adenovirus
  - GPAdV enters the tracheal and bronchial epithelial cells, leading to cell damage and epithelial erosions resulting in inflammation and obstruction of the airways. The incubation period is about 5-10 days followed by transient virus shedding (in nonfatal cases) of about 10-12 days after which the virus is eliminated from the host.

DIAGNOSIS

DIFFERENTIAL DIAGNOSIS

- Respiratory signs
  - Neoplasia (primary pulmonary or metastatic)
  - Congestive heart failure
- Otitis media
  - Extension of otitis externa
  - Streptococcal lymphadenitis due to *S. zooepidemicus* (see Guinea Pigs: *Streptococcus zooepidemicus*)

INITIAL DATABASE

- Thoracic radiographs/CT: findings consistent with bronchopneumonia, pleural effusion, and pulmonary consolidation
- Skull radiographs/CT/MRI: tympanic bullae sclerosis or effusion if otitis media is present
- Complete blood count: neutrophilia, neutropenia if septic
- Serum biochemistry: hypoglycemia if septic
- Transtracheal lavage
  - Aerobic culture and sensitivity and Gram stain
  - Interpret culture and sensitivity with caution because both *B. bronchiseptica* and *S. pneumoniae* can be cultured from clinically normal guinea pigs
  - Cytologic examination
- Serologic testing
  - ELISA and indirect immunofluorescence (IIF) for *B. bronchiseptica*.
  - ELISA and indirect fluorescent antibody (IFA) for GPAdV. Polymerase chain reaction (PCR) is also available.

ADVANCED OR CONFIRMATORY TESTING

- Histopathologic examination
  - GPAdV: intranuclear inclusion bodies in respiratory epithelium and consolidation of cranial lung lobes. PCR on formalin-fixed tissue is also available.

TREATMENT

THERAPEUTIC GOALS

- Stabilization of the septic patient
- Eradication of the bacterial infection. This can be difficult because carrier states can develop.
- Correction of underlying disease, especially hypovitaminosis C
- Assist feeding to avoid GI stasis.

ACUTE GENERAL TREATMENT

- Oxygen therapy if patient is dyspneic or cyanotic
- Fluid therapy: may require intravenous or intraosseous administration in severely compromised patients
- Antibiotic therapy should be based on aerobic culture and sensitivity results:
  - *S. pneumoniae*: Highly resistant strains to penicillins, macrolides, and fluoroquinolones have been reported in humans, so appropriate antibiotic use, based on culture and sensitivity, is extremely important.
  - *B. bronchiseptica* possesses a β-lactamase and is resistant to many penicillins and cephalosporins and mostly resistant to trimethoprim-sulfamethoxazole. Most isolates are sensitive to fluoroquinolones.
  - GPAdV: no direct treatment but some antibiotics are used for control of secondary bacterial infection
    - Chloramphenicol 30-50 mg/kg PO, SC, IM, IV q 8 h
    - Enrofloxacin 10-20 mg/kg PO, SC, IM, IV q 24 h: CAUTION with SC or IM injection as can cause severe pain and tissue necrosis. Dilute with sterile saline before injection.
    - Trimethoprim-sulfa 30 mg/kg PO, SC q 12 h
- Vitamin C 50-100 mg/kg PO, SC q 24 h for treatment of deficiencies, 10-30 mg/kg PO for maintenance
- Nutritional support: syringe feeding with high-fiber diet for herbivores (e.g., Oxbow Critical Care for Herbivores) or crushed and soaked pellets

RECOMMENDED MONITORING

- Patients with severe disease should be hospitalized until able to go home on oral medications.
- Respiratory rate and effort, body weight/condition, and appetite should

be monitored in the hospital and at home by the client.

PROGNOSIS AND OUTCOME

- Outcome depends on concurrent disease, severity of infection, and promptness of antibiotic treatment (for bacterial infection).
- Because no cure for adenoviral pneumonia is known, outcome depends on prevention/treatment of secondary bacterial infection and supportive care of the patient.
- Eradication of the disease may prove difficult because carrier states can be present.

CONTROVERSY

Nebulization with normal saline, hypertonic saline, bronchodilators, and/or antibiotics has been recommended to hydrate the respiratory tract and directly deliver medications. Specific studies with these nebulizations have not been performed in guinea pigs with pneumonia.

PEARLS & CONSIDERATIONS

PREVENTION

- All pathogens
  - Reduction/elimination of stressors (e.g., transport, overcrowding, pregnancy)
    - Appropriate housing with adequate ventilation, low ammonia levels, and low dust/debris
    - Adequate vitamin C supplementation to avoid hypovitaminosis C
    - Isolation of any new guinea pigs
- *B. bronchiseptica*
  - Vaccination with canine *Bordetella* bacterin reported to be safe and efficacious in guinea pigs but is not widely used. Vaccination can cause a localized upper respiratory infection.
  - Separation from dogs and rabbits that may carry/be infected with *B. bronchiseptica*

CLIENT EDUCATION

- Guinea pigs are sensitive prey animals that can easily become stressed. Adequate housing that enables them to hide and have adequate ventilation is important.
- Bedding such as wood shavings should be avoided because its use can lead to dust and contact irritation of the mucous membranes.
- Vitamin C supplementation is important to avoid hypovitaminosis C.
- Guinea pigs should not be housed with rabbits because they can carry *B. bronchiseptica*.

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CROSS-REFERENCES TO OTHER SECTIONS

Hypovitaminosis C
Streptococcus zooepidemicus

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Skin Diseases

BASIC INFORMATION

DEFINITION

Infectious and noninfectious diseases of the integument

SYNONYMS

Alopecia, dermatitis, pyoderma, ringworm, dermatophytosis, acariasis, *Trixacarus caviae,* scabies, abscesses, neoplasia, pododermatitis

EPIDEMIOLOGY

RISK FACTORS

- For pododermatitis: obesity, lack of exercise, poor hygiene, inappropriate bedding, arthritis, age, and trauma
- Symptomatic ectoparasitism and dermatophytosis: immune suppression, poor sanitation

CONTAGION AND ZOONOSIS

- *Trixacarus caviae* is potentially zoonotic.
- Dermatophytes are potentially zoonotic.

ASSOCIATED CONDITIONS AND DISORDERS

- Conspecific trauma
- Ovarian cysts
- Cervical lymphadenopathy
- Cheilitis
- Hypovitaminosis C
- Chronic renal insufficiency
- Hyperthyroidism
- Hyperadrenocorticism

CLINICAL PRESENTATION

DISEASE FORMS/SUBTYPES

- Ectoparasitosis
- Dermatophytosis
- Bacterial dermatitis
- Abscesses
- Pododermatitis
- Alopecia (nonpruritic)
- Neoplasia

HISTORY, CHIEF COMPLAINT

- Hair loss
- Rough hair coat
- Pruritus
- Weight loss
- Lethargy
- Swellings or wounds on body

PHYSICAL EXAM FINDINGS

- Will vary depending on cause
  - Alopecia
  - Pruritus
  - Localized erythema
  - Scaling, crusting
  - Lichenification
  - Cutaneous masses
  - Abrasions, excoriations, ulcerations

ETIOLOGY AND PATHOPHYSIOLOGY

- Parasites
  - All ectoparasitic infections can become complicated by secondary infection and self-mutilation.

- Direct contact is the predominant route of transmission:
  - Sarcoptic mange *(Trixacarus caviae)*
    - Pruritus: in severe cases, pruritus can provoke seizure-like episodes (see Neurologic Disease).
    - Crusting and hyperkeratosis
    - Animals with clinical signs are often immune compromised. Asymptomatic carriers possible
      - Demodicosis *(Demodex caviae)*: rarely causes clinical signs. Alopecia, erythema, scabs on head and forefeet. Pruritus, secondary bacterial infection possible. Healthy carriers, immune compromised animals show clinical signs.
      - Fur mites *(Chirodiscoides caviae)*: nonburrowing mite. Entire life cycle on host. Asymptomatic infection common. Pruritus, alopecia, erythema, and scabs can be seen in clinical cases.
      - Lice *(Gliricola porcelli, Gliricola ovalis)*: poor coat. Parasites localized mainly around ear, eyes, and neck. Can lead to pruritus, anemia, nervousness, loss of body condition; seizure-like episodes possible in severe cases, secondary to intense pruritus
- Dermatophytosis
  - Predominantly *Trichophyton mentagrophytes*, rarely *Microsporum gypseum*.
  - Ubiquitous organisms; subclinical carriers common; young or immune compromised animals will develop clinical signs
  - Transmission is by direct contact or by fomites, such as bedding.
  - Focal alopecia and scaling. Predilected areas include face, feet, and dorsum, but condition can be diffuse and generalized. Animals usually are not pruritic, unless secondary bacterial infection is present.
  - Immune deficiency and stress may be underlying causes in chronic cases.
- Bacterial dermatitis/ulcerative dermatitis
  - *Staphylococcus* spp.
  - Usually secondary to self-trauma due to pruritus from mites; dermatophytosis; fight wounds from chronic wetting due to hypersalivation
- Abscesses
  - *Staphylococcus aureus*, *Streptococcus* spp.
  - Cervical lymphadenitis caused by *Streptococcus zooepidemicus* (see *Streptococcus zooepidemicus*); soft subcutaneous swellings in ventral neck
- Pododermatitis
  - Obesity, lack of exercise, hypovitaminosis C, poor hygiene, inappropriate bedding, arthritis, age, and trauma have been suggested as predisposing factors.
  - Initial stage: erythema, crusting, inflammation, progressing to ulcerative lesions and, in severe cases, affecting underlying bone and tendons
  - Painful condition
  - *S. aureus* commonly isolated
  - Amyloidosis of the kidney, liver, spleen, adrenal glands, and pancreas has been linked to chronic pododermatitis.
- Alopecia (nonpruritic)
  - Ovarian cysts can cause bilateral symmetric flank alopecia.
  - May be seen during advanced pregnancy and early lactation
  - Hyperthyroidism (see Hyperthyroidism)
  - Hyperadrenocorticism
- Poor coat condition without pruritus
  - Increased shedding and thin or roughened coat, poor coat condition, and dandruff have been associated with stress and underlying disease (e.g., chronic renal insufficiency, dental disease, hypovitaminosis C).
- Neoplasia
  - Trichofolliculoma (most common): benign; discharge from central pore possible
  - Squamous cell carcinoma, liposarcoma, sebaceous gland adenoma, and others reported
  - Mammary tumors are usually malignant; male guinea pigs are more commonly affected.

DIAGNOSIS

DIFFERENTIAL DIAGNOSIS

- Alopecia: trauma, dermatophytosis, ovarian cysts, hyperthyroidism, hyperadrenocorticism, vitamin C deficiency, barbering, neoplasia
- Abscesses: neoplasia (e.g., lymphoma), lymphadenopathy
- Crusting or ulcerative lesions, hyperkeratosis: mites, secondary bacterial infection, cheilitis (see Cheilitis)
- Pruritus: mites, lice, secondary bacterial infection
- Crusting or flaking of skin: dermatophytosis, mites, lice, vitamin C deficiency
- Cutaneous masses: neoplasia, abscesses
- Localized erythema or pododermatitis: contact allergy, contact irritation (cleaners), trauma from bedding/cage material

INITIAL DATABASE

- Full dietary history
- Full husbandry history
- Dermatologic examination
  - Direct visualization (lice)
  - Acetate tape preparation
  - Skin scraping
  - Impression smears
- Dermatophyte culture
- Fine-needle aspirate and cytologic examination of cutaneous masses
- Bacterial culture and sensitivity

ADVANCED OR CONFIRMATORY TESTING

- Abdominal ultrasound: rule out ovarian cysts
- Radiographs: rule out underlying skeletal abnormalities (e.g., osteoarthritis; osteomyelitis) in cases of pododermatitis
- Serum biochemistry: if underlying organ disease is suspected
- Serum thyroxine (T_4) measurement
- Adrenocorticotropic hormone (ACTH) stimulation test and cortisol measurement in saliva
- Biopsy and histopathologic examination of skin lesion

TREATMENT

THERAPEUTIC GOALS

- Eliminate pruritus and discomfort.
- Treat primary and secondary infections.
- Promote healing of skin lesions.

ACUTE GENERAL TREATMENT

- Ectoparasites
  - Ivermectin 0.2-0.5 mg/kg SC, PO q 7-14 d
  - Selamectin 15-30 mg/kg topically q 14-28 d (q 14 d for demodex, but q 21-28 d for other ectoparasites).
  - Treat until clinical signs have resolved and no more parasites are found on animals.
  - Treat in-contact animals.
  - Treat the environment to prevent reinfection: regular bedding changes and cage cleaning. Discard cage furnishings that cannot be disinfected (e.g., wood-based furnishings).
- Bacterial infection
  - If indicated, provide systemic antibiotic therapy based on culture and sensitivity whenever possible.
  - Start empirical treatment pending culture and sensitivity:
    - Trimethoprim-sulfa 30 mg/kg PO q 12 h
    - Chloramphenicol 30-50 mg/kg PO q 8 h

        - Enrofloxacin 10-20 mg/kg PO q 12-24 h
- Skin abscesses
    - Lance, débride, and flush or remove in toto if possible.
    - If indicated, provide systemic antibiotic therapy based on culture and sensitivity whenever possible.
- Cervical lymphadenitis: see *Streptococcus zooepidemicus*
- Pododermatitis
    - Depending on severity of disease
    - Mild: soaking in mild antiseptic solution, provision of soft bedding, reduction of body weight, increased exercise
    - Moderate cases: systemic therapy
    - Severe cases: surgical débridement, open wound management, regular bandage changes
    - Systemic antibiotic therapy based on culture and sensitivity, whenever possible
    - Analgesia: meloxicam 0.3-0.5 mg/kg PO, SC q 24 h, buprenorphine 0.03-0.05 mg/kg SC q 6-8 h
- Dermatophytosis
    - Systemic antifungal therapy
        - Terbinafine 20-30 mg/kg PO q 24 h
        - Itraconazole 5-10 mg/kg PO q 24 h
    - Topical antifungal therapy
        - Enilconazole 1:50 emulsion as spray or moist wipe
        - Miconazole/chlorhexidine shampoos
        - Lime sulfur dips (1:40, q 7 d)
        - Used alone or in combination with systemic therapy
        - Use preferably in cases of suspected dermatophytosis while awaiting dermatophyte culture results
    - Environmental decontamination: frequent damp mopping of hard surfaces rather than sweeping can reduce environmental spread of spores; 1:10 bleach solution can be used to clean environment: contact time 10 minutes
    - Monitoring: once-weekly dermatophyte test medium (DTM) cultures. Discontinue treatment once two consecutive negative cultures are obtained.
- Vitamin C deficiency: vitamin C 50-100 mg/kg PO, SC q 24 h for treatment of deficiencies, 10-30 mg/kg PO for maintenance. See Hypovitaminosis C.

CHRONIC TREATMENT

- Improve sanitary conditions in the animal's environment.
- Dermatophytosis will often require long-term therapy.

RECOMMENDED MONITORING

- Resolution of clinical signs
- Repeated evaluation for presence of ectoparasites
- Weekly DTM cultures in cases of dermatophytosis

PROGNOSIS AND OUTCOME

- Good to fair
- Poor: severe pododermatitis

PEARLS & CONSIDERATIONS

COMMENTS

Guinea pigs infected with *T. caviae* can present with a history of seizures due to severe pruritus (see Neurologic Disease).

PREVENTION

- Provision of a commercial diet
- Good sanitation
- Minimization of stress
- Quarantine of all new incoming animals for a minimum of 30 days before contact with other animals is allowed

CLIENT EDUCATION

Dermatophytes and *T. caviae* are contagious to humans; medical advice should be sought if lesions are found on humans in the household.

SUGGESTED READINGS

Donnelly TM, et al: Ringworm in small exotic pets, Sem Avian Exot Pet Med 9:82–93, 2000.

White SD, et al: Dermatologic problems in guinea pigs, Comp Cont Educ Pract Vet 25:690–697, 2003.

CROSS-REFERENCES TO OTHER SECTIONS

Cheilitis
Hyperthyroidism
Hypovitaminosis C
Neurologic Disease
Pododermatitis
Streptococcus zooepidemicus

AUTHOR: **CHRISTOPH MANS**

EDITOR: **THOMAS M. DONNELLY**

Streptococcus zooepidemicus (Cervical Lymphadenitis)

BASIC INFORMATION

DEFINITION

Streptococcal lymphadenitis is a bacterial infection of the cervical lymph nodes caused by a commensal bacterium, *Streptococcus zooepidemicus*, which invades abraded mucosa. Rarely, an acute systemic form can occur in younger guinea pigs, leading to respiratory disease and sepsis.

SYNONYMS

Cervical lymphadenitis, lumps

Significant taxonomic and nomenclature changes in the genus Streptococci have resulted in the expansion from 4 phenotypically easy-to-differentiate species to 34 species. Difficulties between taxonomists and clinicians regarding appropriate nomenclature resulted in the introduction of subspecies. *Streptococcus zooepidemicus* was renamed *Streptococcus equi* subspecies *zooepidemicus*. However, many laboratories report the subspecies name only (e.g., the isolation of *S. zooepidemicus*) as it is easy to understand for clinicians.

SPECIAL SPECIES CONSIDERATION

Streptococcus zooepidemicus is a frequently isolated opportunist pathogen of horses and a cause of hemorrhagic pneumonia in dogs. A normal mucosal commensal of horses, it causes purulent respiratory infections of weanling and yearling horses and uterine infections in elderly mares. *Streptococcus* subspecies *equi* causes "strangles," a highly

contagious upper respiratory infection in horses.

EPIDEMIOLOGY

SPECIES, AGE, SEX Females have been shown to be more susceptible to disease than males.

RISK FACTORS Any condition that results in oral mucosal abrasions such as dental disease, use of inappropriate toys or water bottles with sharp edges or sticks/foreign objects in hay.

CONTAGION AND ZOONOSIS *Streptococcus zooepidemicus* is a Gram-positive encapsulated beta-hemolytic streptococcus and is traditionally classified as a Group C streptococcus. In humans, it is associated with nephritis outbreaks and other infections (meningitis, endocarditis, and pneumonia) often traced back to the consumption of contaminated dairy products.

CLINICAL PRESENTATION

DISEASE FORMS/SUBTYPES

- Localized form
  - Bilateral or unilateral enlargement of cervical lymph nodes
  - Otitis media
- Acute systemic form
  - More common in younger guinea pigs
  - Sepsis, fibrinopurulent bronchopneumonia, pleuritis, and pericarditis

HISTORY, CHIEF COMPLAINT

- Localized form
  - Cervical swelling(s)
  - Torticollis
- Acute systemic form
  - Labored breathing
  - Anorexia, depression

PHYSICAL EXAM FINDINGS

- Localized form
  - Bilateral or unilateral cervical lymphadenopathy, which can be painful upon palpation
  - Torticollis or nystagmus if otitis media is present
- Acute systemic form
  - Dyspnea
  - Tachypnea
  - Cyanosis
  - Rales or muffled heart sounds
  - Collapse, tachycardia, poor peripheral pulses if in septic shock

ETIOLOGY AND PATHOPHYSIOLOGY

- *S. zooepidemicus* is a commensal organism in the nasopharynx and conjunctiva of guinea pigs.
- Disease occurs when the organism is able to invade via abrasions in the oral mucosa (most common), skin, or female genitalia. Invasion via respiratory aerosol is also reported.
- After invasion of underlying tissues, bacteria are spread via the lymphatics to draining lymph nodes, where replication and secondary inflammation occur.
- In adults, the disease usually remains localized in the lymph nodes, but in young guinea pigs, septicemia can occur, leading to death or respiratory disease.

DIAGNOSIS

DIFFERENTIAL DIAGNOSIS

- Cervical lymphadenopathy
  - Lymphoma
  - Sialocele
  - *Streptobacillus moniliformis* infection (see Rat Bite Fever)
  - Other causes of abscesses: periodontal, fungal, bite wounds, foreign body
- Otitis media
  - Extension of otitis externa
- Septicemia/respiratory disease
  - *Bordetella bronchiseptica*
  - *Streptococcus pneumoniae*
  - Guinea pig adenovirus (GPAdV)

INITIAL DATABASE

- Localized form
  - Aerobic culture and sensitivity from lymph node aspirates. An initial tentative diagnosis can often be made from Gram stain results revealing pure Gram-positive cocci.
  - Skull radiographs/CT: tympanic bullae, sclerosis, or effusion if otitis media is present
- Acute systemic form
  - Complete blood count: neutrophilia, neutropenia if septic
  - Serum biochemistry: hypoglycemia if septic
  - Thoracic radiographs/CT: findings consistent with bronchopneumonia

TREATMENT

THERAPEUTIC GOALS

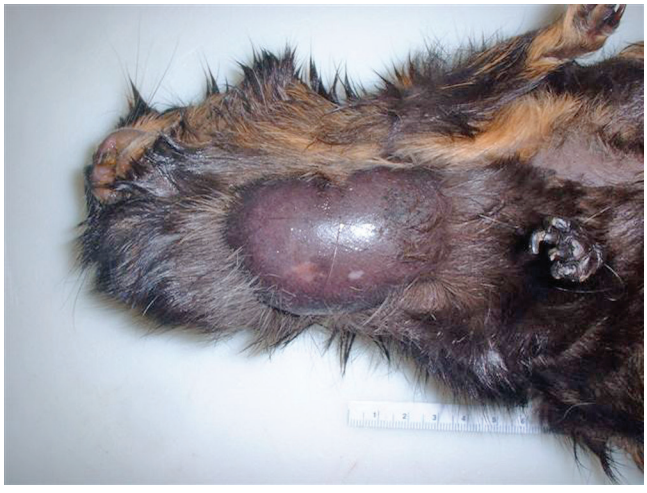
- Localized form
  - Eradication of bacteria causing disease: because *S. zooepidemicus* is a commensal, complete eradication is not the treatment goal.
  - Identification and elimination of underlying causes of mucosal abrasions
- Acute systemic form
  - Stabilization of the septic patient

ACUTE GENERAL TREATMENT

- Localized form
  - Complete surgical removal of the abscessed lymph node, including its capsule
  - Antibiotic therapy: should be based on culture and sensitivity results
    - Chloramphenicol 20-50 mg/kg PO, SC, IM, IV q 8 h
    - Enrofloxacin 10-20 mg/kg PO, SC, IM, IV q 24 h; caution with SC or IM injection as can cause severe pain and tissue necrosis. Dilute with sterile saline before injection.
    - Trimethoprim-sulfa (30 mg/kg PO, SC q 12 h)
- Acute systemic form
  - Oxygen therapy
  - Fluid support: may require intravenous or intraosseous administration
  - Antibiotic therapy (see earlier): use parental route of administration
  - Nutritional support to prevent GI stasis: syringe feeding of high-fiber diet for herbivores (e.g., Oxbow Critical Care for Herbivores) or crushed and soaked pellets

POSSIBLE COMPLICATIONS

Depending on the size of the abscessed lymph node, surgical removal may be



Streptococcus zooepidemicus Cervical lymphadenitits in a guinea pig. Pure growth of *Streptococcus zooepidemicus* was cultured from a cervical lymph node aspirate. *(Photo courtesy Jörg Mayer, The University of Georgia, Athens.)*

difficult because lesions can be near the trachea, jugular veins, and/or recurrent laryngeal nerve.

RECOMMENDED MONITORING

Cervical palpation for recurrence of infection if entire abscess and capsule could not be removed

PROGNOSIS AND OUTCOME

- Localized form
  - Good if able to surgically remove the entire infected lymph node
  - Incomplete resolution of signs if unable to surgically remove lymph node and capsule and/or if antibiotics alone are used
- Acute systemic form
  - Guarded to poor

PEARLS & CONSIDERATIONS

PREVENTION

- Treatment of any dental disease that could lead to mucosal abrasions
- Avoidance of toys, food, or water bottles that can cause mucosal abrasions

CLIENT EDUCATION

- Ensure that hay does not have foreign bodies or sharp plant material that may cause oral trauma.
- Water bottles used for guinea pigs should have a smooth ball tip; avoid those with metal levers that could cause oral trauma during drinking.
- Guinea pigs should not be allowed to play with toys that have metal or abrasive edges that could cause oral trauma.

SUGGESTED READING

Murphy JC, et al: Cervical lymphadenitis in guinea pigs: infection via intact ocular and nasal mucosa by *Streptococcus zooepidemicus*, Lab Anim Sci 41:251–254, 1991.

CROSS-REFERENCES TO OTHER SECTIONS

Rat Bite Fever

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EDITOR: **CHRISTOPH MANS**

Urolithiasis

Client Education Sheet Available on Website

BASIC INFORMATION

DEFINITION

Urolithiasis describes calculi in any part of the urinary tract. Calculi in guinea pigs are found frequently in the urinary bladder or the urethra. Most uroliths in guinea pigs are calcium based.

SYNONYMS

Bladder stones, kidney stones, urinary calculus/calculi

SPECIAL SPECIES CONSIDERATIONS

- Unlike cats and dogs that have calculi composed of different materials (e.g., struvite, calcium oxalate, calcium phosphate, cysteine, urate), guinea pigs have calculi typically made up of calcium carbonate or calcium phosphate; calculi can also be composed of calcium oxalate, but this is rare. Consequently, guinea pig calculi are radiopaque.
- In female guinea pigs the external urethral opening is not located within the floor the vagina, but instead on the urinary papilla, which is located cranial to the vaginal opening.

EPIDEMIOLOGY

SPECIES, AGE, SEX Urolithiasis is a common problem in older guinea pigs (>4 years), especially in females (75%).
GENETICS AND BREED PREDISPOSITION Surveys of pet and laboratory guinea pigs suggest an overall 10% incidence.
RISK FACTORS Hypercalciuria from too much calcium in the diet is often due to feeding only alfalfa, a calcium-rich hay.
CONTAGION AND ZOONOSIS In one large survey, the incidence of bacteria associated with urolithiasis in guinea pigs was 3%.
ASSOCIATED CONDITIONS AND DISORDERS

- Recurrent bacterial cystitis
- Pyuria

CLINICAL PRESENTATION

HISTORY, CHIEF COMPLAINT

- Stranguria
- Dysuria
- Hematuria
- Anuria
- Polyuria
- Anorexia
- Abdominal pain (hunched posture)
- Vocalization during urination

PHYSICAL EXAM FINDINGS

- Palpation of cystic calculi in the urinary bladder
- Palpation of an enlarged, nonexpressible urinary bladder if urethral obstruction is present
- Small calculi and hematuria may be visualized during evaluation of urethral orifices.

ETIOLOGY AND PATHOPHYSIOLOGY

- The cause of urolithiasis in guinea pigs is unknown.
- Calcium carbonate is the predominant stone type isolated through composition analysis.
- Bacteria commonly cultured include *E. coli*, *Streptococcus pyogenes*, *Proteus mirabilis*, and *C. renale*.

DIAGNOSIS

DIFFERENTIAL DIAGNOSIS

- Hematuria, stranguria, dysuria
  - Bacterial cystitis
  - Renal disease (pyelonephritis, interstitial nephritis)
  - Rule out by identification of abnormal discharge from the vaginal opening vs. hematuria observed from the external urethral orifice.

INITIAL DATABASE

- Urinalysis
- Urine culture
- Abdominal radiographs: pay attention to coccygeal area and stretch hind limbs away from body because calculi are often lodged in the urethra and may be missed.
- If hind limbs are not stretched out, the femur may obscure a urethral calculus. It is easy to mistake patellar ossicles for a calculus in the urethra of males.
- Abdominal ultrasound to confirm calculi location and to evaluate the urinary and reproductive tract.

ADVANCED OR CONFIRMATORY TESTING

Cystocentesis for urine culture and sensitivity

TREATMENT

THERAPEUTIC GOALS

- Resolution of urinary outflow obstructions
- Removal of stones that present risk of causing urinary obstruction
- Resolution of bacterial cystitis
- Diet modification to reduce calcium-dense roughage and subsequent urinary calcium excretion
- Increased diuresis through increased water intake

ACUTE GENERAL TREATMENT

- Minimally invasive stone removal
  - For very small stone sediments, a urinary catheter can be passed to flush stones out by way of the urethra.
  - In females, cystoscopic stone removal has been reported. This technique is feasible only for stones that are not larger in diameter than the urethra.
- Surgical management
  - Routine cystotomy can be performed to remove large urinary bladder calculi.
- Treatment for suspected concurrent bacterial cystitis
  - Trimethoprim sulfonamide 30 mg/kg PO q 12 h pending urine culture results
- Urethral obstruction
  - Therapeutic management of obstructive postrenal azotemia
    - IV catheterization for fluid therapy
    - Urinary catheter placement and quantification of urine output
    - Nutritional support to delay gastrointestinal stasis
- Pain management
  - Buprenorphine 0.02-0.05 mg/kg SC q 6-8 h
  - Meloxicam 0.3-0.5 mg/kg PO, SC q 24 h
  - Tramadol 2.5-5.0 mg/kg PO q 12 h

CHRONIC TREATMENT

- Diet modification is thought to be helpful in managing severe calciuria. Avoid large quantities of alfalfa and alfalfa-based pellets and fresh greens, which contain large amounts of calcium (e.g., parsley).
- Increasing diuresis by increased water consumption. Provide multiple sources of fresh water. Flavor water with small amounts of unsweetened fruit juice. Offer a variety of fresh leafy greens.

POSSIBLE COMPLICATIONS

- Stone recurrence
- Urethral tears can occur with aggressive advancement of urinary catheters.
- Postoperative serosal adhesions can occur commonly in rodents that undergo any abdominal surgery.
- Suture reactions within the bladder wall or at the abdominal incision site

RECOMMENDED MONITORING

- Repeat chemistry screen should be performed to confirm resolution of azotemia.
- Repeated radiographs or focal urogenital tract ultrasounds can be recommended to screen for recurrence.

PROGNOSIS AND OUTCOME

- Prognosis is guarded because stone formation commonly recurs.
- Repeated surgical interventions can increase overall morbidity and mortality of affected patients.

PEARLS & CONSIDERATIONS

COMMENTS

- Guinea pigs have large urethral diameters relative to their size. Sterile red rubber urinary catheters (3.5-5 Fr) can be easily advanced into the urethra and bladder in both sexes. Therapeutic bladder flushes can be administered routinely to relieve severe calciuria. Urethral flushing can be performed to retropulse urethral stones back into the bladder for surgical removal.
- In male guinea pigs during urethral catheterization, the external urethral opening should not be confused with the opening of the intromittent sac, which is located ventral to the urethral opening (see figure).

PREVENTION

Because of the unknown cause of urinary calculi in guinea pigs, no effective method of prevention has been reported. However, foods high in calcium should not be offered to mature animals. Alfa-Alfa–based pellets and hay should be limited to growing, pregnant, or lactating animals.

CLIENT EDUCATION

- Avoid calcium-rich food items. Avoid Alfalfa–based pellets and hay.
- Increase water consumption. Provide multiple sources of fresh water. Consider flavoring water with small amounts of unsweetened fruit juice. Offer a variety of fresh leafy greens.
- Recurrence of urinary calculi is common. By reducing risk factors such as high dietary calcium intake and low water intake, recurrence may be only delayed.

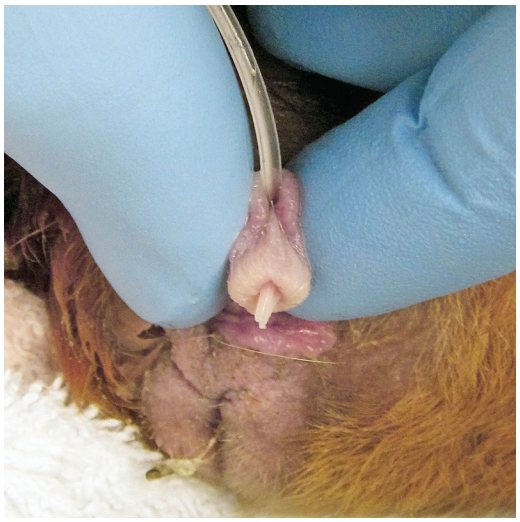
SUGGESTED READINGS

Brown C, et al: Urethral catheterization of the male guinea pig *(Cavia porcellus)*, Lab Anim (NY) 36:20–21, 2007.

Hawkins MG, et al: Composition and characteristic of urinary calculi from guinea pigs, J Am Vet Med Assoc 234:214–220, 2009.

AUTHORS: **LA'TOYA LATNEY AND THOMAS M. DONNELLY**

EDITOR: **CHRISTOPH MANS**



Urolithiasis Urethral catheterization in a male guinea pig. Note the partially everted intromittent sac (arrow; nb the two penile styles protruding from the intromittent sac), located ventral to the urethra, within the glans penis. Accidental catheterization of this blind sac can occur, if the opening of the intromittent sac is confused with the external urethral opening on the tip of the glans penis. The catheter is inserted into the urethra.

SMALL MAMMALS: GUINEA PIGS

Uterine and Vaginal Disorders

BASIC INFORMATION

DEFINITION

Diseases of the uterus, cervix, vagina, and vulva

SPECIAL SPECIES CONSIDERATIONS

- Guinea pigs have bicornuate uterus with a short uterine body (12 mm long), a single cervix, and a vaginal closure membrane that seals the vaginal orifice but is absent during estrus and during parturition.
- The urethral opening is not located within the vagina but on the urinary papilla cranial to the vaginal opening.

EPIDEMIOLOGY

SPECIES, AGE, SEX Female guinea pigs of any age

RISK FACTORS Poor husbandry, neoplasia, immune suppression, recent pregnancy (see Pregnancy and Parturient Disorders)

ASSOCIATED CONDITIONS AND DISORDERS Ovarian cysts (see Ovarian Cysts) can be associated with endometrial hyperplasia and endometritis. Vaginal/uterine prolapse may be associated with a recent parturition.

CLINICAL PRESENTATION

DISEASE FORMS/SUBTYPES

- Vaginitis
- Endometritis and pyometra
- Uterine/vaginal prolapse
- Uterine torsion

HISTORY, CHIEF COMPLAINT Based on the underlying disease process, the chief complaint may include vaginal discharge, inability to urinate, lethargy, or inappetence.

PHYSICAL EXAM FINDINGS On physical exam, one may find vaginal discharge with or without blood, an abdominal mass, perivulvar and vulvar inflammation, and/or a prolapsed vagina/uterus.

ETIOLOGY AND PATHOPHYSIOLOGY

- Vaginitis can be induced by soiled bedding and dirty cage conditions.
- Pyometra endometritis can be induced from ovarian cysts and/or normal ovulatory activity.
- Vaginal/uterine prolapse is most commonly seen in the parturient and periparturient periods.
- Uterine torsion is rare and is seen in gravid guinea pigs, usually after 30 days of gestation.

DIAGNOSIS

DIFFERENTIAL DIAGNOSIS

- Vaginitis
- Endometritis
- Pyometra
- Neoplasia
- Vaginal or uterine prolapse
- Uterine torsion

INITIAL DATABASE

- Bacterial culture and sensitivity and cytologic examination for cases presented with vaginal discharge
- Abdominal radiographs: assess for urolithiasis (see Urolithiasis), pyometra, neoplasia, and pregnancy
- Abdominal ultrasound
- Complete blood count, biochemistry panel, and urine analysis

ADVANCED OR CONFIRMATORY TESTING

- Exploratory laparotomy
- Histopathologic examination

TREATMENT

THERAPEUTIC GOAL

Resolution of underlying disease process

ACUTE GENERAL TREATMENT

- Vaginitis
  - Empirical systemic antibiotic therapy while bacterial culture and sensitivity is pending. Adjust treatment as indicated.
    - Trimethoprim-sulfa 30 mg/kg PO q 12 h
    - Chloramphenicol 30-50 mg/kg PO, SC, IM, IV q 8 h
    - Enrofloxacin 10-20 mg/kg SC, PO q 12-24 h
  - Careful lavage of the vaginal vestibule with diluted chlorhexidine
  - Improvement of husbandry practices
  - For pyometra, endometritis, neoplasia, and prolapsed vagina/uterus:
    - Ovariohysterectomy is indicated after animal has been stabilized.
- If animal is anorexic (see Anorexia), dehydrated, or in discomfort, provide supportive care as needed:
  - Fluid therapy
    - Maintenance fluid rate: 60-100 mL/kg/d SC, PO, IV, IO
    - Replace fluid deficits and maintain normovolemia.
  - Nutritional support
    - Syringe-feed with high-fiber diet for herbivores (e.g., Oxbow Critical Care for Herbivores, 50-80 mL/kg/d PO, divided into 4-5 feedings) or crushed and soaked pellets
    - Vitamin C 50-100 mg/kg PO, SC q 24 h for treatment of deficiencies, 10-30 mg/kg PO for maintenance
  - Analgesia
    - Buprenorphine 0.02-0.05 mg/kg SC q 6-8 h
    - Meloxicam 0.3-0.5 mg/kg PO, SC q 24 h

RECOMMENDED MONITORING

- Vaginal discharge
- Appetite
- Fecal output

PROGNOSIS AND OUTCOME

- Prognosis is good with vaginitis.
- Diseases requiring surgery carry a guarded prognosis.
- Animals presenting with uterine torsion are generally in shock and require emergency stabilization and surgery. The prognosis is guarded if animals can be stabilized.

PEARLS & CONSIDERATIONS

COMMENTS

- Because guinea pigs do not tolerate well postsurgical pain due to laparotomy, epidural anesthesia should be considered as part of the anesthetic and analgesic managment.
- Diagnostic testing is the key to uterine and vaginal disorders. Symptomatic therapy instead of diagnostic testing can lead to poorer outcomes if conditions requiring surgical intervention are not recognized.

PREVENTION

Good sanitation will help to avoid vaginitis.

CLIENT EDUCATION

- Surgery and anesthesia always carry risk and must be discussed with owners before the procedure is performed.
- Laparotomy in guinea pigs carries higher postsurgical risks compared with other rodent species.

SUGGESTED READINGS

Bodri MS, et al: What is your diagnosis? Poor intra- and retroperitoneal contrast suggestive of emaciation and alimentary visceral displacement consistent with bladder or uterine mass. Pyometra in a guinea pig, J Am Vet Med Assoc 202:654–655, 1993.

Kunstyr I: Torsion of the uterus and the stomach in guinea pigs, Z Versuchstierkd 23:67–69, 1981.

Okewole PA, et al: Uterine involvement in guinea pig salmonellosis, Lab Anim 23:275–277, 1989.

CROSS-REFERENCES TO OTHER SECTIONS

Anorexia
Ovarian Cysts
Pregnancy and Parturient Disorders
Urolithiasis

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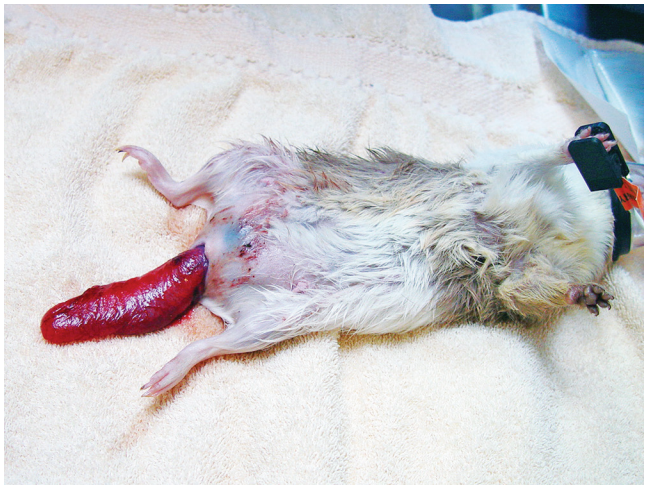

Uterine and Vaginal Disorders Prolapsed uterus of a female guinea pig after delivery. If the tissue is fresh, it can be cleared and replaced. If the prolapse is old, an ovariohysterectomy is indicated.