



Clinical Approach to Patients with Epistaxis

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ABSTRACT:

Epistaxis is a common disorder that can have a local or systemic origin. Extensive evaluation of patients is often required to determine the diagnosis and includes serologic studies, radiographic imaging, tissue culture, endoscopy with biopsy, and, rarely, surgery. This article reviews the history, physical examination, differential diagnosis, and diagnostic plan for dogs and cats with epistaxis. Supportive care is instituted until an underlying cause can be identified; therapy, which focuses on management of the underlying cause, is briefly discussed.

Epistaxis (from the Greek *epi*, “on,” and *stazo*, “to fall in drops”) is defined as hemorrhage originating from the nose.¹ Epistaxis is a frequent clinical complaint that may result from local (intranasal) or systemic (extranasal) causes and often requires extensive medical and surgical evaluations to reveal the cause and allow treatment. This article reviews the signalment, history, physical examination, differential diagnosis, diagnostic plan, and therapy for epistaxis in dogs and cats.

SIGNALMENT AND HISTORY

Information about a patient’s signalment and history may help guide the diagnostic workup. For example, immune-mediated thrombocytopenia, which can cause epistaxis, occurs most commonly in young to middle-aged female dogs.² Nasal tumors are more common in animals older than 8 years of age, although nasal lymphoma may occur in younger cats.³⁻⁵ Fungal rhinitis is seen most often in dogs younger than 7 years of age.⁶ Nasopharyngeal polyps occur more often in young cats than in older cats. Brachycephalic cats are more susceptible than mesocephalic cats to chronic viral respiratory infections.⁷ A history of bleeding after tooth loss or elective neutering may indicate a congenital coagulation factor defect or platelet disorder

such as von Willebrand’s disease (vWD).^{2,8,9} Intact dogs (especially males) that roam are susceptible to transmissible venereal tumors, which can be localized in the nose.¹⁰

Information about a patient’s environment, vaccination and heartworm status, tick exposure, and medications is essential. Outdoor pets are more susceptible than indoor pets to nasal trauma, parasitic and fungal infections, anticoagulant rodenticide toxicity, and foreign body inhalation.^{7,11-13} Owners should be questioned about travel to areas endemic for fungi, rickettsial organisms, *Leishmania* spp, and *Hepatozoon* spp. Drugs given currently or in the past should be reviewed. Aspirin and other NSAIDs, for example, inhibit platelet function. Trimethoprim-sulfamethoxazole, penicillins, and other antibiotics may cause immune-mediated platelet destruction. Chemotherapeutic agents, estrogens, and phenylbutazone may cause myelosuppression and thrombocytopenia. Immune-mediated thrombocytopenia is an uncommon sequela to vaccination.^{2,9,12-14}

An accurate description of the character and chronicity of the epistaxis can help narrow the differential list. Intranasal foreign bodies, neoplasia, dental disease, and fungal rhinitis often begin with unilateral nasal discharge or epistaxis that becomes bilateral as the disease disrupts the nasal septum. Many patients with these disorders have other clinical signs such as

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sneezing, stertorous respiration, gagging or dysphagia, halitosis, and pawing at the face. Bilateral epistaxis may occur with intranasal diseases but often indicates systemic causes such as coagulopathies, hypertension, hyperviscosity, thrombocytopenia, and thrombocytopenia.^{2,3,6,7,9,11-16} Nasal trauma results in acute-onset and often severe bleeding that resolves with supportive measures and does not recur. Hemostatic abnormalities related to thrombocytopenia, platelet function, or clotting factor defects may cause acute-onset epistaxis that does not resolve without appropriate therapy.^{2,8,9,14} Inhalation of foreign bodies, most commonly wood splinters or grass awns, often causes an acute-onset epistaxis, sneezing, and pawing at the face. If foreign objects remain lodged in the nasal cavity, chronic nasal discharge may result from granuloma formation.

Chronic or intermittent epistaxis is more common with oronasal fistulas, fungal rhinitis, and nasal tumors; often, these diseases begin with mucoid nasal discharge that later progresses to epistaxis. A history of dental disease may support oronasal fistula formation as causing epistaxis. Allergic rhinitis may cause seasonal nasal discharge and epistaxis.^{7,11-13,15,17}

Some patients with nasal disease may not have epistaxis or nasal discharge initially and can present with clinical signs unrelated to the nasal cavity. Central nervous system abnormalities, such as disorientation or blindness, may be seen in hyperviscosity syndromes or nasal tumors invading the brain.^{3,7,11,15,18} Polyuria and polydipsia are seen with hyperadrenocorticism, chronic renal failure, and hyperthyroidism, which uncommonly cause epistaxis secondary to hypertension.^{11-13,15,17}

PHYSICAL EXAMINATION

A careful, thorough physical examination is essential to prioritize the diagnostic differentials in dogs and cats. The face should be examined for visual or palpable asymmetry and bony defects (Figure 1), which most often result from neoplasia or severe fungal rhinitis. A glass slide or tuft of hair may be held up to the patient's nose to document airflow through the nostrils and may help localize the disease. The eyes should be examined, with gentle retropulsion because mass lesions may produce epiphora, exophthalmos, third eyelid prolapse, and deviation of the globe. The anterior chamber should be evaluated for uveitis and hemorrhage, and the fundus for chorioretinitis, hypertensive retinopathy, and hyperviscosity (i.e., tortuous retinal vessels, retinal hemorrhages).^{7,11,13,15} Ulceration and depigmentation of the



Figure 1. Facial deformity in a dog with intranasal undifferentiated carcinoma. Note the third eyelid protrusion, exophthalmos, and deviation of the globe caused by a tumor.

nasal planum may be seen with aspergillosis or squamous cell carcinoma of the nasal planum.^{6,19} Polypoid masses extending from the nares are found with rhinosporidiosis, phaeohyphomycosis, cryptococcosis, and, rarely, tumors.^{16,20-22} Cats with nasal cryptococcosis often have a characteristic convexity of the nose (Roman nose).¹⁶

The mouth should be visually inspected and palpated for palate deformity or masses, oronasal fistulas, and loose teeth. Regional lymph nodes should be palpated for enlargement caused by infection, inflammation, or metastatic neoplasia. A thorough evaluation of the skin and mucous membranes, body cavities, and joints is indicated to search for evidence of coagulopathy. Animals with petechia, mucosal bleeding, melena, or fundic hemorrhages are likely to have a defect of primary hemostasis (platelets), whereas those with hemarthrosis, hematomas, or bleeding into body cavities are likely to have a defect of secondary hemostasis (coagulation factors). Melena and hematemesis may occur when blood from the nasopharynx is swallowed.^{2,8,9,11-15}

DIFFERENTIAL DIAGNOSIS

The differential diagnosis for epistaxis can be divided into local (intranasal) and systemic (extranasal) causes (see box on p. 32). Local disease may progress and produce systemic complications that can exacerbate bleeding.

Local Processes

Local processes are the most common cause of epistaxis. Blood vessels may rupture after direct trauma or

Causes of Epistaxis²⁻⁴⁰**Local processes****Trauma****Neoplastic or benign masses**

- Epithelial: adenocarcinoma, undifferentiated carcinoma, squamous cell carcinoma, polyps
- Mesenchymal: chondrosarcoma, fibrosarcoma, hemangiosarcoma, osteosarcoma, melanoma
- Round cell: lymphoma, transmissible venereal tumor, mast cell tumor, plasmacytoma

Infection

- Fungal: cryptococcosis, aspergillosis, penicilliosis, rhinosporidiosis, pythiosis, phaeohyphomycosis
- Parasitic: nasal mites (*P. caninum*), nasal nematode (*E. boehmi*), *L. serrata*, *Cuterebra* species, *Leishmania* species
- Bacterial: primary (*Bordetella*, *Pasteurella*, *Mycoplasma* species) or secondary
- Viral: feline viral rhinotracheitis and calicivirus

Inflammatory disease

- Lymphoplasmacytic: primary or secondary (e.g., to neoplasia, fungal disease, parasites)
- Eosinophilic: allergic rhinitis

Dental disease

- Tooth root abscess
- Oronasal fistula

Foreign body**Vascular malformation****Systemic processes****Thrombocytopenia***Decreased production*

- Infectious: ehrlichiosis, FeLV, FIV, Rocky Mountain spotted fever, hepatozoonosis, septicemia, endotoxemia, leishmaniasis
- Drugs: cytotoxic agents, estrogens, sulfa drugs, methimazole, phenobarbital
- Neoplasia: myelophthisis secondary to myeloproliferative or lymphoproliferative diseases, hyperestrogenism (secondary to Sertoli cell and granulosa cell tumors)
- Other causes: bone marrow aplasia, cyclic

thrombocytopenia, myelofibrosis, myelodysplasia, toxins, osteosclerosis, idiopathic

Increased destruction

- Immune mediated: idiopathic or secondary to drugs, neoplasia, infection, vaccines
- Microangiopathy: shearing of platelets, associated with hemangioma or hemangiosarcoma

Sequestration

- Neoplasia: large vascular tumors, lymphoma
- Splenomegaly or splenic torsion
- Hepatomegaly

Increased consumption

- DIC
- Vasculitis: rickettsial infections, neoplasia, heartworm disease, bacteremia, uremia, cutaneous and renal glomerular vasculopathy of greyhounds
- Hemorrhage

Thrombocytopathia

- Congenital: vWD, platelet procoagulant activity deficiency in German shepherds, Glanzmann's thrombasthenia in Great Pyrenees, basset hound and foxhound thrombopathia, others
- Acquired: vWD (associated with hypothyroidism), uremia, dysproteinemia (associated with multiple myeloma, ehrlichiosis, leishmaniasis), drugs (NSAIDs, phenothiazines), polycythemia vera

Coagulation factor deficiency

- Congenital: hemophilia A (factor VIII deficiency) and B (factor IX deficiency), others
- Acquired: anticoagulant rodenticide toxicity, liver failure, DIC

Increased capillary fragility

- Hypertension: primary or secondary to chronic renal failure, glomerulonephropathies, hyperadrenocorticism, hyperthyroidism, hypertrophic cardiomyopathy, pheochromocytoma
- Hyperviscosity syndrome: secondary to multiple myeloma, ehrlichiosis, polycythemia (primary or secondary to hypoxia or neoplasia), leukemias
- Hyperlipidemia
- Thromboembolic disease
- Neoplastic invasion of blood vessels

erosion by infection, inflammation, or neoplasia. Trauma is generally readily diagnosed on the basis of acute onset, history, and other signs. A thorough evaluation for central nervous system, cardiovascular, and orthopedic injuries is indicated because head trauma severe enough to result in epistaxis often damages other organ systems.^{7,11-13,15}

Inhalation of foreign bodies (commonly grass awns, wood splinters, and small household objects) can result in acute onset of sneezing, head rubbing, and pawing at the face. If objects are not sneezed out, swallowed, or removed endoscopically, granuloma formation may result and lead to an often protracted course of nasal

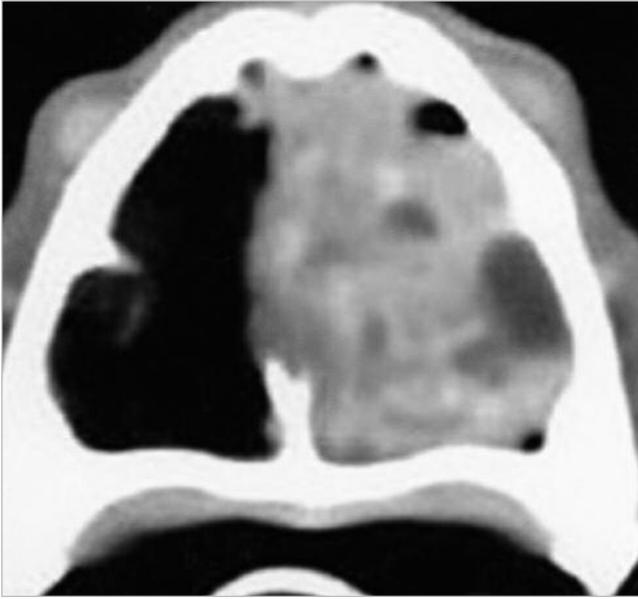


Figure 2. CT scan of a dog with intranasal adenocarcinoma. Note that the mass fills the entire right side of the nasal cavity and bulges into the left side, thus causing deviation of the vomer.

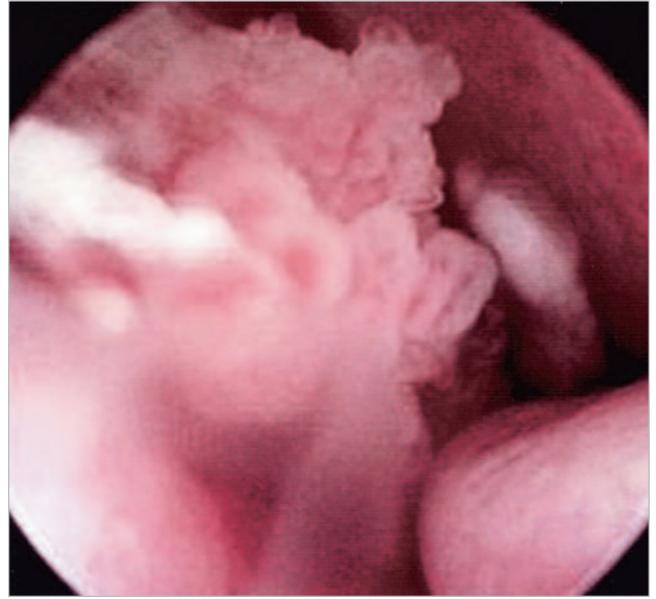


Figure 3. Rhinoscopic image of the dog in Figure 2. Biopsy of the mass revealed adenocarcinoma.

discharge, sneezing, and epistaxis. Foreign bodies present for longer than a few hours may become covered by mucus, blood, or granulation tissue and may be overlooked during rhinoscopy.^{7,11-13,15,23,24}

Nasal tumors should be the primary diagnostic differential in older animals with an intermittent, progressive history of nasal discharge and epistaxis.^{7,11-13,15} These tumors are locally invasive and destructive (Figures 2 and 3) and sometimes result in clinically detectable metastasis to regional lymph nodes and the lungs.³ In dogs, carcinomas make up approximately two-thirds of intranasal cancers, the remainder being sarcomas and, rarely, round cell tumors.^{3,5} Feline intranasal tumors are mostly lymphomas and carcinomas; lymphomas usually affect younger cats (mean age: 9.6 years) and adenocarcinomas older cats (median age: 14.9 years).⁴ Benign tumors are uncommon except for nasopharyngeal polyps in cats. The workup for nasal tumors ideally includes computed tomography (CT) or magnetic resonance imaging (MRI) and biopsy.³

Nasal aspergillosis and penicilliosis, with similar clinical appearances, are distinguished only by tissue culture.⁶ These infections are generally confined to the nasal cavity and paranasal sinuses, where they cause turbinate destruction and erosion of the nasal mucosa and thus nasal discharge and epistaxis (Figures 4 to 7). Most

patients are dogs younger than 7 years of age. Intermittent, chronic nasal discharge and epistaxis, nasal planum ulceration and depigmentation, and facial pain secondary to bone destruction are seen in dogs.^{6,7,11-13} No single test is diagnostic for nasal aspergillosis or penicilliosis, and false-positive and -negative results occur often. These fungi are common in the environment, so positive serologic and culture results may be misleading. Of dogs with nasal tumors, 40% reportedly had positive culture results for either *Aspergillus* or *Penicillium* spp; therefore, the workup for these infections should include a search for neoplasia. Evaluation of history, signalment, rhinoscopic findings (i.e., presence of white, yellow, or green fungal mats), culture, and histopathology documenting infiltration of fungal hyphae into tissues is essential for diagnosis. Therapy most often involves topical local infusion of clotrimazole; systemic antifungal agents are rarely indicated.^{6,25}

Fungal rhinitis caused by *Cryptococcus neoformans* is more common in cats than in dogs.¹⁶ The organism is inhaled, induces nasal granuloma formation, and can disseminate into the central nervous system and other organs. Granulomas appear as polyps protruding from the nose or as intranasal polyps, leading to a characteristic convex shape (Roman nose) over the bridge of the nose.^{7,15,16} Many cats present with signs related only to the nasal cavity and then develop systemic signs. Diagnosis is based on identification of the organism in nasal

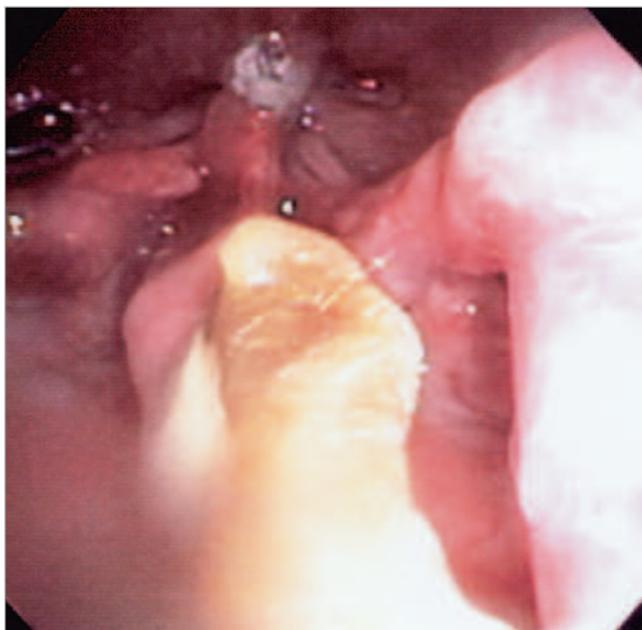


Figure 4. Endoscopic image of a dog with fungal rhinitis. Biopsy samples of the yellow plaque were diagnostic for nasal aspergillosis.



Figure 5. CT scan of the dog in Figure 4. Note involvement of the sinuses (arrows), the presence of abnormal soft tissue opacities in both sides of the nasal cavity, and destruction of the turbinates.

discharge or histologic tissues and/or serology. Wright's stain and India ink may be used for cytologic identification. Detection of cryptococcal capsular antigen by the latex agglutination test is sensitive and specific for diagnosis and useful for therapeutic monitoring. Therapy may include surgical debulking of large lesions in addition to systemic antifungal therapy.¹⁶

Rhinosporidiosis and phaeohiphomycosis are uncommon, generally localized fungal diseases that often present with polypoid masses protruding from the nose and may be well controlled with surgery or antifungal therapy.²⁰⁻²² The rare nasopharyngeal pythiosis affects animals in subtropical climates and is difficult to treat.²⁶

Infestations include disease caused by *Pneumonyssoides caninum*, a small (1 mm) mite that infests the canine nasal cavity and sometimes causes head shaking, violent sneezing, nasal discharge, and epistaxis; other animals are asymptomatic. Diagnosis is based on observation of mites during rhinoscopy or of parasite ova in nasal flush fluid or fecal flotations.^{11-13,27} Successful treatment with ivermectin has been reported. The nematode *Eucoleus boehmi* infests the nasal mucosa and sinuses; worms are large (1.5 to 4 cm), visible endoscopically,²⁸ and treated with ivermectin. *Cuterebra* larvae may be found in the nasal cavity; therapy consists of removal of the organism.^{11,27} Dogs become infected with *Linguatula serrata*, a

nasal parasite, by ingesting viscera of infected sheep and cattle. *Leishmania* is a protozoan that produces a systemic illness secondary to induction of hyperglobulinemia, vasculitis, and organ dysfunction and may cause epistaxis because of inflammatory and ulcerative lesions in the nasal mucosa.²⁹

Lymphoplasmacytic rhinitis can be a primary disease entity, and it often accompanies neoplastic and fungal rhinitis. Diagnosis depends on ruling out other diseases on the basis of a workup and histologic evidence of infiltration of mature lymphocytes, plasma cells, and other inflammatory cells into the nasal mucosa and submucosa. Immunosuppressive doses of corticosteroids and, in some cases, other immunosuppressive therapies are used. If the animal's condition worsens despite therapy or only a minimal response to therapy is achieved, reevaluation for another disease process is indicated.³⁰

Allergic rhinitis is a hypersensitivity response to antigens; as in lymphoplasmacytic rhinitis, underlying diseases must be excluded. If a relationship between a particular antigen and onset of clinical signs is identified, therapy could include removal of the offending substance. Biopsy reveals eosinophilic inflammation. Steroids and antihistamines are useful.^{30,31}

Animals with oronasal fistulas or tooth root abscesses



Figure 6. Lateral oblique radiograph of a dog with nasal aspergillosis. Note increased opacity within the left frontal sinus and destruction and irregularity of the frontal bone (arrows).

may develop nasal discharge or epistaxis.^{7,11–13,15} A periodontal probe should be used to examine all maxillary teeth to identify disease sites and to look for communication between these areas and the nasal cavity.

Occasionally, animals develop sporadic, self-limiting epistaxis associated with environmental humidity changes (i.e., dry air) or mild, intermittent epistaxis related to a small intranasal ulceration with no underlying etiology. Cats with upper respiratory infections uncommonly develop chronic nasal discharge and sneezing and thus intermittent epistaxis.⁷ Rupture of arteriovenous malformations is a rare cause of sudden-onset epistaxis.³² Bleeding can also occur after repeated violent sneezing of any cause.

Systemic Processes

Primary hemostatic defects (platelet plug formation) include thrombocytopenia and thrombocytopathia.^{2,9,14} Epistaxis is often associated with platelet defects and likely related to the paucity of tissue between the blood vessels and nasal mucosa.⁹ Mechanisms of thrombocytopenia include decreased production, increased destruction, sequestration, and increased consumption. Spontaneous bleeding is uncommon unless the platelet count is 30,000/ μ l or less. Decreased platelet production can result from neoplastic conditions that lead to myelophthisis or hyperestrogenemia as well as from viral, rickettsial, protozoal, parasitic, or bacterial infections; drugs; toxins; idiopathic factors; or immune-mediated destruction of megakaryocytes. Increased platelet destruction may be immune-mediated (primary or secondary) or related to microangiopathy (seen with hemangiosar-



Figure 7. Open-mouth ventrodorsal radiograph of a dog with nasal aspergillosis. Increased soft tissue opacity is visible within both sides of the nasal cavity, and the normal trabecular pattern of the turbinates is absent. The left side is more severely affected.

coma). Platelet sequestration in the spleen, liver, or large vascular tumors results in thrombocytopenia. Increased platelet consumption occurs with disseminated intravascular coagulopathy (DIC), vasculitis, and severe hemorrhage. Thrombocytopathia may be primary (vWD) or secondary to uremia, dysproteinemias (e.g., associated with ehrlichiosis and multiple myeloma), or use of drugs such as NSAIDs.

Secondary hemostatic (coagulation factor) defects usually result in bleeding into body cavities and ecchymosis but occasionally produce mucosal bleeding and epistaxis. These disorders include congenital abnormalities such as hemophilia A (factor VIII deficiency) and B (factor IX deficiency) and acquired coagulopathies such as anticoagulant rodenticide toxicity (resulting in loss of factors II, VII, IX, and X) and hepatic failure (with decreased coagulation factor production). Increased capillary fragility with subsequent rupture can result from hypertension, neoplasms invading blood vessels, hyperviscosity syndromes, hyperlipidemia, and thromboembolic disease.^{2,9,14}

DIAGNOSTIC PLAN

A detailed history and physical examination are essential for a proper diagnostic plan (see box on this page). If findings strongly indicate intranasal disease, first tests may focus on the nasal cavity. An initial minimum database, including complete blood cell count (CBC) with platelet count, chemistry profile, and urinalysis, is needed before induction of anesthesia. A coagulogram and buccal mucosal bleeding time (BMBT) are required before nasal biopsy because of possible severe complications of a coagulopathy. Examination of oral and nasal cavities with an endoscope or dental mirror with light source, radiographs of the nasal cavity and thorax, CT or MRI of the nasal cavity, flushing of the nose, cytology of nasal discharge, staining with India ink (for *Cryptococcus* organisms), fungal serology, and nasal biopsy will most likely yield diagnostic information. Nasal cultures are infrequently useful because bacterial contaminants are usually abundant in the nose.^{7,23,33–35} Clinical signs and initial laboratory data may support the possibility of systemic disease.

Complete Blood Count, Including Platelet Count

The CBC is normal in many cases of epistaxis, but abnormalities may help pinpoint the cause. Regenerative anemia (significant reticulocytosis) indicates bone marrow response to bleeding and usually occurs within 3 to 5 days of blood loss; with chronic epistaxis, iron deficiency with nonregenerative anemia may occur.³⁶ Leukocytosis is generally nonspecific and may result from chronic inflammation or infection. Leukopenia may result from infections, cytotoxic drug administration, immune-mediated disease, or sepsis.³⁷ Increased destruction or consumption, sequestration, or decreased production of platelets can cause thrombocytopenia. Evaluation of a blood smear may be useful until laboratory test results are available: normal dogs and cats have 10 to 15 platelets per 100× oil immersion field (1 platelet per oil immersion field indicates a platelet count of approximately 20,000/ μ l). Macroplatelets suggest regeneration associated with peripheral platelet destruction or consumption; these platelets may be more functional than normal, which explains why dogs with platelet counts less than 10,000/ μ l often do not bleed.^{2,9,14} A bone marrow aspirate or core biopsy is indicated in cases of unexplained nonregenerative anemia, thrombocytopenia, or leukopenia or when abnormal cells are found in circulation.

Clinical Approach to Patients with Epistaxis^{7,11–13,15,30,33–35}

Initial evaluation

Completion of these tests should help the clinician localize the disease to the nasal cavity and rule out systemic processes:

- History
- Physical examination
- CBC, including platelet count
- Serum chemistry panel
- Urinalysis
- Coagulation panel, with tests for clotting factors if coagulation results are abnormal
- BMBT, with von Willebrand's factor assay if BMBT results are abnormal
- Rickettsial serology: *Ehrlichia*, *Rickettsia*, *Borrelia* spp
- Fecal flotation for detection of parasite ova
- Indirect blood pressure measurement
- Cytology of nasal discharge to examine for *Cryptococcus* spp
- Cryptococcus* LCAT
- Viral testin (cats): FeLV, FIV, \pm herpesvirus, calicivirus
- Thoracic radiography
- Heartworm serology

Secondary evaluation

If initial tests do not reveal evidence of systemic disease, epistaxis can be localized to the nasal cavity. General anesthesia is required for the following procedures:^a

- Oral examination
- Nasal radiography, CT, or MRI
- Rhinoscopy
- Nasal biopsy (even if lesions are not seen via diagnostic imaging or rhinoscopy)
- Culture of deep biopsy specimens for fungi and bacteria
- Nasal cavity flush for parasite ova, foreign bodies, and tissue

^aIf these procedures yield inconclusive results, referral for CT or MRI is indicated. If mass lesions are present and biopsy is inconclusive for neoplasia or fungal disease, another biopsy procedure may be indicated. Rhinotomy and turbinectomy are considered only when repeated biopsies of mass lesions give inconclusive results or when foreign bodies cannot be removed endoscopically.

Chemistry Profile

Panhypoproteinemia may result from chronic blood loss. Hyperglobulinemia may occur secondary to neoplasia or chronic infections. Serum protein electrophoresis can document a monoclonal or polyclonal gammopathy. Monoclonal gammopathies occur with multiple myeloma, chronic ehrlichiosis, lymphoma,

leukemias, and macroglobulinemia.¹⁸ Evidence of renal, hepatic, or endocrine disease that can cause or exacerbate epistaxis may be present, and abdominal ultrasonography, endocrine testing, and other diagnostic tests may be required.

Urinalysis

Metabolic, neoplastic, and infectious diseases that result in epistaxis can also cause glomerulonephropathies with subsequent proteinuria.³⁸ A urinary protein:creatinine ratio should be determined when proteinuria and an inactive urine sediment are found. Bladder mucosal bleeding and hematuria may be seen with thrombocytopenia and thrombocytopathia.^{2,9,14}

Hemostatic Studies

BMBT is a useful in-hospital test of platelet function and is reliable when platelet counts are higher than 100,000/ μ l. Abnormal results should prompt a search for a cause of thrombocytopathia, including von Willebrand's titer and

**Supportive care is needed until
the underlying cause can be
identified and treated.**

evaluation for secondary causes of platelet function defects. Coagulation studies, such as partial thromboplastin time (for the intrinsic clotting cascade), prothrombin time (for the extrinsic clotting cascade), and activated clotting time (for the intrinsic clotting cascade and platelet function), should be considered if platelet abnormalities have been ruled out. If coagulograms are abnormal, tests for specific clotting factors and PIVKA (proteins inhibited by vitamin K antagonists) should be considered. A coagulogram should also include fibrinogen, fibrin degradation products, and an antithrombin III concentration to reveal evidence of DIC.^{2,9,14}

Thoracic Radiographs

Thoracic radiographs are usually normal in patients with intranasal disease but can uncover systemic fungal disease and metastatic neoplasia. They should be obtained before use of anesthesia and further workup.¹⁵

Serology

Ehrlichiosis and Rocky Mountain spotted fever are diagnosed via immunofluorescent antibody testing.³⁹ *Aspergillus* spp antibody titers are nonspecific but support a diagnosis of fungal rhinitis when positive in a patient with a positive fungal culture as well as historical, radiographic, histologic, cytologic, and endoscopic signs of nasal aspergillosis. A negative *Aspergillus* spp titer does not rule out the disease.⁶ A latex agglutination test for *Cryptococcus* spp capsular antigen is useful for diagnosis and therapeutic monitoring.¹⁶ Tests for FeLV and FIV are indicated when viral status is unknown.⁴⁰ Thyroxine levels should be part of the minimum database for cats older than 6 years of age. Heartworm testing is indicated in areas with endemic disease.

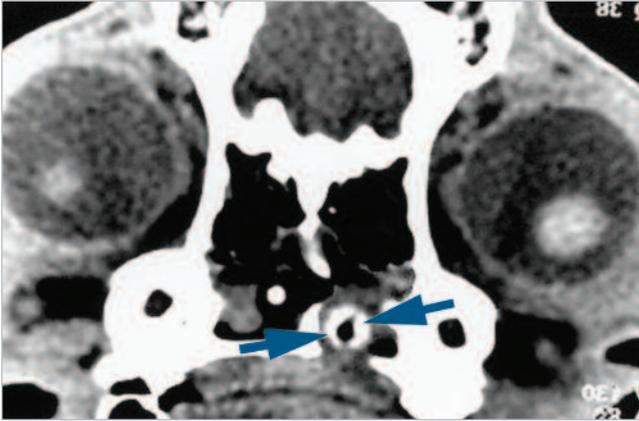


Figure 8. CT scan of a 3-year-old female pug with acute-onset epistaxis. A soft tissue to mineral hollow spherical density is seen within the right choana (arrows). Note lysis of the hard palate ventral to the object.

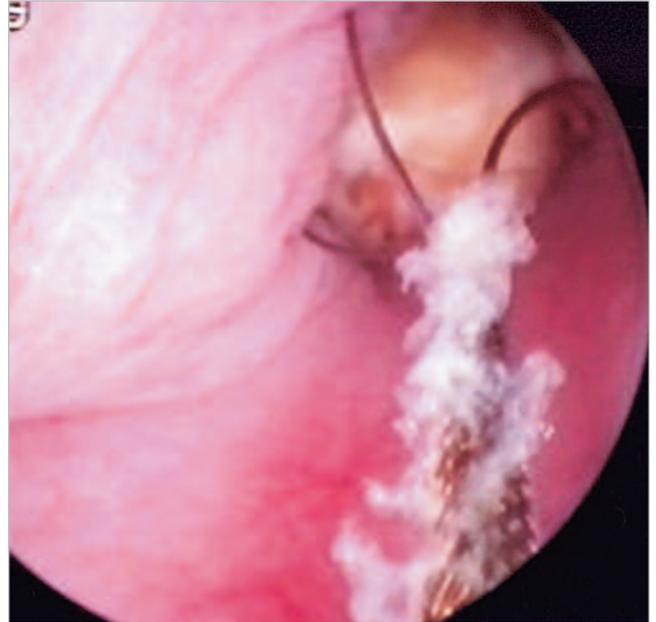


Figure 9. Endoscopic examination of the dog in Figure 8 revealed the presence of a foreign body—a popcorn kernel. The object is being retrieved with a grasping forceps.

Fecal Flotation

Fecal flotation can reveal parasite ova, which may be swallowed when parasites infest the nasal cavity.²⁷

Blood Pressure

When hypertension is suspected as a contributing cause of epistaxis, blood pressure is commonly evaluated by using indirect Doppler or oscillometric methods.^{12,13} Documented hypertension should prompt endocrine testing and a search for the primary cause via abdominal and cardiac ultrasonography.

Imaging

Imaging studies are performed before rhinoscopy to avoid difficulties in interpreting iatrogenic lesions (i.e., bleeding induced by biopsy). Images should be examined for asymmetry, mass lesions, bony lysis, increased fluid density, loss of turbinates, dental abnormalities, and radiodense foreign bodies. This information can indicate disease location, demonstrate severity, and guide biopsy procedures. Nasal radiographs require general anesthesia for proper positioning and should include lateral, oblique, open-mouth ventrodorsal, intraoral, and frontal sinus views. Dental radiographs are indicated for suspected tooth root abscesses. A tympanic bulla series is needed for cats with suspected nasopharyngeal polyps. CT and MRI are superior to radiography for nasal disease because they allow visualization of and contrast between bony and soft tissue lesions and they can image all areas of the mouth, pharynx, and nose, including turbinates, nasal septum, cribriform plate, and sinuses,

which allows assessment of disease extent. Uptake of contrast material by tumors can distinguish them from mucus, although not all tumors enhance after use of contrast material. CT or MRI is essential for planning radiotherapy for neoplasia.^{3,5,7,12,13,34,35}

Rhinoscopy

Rhinoscopy allows visualization of foreign bodies, mass lesions, turbinate erosion, fungal plaques, oronasal fistulas, and nasal parasites.^{23,24,33,34} A 1992 study examined the usefulness of rhinoscopy and rhinoscopy-assisted mucosal biopsy in 119 dogs. In 83% of evaluable cases, rhinoscopy with biopsy provided a definitive diagnosis; in 10 cases, rhinoscopy alone provided a definitive diagnosis (foreign bodies, oronasal fistula, and *P. caninum* infection). Although prolonged hemorrhage after biopsy was the most common complication, it occurred in only two dogs, one of which died.²³

If a coagulopathy has been ruled out, rhinoscopy is performed after the imaging studies, with the animal under general anesthesia and use of a cuffed endotracheal tube. When a foreign body is strongly suspected, rhinoscopy may be performed as one of the first tests (Figures 8 and 9). Instruments such as dental mirrors, spay hooks, and otoscopes provide limited visualization of the nasal cavity and oropharynx but may assist in



Figure 10. Biopsy forceps.

diagnosis of foreign bodies and large tumors. Rigid (1.9- or 2.7-mm external diameter) or flexible (3.2- or 6.6-mm external diameter) endoscopes are required for a full examination and are useful for retrieving foreign bodies and collecting biopsy and deep tissue specimens for culture. The largest scope available that fits the patient is generally preferred.

Narrow rigid scopes are best for visualization through external nares. The distance from the medial canthus to the nostril opening should be identified before entry into the nose, and the scope should not be advanced past this point to avoid cribriform plate penetration. The least-affected side should always be examined first, and the evaluation should begin ventrally and move dorsally in case of iatrogenic hemorrhage. Each nasal meatus should be evaluated, with the scope advanced as caudad as possible without causing hemorrhage. A flexible scope is retroflexed and introduced into the pharynx, hooked above the soft palate, and then advanced rostrally to allow visualization of the choanae.²⁴

The oropharynx and oral cavity should be thoroughly evaluated. The entire nasal cavity including the frontal sinuses (if possible) should be examined for masses, foreign bodies, fungal or inflammatory plaques, parasites, and polyps. The presence of blood, excess mucus, and inflamed mucosa can interfere with visualization of lesions and foreign objects. Saline flushes may be used to try to clear mucus or blood but may further impair the view. Endoscopic visualization of the full nasal cavity is not possible, and lesions may be overlooked.^{7,23,24,33,34}

Nasal Swabs, Flushing, and Biopsy

Results of cytologic studies of nasal discharge are generally nonspecific, but these assays should be performed



Figure 11. Blind nasal biopsy. The instrument seen in Figure 10 was used. Before the forceps was introduced into the nose, it was marked with tape at a premeasured distance between the medial canthus and the external nares to avoid cribriform plate penetration. Note that the patient's head is ventroflexed and an endotracheal tube is in place.

early in a workup in cats because *Cryptococcus* organisms can easily be identified when stained with India ink.¹⁶ Nasal cavity flushing is performed with the animal under anesthesia, after the oropharynx has been packed with gauze sponges and the head is positioned ventrally to avoid aspiration of blood or fluid. Sponges should always be counted before placement in the oropharynx to ensure that all are removed at the end of the procedure, before extubation. A flexible endoscope or red rubber catheter retroflexed behind the soft palate may be used to flush approximately 100 ml of sterile saline rostrally through the nose. The fluid, collected in a bowl, is evaluated via cytologic studies; pieces of tissue may be submitted for histopathology. Foreign bodies may be retrieved, and parasitic ova in the fluid may be evident by microscopy.^{7,34,35}

Biopsy should follow rhinoscopy. The clinician should try to sample the most obvious lesion first because subsequent bleeding often precludes further visualization. A “blind” method may be used if visualization is difficult because of hemorrhage or the patient's small size. Biopsy instruments include alligator or pituitary-cup forceps (Figure 10). Before the forceps is advanced into the nose, it should be marked with tape at the premeasured distance between the medial canthus and the external nares to avoid cribriform plate penetration (Figure 11). For mass lesions, a closed instrument is passed toward the lesion; when the mass is reached (i.e., resistance is felt), the instrument is opened to grasp a piece of the lesion.

At least 6 to 10 pinch biopsy samples should be obtained to increase the probability of obtaining a diagnostic sample. If lesions are not seen via imaging or rhinoscopy, multiple biopsy samples throughout the nose should be obtained. Most such specimens are small (about 5 × 5 mm), so pieces of tissue should be placed in marked cassettes (i.e., right and left sides) before putting them in formalin. Occasionally, blind biopsy of the nose yields larger pieces of turbinate, usually accompanied by significant bleeding. A larger core biopsy specimen may be obtained from a mass lesion by using the plastic sleeve of an IV catheter or spinal needle or a large polypropylene male dog urinary catheter. The sleeve is cut at a 45° angle to allow penetration of the mass and is fitted to a 12- or 20-ml syringe. Negative pressure is applied to the syringe while the mass is punctured so that a core of tumor remains in the sleeve.³

Incisional or Tru-Cut biopsy or aspiration of hard palate defects or areas of facial deformity may help determine a diagnosis. Touch preparations of the biopsy tissue on slides for cytologic examination may hasten the diagnosis and are especially helpful for fungal identification.

loss. Severe or intractable bleeding necessitates flushing the nose with dilute epinephrine (1:100,000); packing the entire nasal cavity and pharynx with sponges or tampons; applying ice packs or cold saline flushes to the nose; and, rarely, carotid artery ligation.^{7,12,13,23,24,33,34}

Culture

Nasal cultures are generally not recommended because primary bacterial rhinitis is rare and secondary overgrowth of normal nasal flora is common. If needed, cultures may be obtained via nasal swabs, flushing, or tissue culture; the last is most likely to reveal true nasal cavity flora. A superficial nasal swab is likely to yield growth of normal flora, including *Escherichia coli*, *Streptococcus* spp, and *Pasteurella* spp. Growth of one or two species more likely represents an abnormality, whereas growth of multiple bacteria is usually normal, so the laboratory should be advised to report all growth. Antibiotic treatment may improve clinical signs and can give a false sense of disease resolution, with an ultimate delay in definitive diagnosis and therapy. Growth of *Aspergillus* and *Penicillium* should be interpreted in light of other findings, such as

In young animals, epistaxis most commonly results from trauma, foreign body inhalation, or fungal rhinitis; in older patients, neoplasia is the top diagnostic differential.

Clinicians should be aware that most nasal tumors are accompanied by severe inflammation, which often makes cytologic (and sometimes histologic) diagnosis difficult. Client education is essential before biopsy because many patients with nasal disease must undergo repeated procedures. If biopsy of mass lesions does not support a diagnosis of neoplasia, another endoscopic biopsy and more aggressive biopsy techniques, such as sinus trephination or rhinotomy, may be indicated.

Complications of nasal biopsy that should be anticipated include life-threatening hemorrhage, aspiration of blood, and neurologic signs in the case of cribriform plate penetration. Careful monitoring and treatment of hemorrhage and pain should be instituted. Digital pressure and packing the nasal cavity with sponges are helpful for mild hemorrhage until bleeding subsides. Extra caution is needed to ensure that all blood clots are suctioned or removed from the pharynx before extubation. IV fluid support should be provided to replace volume

the presence of fungal plaques, radiographic evidence of bony destruction, and presence of organisms infiltrating tissues, for a diagnosis of fungal rhinitis, as these organisms may represent normal flora or may cause a secondary infection related to an underlying neoplasm.^{6,7,33-35}

Exploratory Rhinotomy with Turbinectomy

If all the tests just described do not lead to a definitive diagnosis, or a foreign body cannot be removed via rhinoscopy, options include repeating the tests immediately or in 1 to 2 months or pursuing exploratory rhinotomy.^{34,35} Although some clinicians may pursue medical therapy for infectious or inflammatory causes (e.g., antibiotics for bacterial rhinitis and corticosteroids for inflammatory rhinitis) before diagnostics, the underlying disease will likely progress. Antibiotics and corticosteroids may eliminate clinical signs but ultimately delay diagnosis and may hasten the patient's demise, especially if neoplasia or fungal rhinitis exists.

Exploratory rhinotomy may be the only way to definitively diagnose small tumors or foreign bodies.^{34,35} If aspergillosis is strongly suspected, catheters can be placed in the sinuses at the same time for future antifungal therapy.^{6,25} Potential benefits of surgery must outweigh potential complications, including hemorrhage, subcutaneous emphysema, inadvertent entry into the brain, and recurrent nasal cavity infections.³³⁻³⁵

TREATMENT

The goal of treatment is to control epistaxis until a definitive diagnosis and therapeutic plan for the primary cause can be determined. Treatments including cage rest, ice packs, application of pressure to the nose, and sedation may help control hemorrhage. Use of sedatives such as acepromazine, diazepam, and butorphanol at low doses may help relieve anxiety, but care should be taken to avoid causing hypotension. In animals that have suffered trauma or are obtunded, blood should be suctioned from the oropharynx to prevent its aspiration. Instillation of phenylephrine (10 mg/ml; 0.1 ml in 1 ml of 0.9% NaCl) into the nose may resolve hemorrhage. In severe cases, general anesthesia and packing the nasal cavity and oropharynx with dilute (1:100,000) epinephrine-soaked sponges or tampons or ligation of the external carotid artery on the affected side or both sides may help control bleeding. In animals with severe acute hemorrhage, IV fluid therapy and packed erythrocytes may be needed.^{12,35} If a coagulopathy is suspected, transfusions of whole blood or fresh-frozen plasma or both are indicated. In thrombocytopenic animals, transfusions rarely supply adequate platelet numbers to stop bleeding.^{2,9,14}

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ARTICLE #2 CE TEST



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1. A diagnosis of nasal aspergillosis is based on

- a. a positive *Aspergillus* titer.
- b. positive culture of *Aspergillus* from a nasal swab.
- c. the presence of *Aspergillus* on a cytology of nasal discharge.
- d. radiographic evidence of turbinate destruction.
- e. tissue culture and radiographic, endoscopic, serologic, and histologic findings.

2. Which method is best for avoiding puncture of the cribriform plate during a nasal biopsy?

- a. premeasuring the distance from the opening of the nostril to the medial canthus of the eye, marking the instrument at this site, and then avoiding going past this mark
- b. estimating the distance between the external nares and the frontal sinuses with skull radiographs, and then taking care not to exceed the premeasured distance with the biopsy instrument

- c. entering the cribriform plate is a rare complication of nasal biopsy, and no precautions are needed
- d. avoiding advancement of the biopsy instrument past any areas of resistance
- e. performing biopsies to a depth of 3 cm, regardless of patient size

3. Which condition is most likely to result in chronic, intermittent epistaxis in a 12-year-old golden retriever?

- a. trauma
- b. nasal mite infestation
- c. nasal adenocarcinoma
- d. arteriovenous malformation rupture
- e. vWD

4. _____ should be performed before anesthesia and nasal biopsy.

- a. A thorough history and physical examination
- b. BMBT
- c. Thoracic radiography
- d. Chemistry profile, CBC, platelet count, and urinalysis
- e. all of the above

5. Which statement about CT and MRI of the nasal cavity in the workup of epistaxis is true?

- a. CT and MRI allow visualization of bony and soft tissue structures of the nasal cavity and oropharynx.
- b. CT and MRI are essential for radiotherapy planning in cases of neoplasia.
- c. CT and MRI are superior to radiography because they document the presence of bony lysis without superimposition of overlying structures.
- d. CT and MRI can determine whether a tumor has invaded the cribriform plate.
- e. all of the above

6. Which statement about foreign body inhalation is true?

- a. Foreign body inhalation occurs in dogs of all ages and most commonly results in acute-onset epistaxis.
- b. Foreign bodies may be overlooked during rhinoscopy because they are quickly covered with mucus and blood clots, so a degree of suspicion and careful endoscopic examination may be required.
- c. If foreign bodies are not sneezed out or otherwise removed, they can result in chronic nasal discharge secondary to granuloma formation.
- d. Foreign bodies may be removed from the nose by flushing (if they are small enough), with a grasping forceps via endoscopy, or, rarely, by a surgical procedure.
- e. all of the above

7. Which abnormality is least likely related to a defect in primary hemostasis (i.e., platelets)?

- a. petechiated mucous membranes
- b. hemarthrosis
- c. retinal hemorrhages
- d. gingival mucosal bleeding
- e. epistaxis

8. Which statement regarding nasal tumors in dogs and cats is not true?

- a. Carcinoma is the most common type of nasal tumor in dogs.
- b. Nasal lymphoma is more common in younger cats, and nasal adenocarcinoma occurs more often in older cats.
- c. Radiation therapy is often a primary treatment of nasal tumors in dogs and cats.
- d. Nasal tumors are locally invasive and highly metastatic, with up to 80% of animals developing pulmonary metastasis.
- e. Benign nasal tumors are rare but occur more commonly in cats than in dogs.

9. Which statement about nasal cryptococcosis is not true?

- a. The LCAT is useful for both diagnosis and monitoring response to therapy.
- b. Nasal cryptococcosis is more common in cats than in dogs.
- c. The organism is inhaled and can disseminate into the eyes and central nervous system.
- d. Treatment consists of surgical debulking of lesions; systemic antifungal therapy is rarely indicated.
- e. Nasal cryptococcosis is readily diagnosed by visualizing the organism in an India ink–stained preparation of nasal discharge.

10. Which statement about platelet evaluation in dogs and cats is not true?

- a. Normal dogs and cats have 10 to 15 platelets per oil immersion field.
- b. The BMBT is an in-hospital test of platelet function and is reliable if the platelet count is greater than 100,000/ μ l.
- c. Macroplatelets indicate platelet regeneration and may be more functional than normal platelets.
- d. Thrombocytopenia rarely results from chronic hemorrhage.
- e. Rickettsial diseases such as ehrlichiosis rarely result in thrombocytopenia.