

Critical Concepts to Providing Compassionate Cancer Care

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Front page: Hardcover

Size: 20 x 28 cm

Pages: 472

Publication: 2017

Illustration: Color

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Chapter 45

Feline lymphoma

Clinical presentation

- Moderately common.
- May be uncomfortable.
- Weight loss, anorexia and lethargy are common.
- Clinical presentation often relates to anatomic location of the disease.



Key point

GI lymphoma generally occurs in older, FeLV-negative cats, whereas mediastinal lymphoma is seen more commonly in FeLV-positive cats, often of Siamese/Oriental breed.

Alimentary lymphoma

- Most common type; usually affects older, FeLV-negative cats.
- Vomiting, diarrhea, weakness, cachexia seen with lymphoma of the gastrointestinal tract.
- May be large cell (best treated with modified CHOP protocol) or small cell lymphoma (best treated with chlorambucil and prednisolone).

Mediastinal lymphoma

- Usually affects young, FeLV-positive cats, often of Siamese/Oriental breed.
- Respiratory difficulty, cyanosis, and tachypnea may be seen with mediastinal lymphoma.

Spinal lymphoma

- Usually affects FeLV-positive cats. Demographics may be changing as FeLV infection is becoming less common.
- Weakness, ataxia, cranial nerve abnormalities and conscious proprioception deficits seen with lymphoma of the central nervous system.

Renal lymphoma

- Cats may be FeLV-positive.
- Large kidneys, uremic breath, and cachexia seen with renal lymphoma.

Nasal lymphoma

- Chronic nasal discharge that may be transiently responsive to antibiotics due to secondary bacterial infection.
- Must be differentiated from cryptococcus, herpes and calici-induced upper respiratory infections.

Hodgkin's-like lymphoma

- Cervical lymphadenopathy may be seen with Hodgkin's-like lymphoma.
- Pale mucous membranes, weakness, petechial and ecchymosis with bone marrow involvement.

Lymphoma of large granular cell lymphocytes

- Enlarged lymph nodes at or around the gastrointestinal tract that stain intensely with intra-cytoplasmic granules.
- Weight loss, vomiting and diarrhea are common with LGL lymphoma

Staging and diagnosis



Key point

Small cell lymphoma of the gastrointestinal tract causes loss of layering of the intestine, whereas large cell lymphoma is more commonly associated with masses of the bowel wall, sometimes with marked lymph node enlargement. A biopsy is needed to definitively determine the difference between the two.

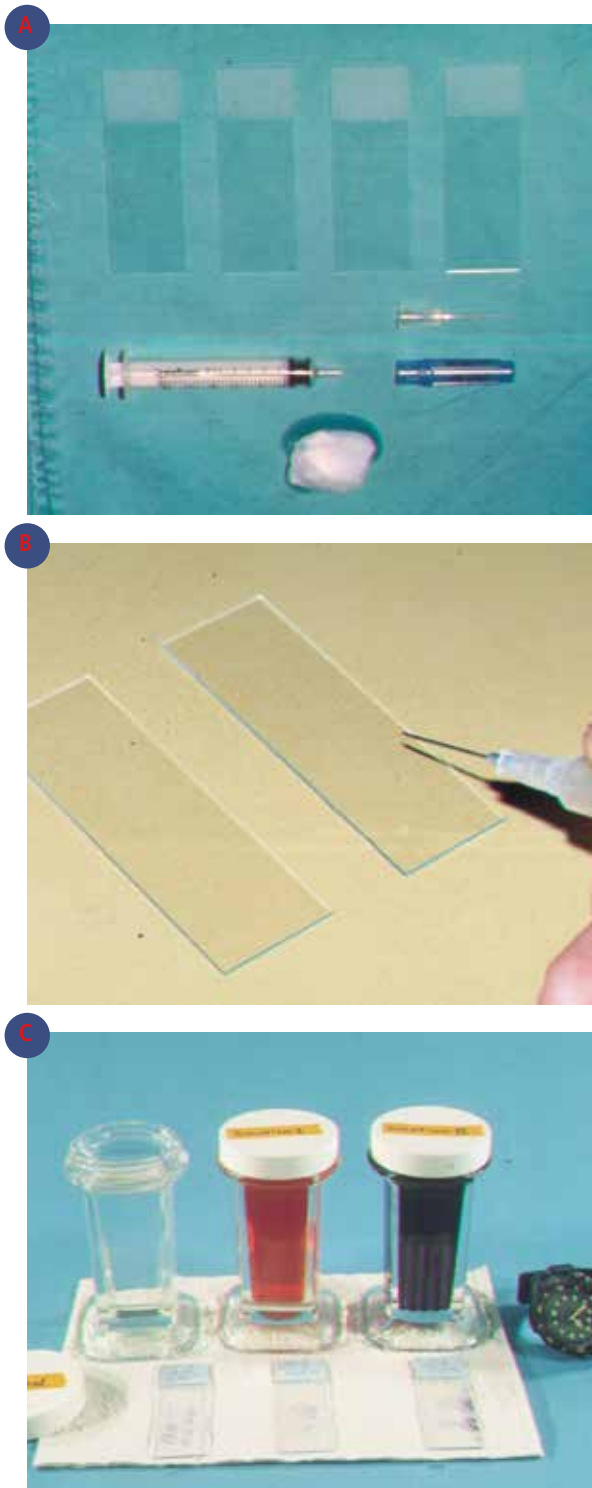


Figure 45-1: Fine needle aspirate cytology is a commonly used diagnostic tool for the diagnosis of feline lymphoma. Slides and 20-22 gauge needles (A) and a microscope are all that is needed. Once the needle is placed through the tissue, it is forcibly blown out of the needle and on to the slide (B) and stained appropriately such as with Diff Quick Stain (C).

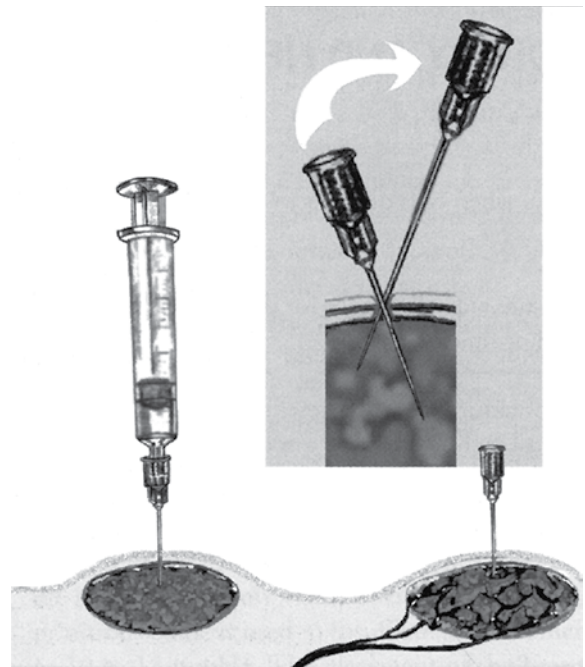


Figure 45-2: Directing the needle into the tissue with the needle attached to the syringe may be less effective than repeatedly directing only the needle into the tissue. Aspirating may cause rupture of cells and dilute out the sample by drawing in blood and other fluids. Once the needle is filled with tissue, it is attached to a syringe filled with air to forcibly eject the contents onto a slide for further preparation. Reprinted with permission from: Ogilvie GK, Moore AS. *Feline Oncology: A Comprehensive Guide for Compassionate Care*. Trenton NJ, Veterinary Learning Systems. 2002

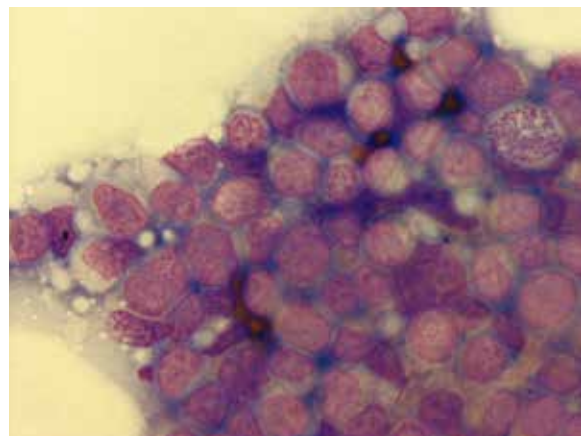


Figure 45-3: Large or intermediate cell lymphoma is common in the cat and is characterized by very large immature lymphocytes. These malignant lymphocytes have scanty cytoplasm and an open, non-condensed chromatin that may also contain nucleoli. These tumors are most effectively treated with multiagent chemotherapy protocols such as the CHOP protocol.

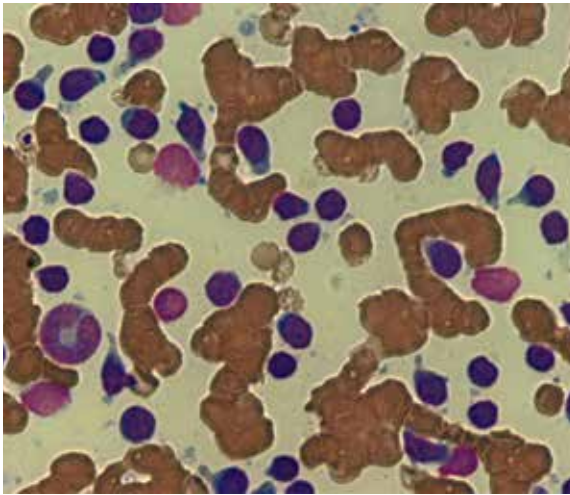


Figure 45-4: Small cell lymphoma is composed of small lymphocytes that are most often smaller than neutrophils. They often have dense nuclei and cannot be distinguished from normal circulating lymphocytes. This disease may have a prolonged asymptomatic period. Once clinical signs are noted, treatment with chlorambucil and prednisolone is usually quite effective for enhancing and improving quality of life.



Key point

Whenever cats are biopsied to confirm the presence of nasal lymphoma, the biopsy instrument (curette, cup biopsy instrument, etc.) is best passed up the nostril to secure a sample of the tissue in question. The instrument should never be passed further caudal than the medial canthus of the eye.

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest, ultrasound or CT of the abdomen.
- Aspirate or biopsy considered essential.
- Unique diagnostic tests depend on anatomic location of the disease:

Alimentary lymphoma

- Large or intermediate cell lymphoma is almost always associated with enlarged lymph nodes and thickening of the gastrointestinal tract. Ultrasound-guided aspirates or biopsies, upper or lower GI endoscopy, or surgical biopsies may be indicated.
- Small cell lymphoma may be associated with infiltration of the pancreas, liver and intestinal tract, but it is not commonly associated with significant intra-abdominal lymphadenopathy. Surgical or gastrointestinal endoscopic biopsies or ultrasound-guided biopsies or aspirates may be diagnostic.

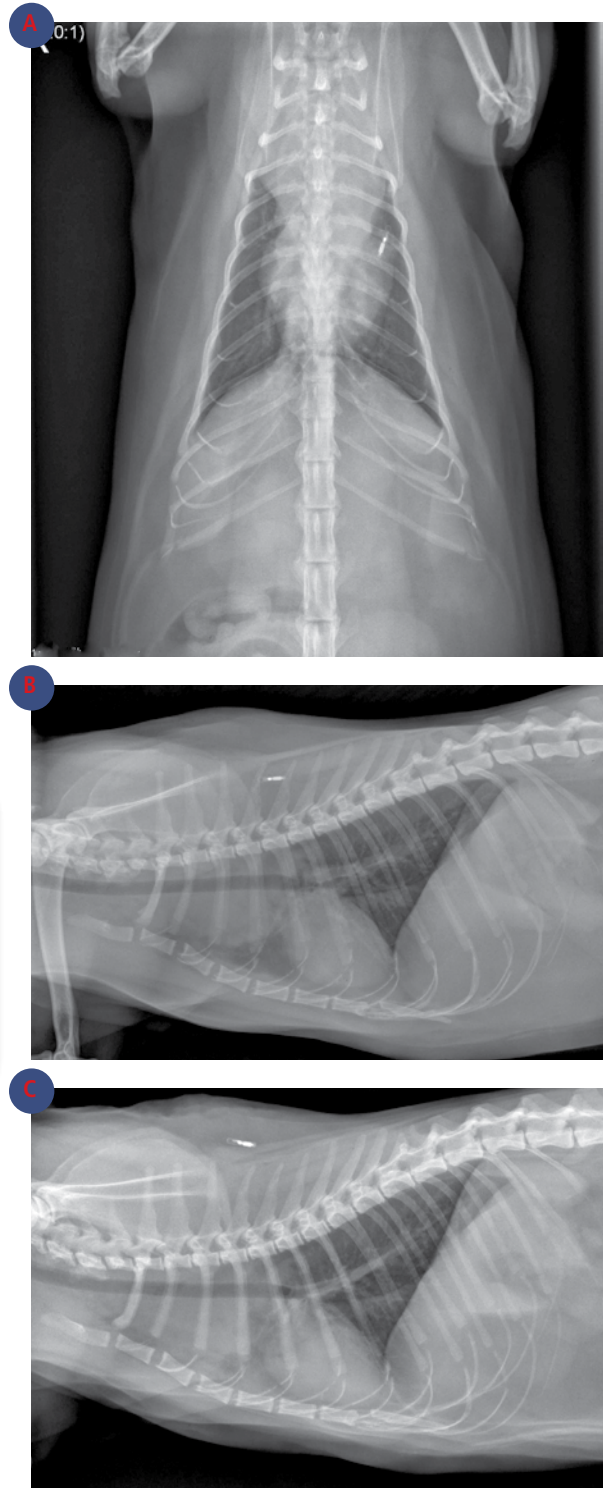


Figure 45-5: Lymphoma of the gastrointestinal tract is now more common than mediastinal lymphoma. The latter is associated with a non-compressible chest and a mass noted in the cranial mediastinum that can be seen on radiographs (A-C). Imaging courtesy of Lenore Anderson Mohammadian, DVM, MSpVM, Diplomate ACVR.



- Cats with low grade lymphoma almost never have a palpable or ultrasonographically evident abdominal mass. Those with intermediate or high grade gastrointestinal lymphoma have a mass almost half the time.

Mediastinal lymphoma

- Important to differentiate from thymomas, heart based tumors and primary lung tumors and cystic structures.
- Aspirates or biopsies obtained via ultrasound or computerized tomographic imaging.

Spinal lymphoma

- Often extradural and in FeLV-positive cats that also have lymphoma in the bone marrow. Therefore, testing for FeLV and performing a bone marrow aspirate is reasonable.
- Magnetic resonance or computerized tomographic imaging of the spinal cord is logical. If unavailable, then consider a myelogram with or without obtaining cerebrospinal fluid. Securing cells or a biopsy from the abnormal region is important.

Renal lymphoma

- Lymphoma is almost always bilateral. Occasionally there are lymph nodes that are involved.
- Aspirate or biopsy of one or both enlarged kidneys and associated enlarged lymph nodes can be diagnostic.

Nasal lymphoma

- Computerized tomography or nasal radiographs plus a biopsy of abnormal tissue visualized on imaging may help determine the extent of the disease.
- Rhinoscopy and biopsy may be helpful in some cases.

Hodgkin's-like lymphoma

- Cervical lymph nodes are often enlarged. Aspirates may be misleading, therefore a Tru-Cut, incisional or excisional biopsy of an enlarged lymph node is often necessary to make a definitive diagnosis.

Lymphoma of large granular cell lymphocytes

- Obtaining aspirates or a biopsy with ultrasound-guidance or during an abdominal exploratory may be needed.
- Stage of disease, as defined by Mooney,⁵⁵ was significantly related to response in one study,⁵⁶ in which cats with stage I lymphoma had higher response rates (93%) than those with stage IV to V disease (40% to 60%); in addition, cats with stage I and II lymphoma had longer survival times (7.6 months versus 3 months).

- A positive response to therapy is favorable prognostic indicator.
- Cats that are relatively healthy, FeLV-negative, and those that are treated with a doxorubicin-containing protocol generally do well.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Key point

Cats with nasal lymphoma have been reported to respond to combination chemotherapy and/or radiation therapy. Survival times exceeding a year are common.

Key point

Cats with small cell lymphoma usually respond quite well when treated with chlorambucil and prednisolone, whereas those cats with intermediate and large cell lymphoma generally respond favorably to combination chemotherapy.

Comfort

- Therapy to provide some benefit for the lymphoma by prescribing prednisolone plus therapy to enhance comfort and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine, cyproheptadine).

Comfort and control (first remission)

Above mentioned therapy for comfort plus:

CCNU (lomustine) at 60 mg/m² body surface area PO q3 weeks for 5 treatments. Note that treatment delays may be required due to neutropenia or thrombocytopenia.

- CCNU was used in one study as a rescue agent for 39 cases of resistant feline lymphoma. The overall median progression-free interval (MPFI) was 39 days (range 7-708 days). The MPFI for large versus small and intermediate cell lymphomas was 21 versus 169 days, respectively. The MPFI for gastrointestinal versus non-gastrointestinal lymphomas was 180 versus 25.5 days, respectively.⁶⁴
- COP protocol (cyclophosphamide, vincristine and prednisolone) has been shown to be helpful for cats with lymphoma.

**Table 45-1.** COP Protocol for treatment of lymphoma^{66,106}

Agent	Week						
	1	2	3	6	9	12	15 ^a
Vincristine (0.7 mg/m ² IV)	•	•	•	•	•	•	•
Cyclophosphamide (250 mg/m ² IV or PO [to nearest 25 mg])	•			•	•	•	•
Prednisolone (10 mg PO daily throughout the protocol)	•						

^aAfter week-15, administer protocol every 3 weeks to 1 year, then stop therapy.

- In one study, 61 cats with lymphoma were treated with a COP chemotherapy protocol (cyclophosphamide, vincristine, and prednisolone) in the Netherlands. Complete remission (CR) was achieved in 46 of the 61 cats (75.4%). The estimated 1- and 2-year disease-free periods in the 46 cats with CR were 51.4 and 37.8%, respectively, whereas the median duration of remission was 251 days. The overall estimated 1-year survival rate in all cats was 48.7%, and the 2-year survival rate was 39.9%, with a median survival of 266 days. While these numbers are impressive, most believe that a doxorubicin containing combination protocol is likely preferable.⁶⁶
- Palliative radiation, especially for those with localized or extranodal lymphoma, may be quite helpful (e.g.: 2-5 dosages of radiation) to first enhance comfort, second, to reduce the rate of growth and third, to occasionally to reduce the size of the tumor.
- A study was performed to evaluate the efficacy of hypofractionated radiation for the treatment of 65 cats with nasal lymphoma. The median overall survival time and progression-free interval in 65 cats was 432 days and 229 days, respectively.¹⁹

Comfort and longer-term control (first remission)

Above mentioned therapy for comfort plus:

- CHOP chemotherapy to include cyclophosphamide, vincristine, prednisolone, doxorubicin and in some cases, L-asparaginase.
- A study was completed to describe the outcome of 119 cats with intermediate- to high-grade lymphoma that were prescribed a modified 25-week University of Wisconsin-Madison (UW-25) chemotherapy protocol. The Kaplan-Meier median progression-free interval (PFI) and survival time (MST) were 56 and 97 (range

Table 45-2. Modified CHOP protocol for the treatment of lymphoma^{69,160}

Week 1	Vincristine 0.5 mg/m ² IV L-asparaginase 400 IU/kg or 10,000 IU/m ² IM Prednisolone 2 mg/kg PO once daily
Week 2	Cyclophosphamide 250 mg/m ² IV L-asparaginase 400 IU/kg or 10,000 IU/m ² IM Prednisolone 1.5 mg/kg PO once daily
Week 3	Vincristine 0.5 mg/m ² IV Prednisolone, 1.0 mg/kg PO once daily
Week 4	Doxorubicin 25 mg/m ² or 1 mg/kg IV Prednisolone 0.5 mg/kg PO once daily
Week 6	Vincristine 0.5 mg/m ² IV
Week 7	Cyclophosphamide 250 mg/m ² IV
Week 8	Vincristine 0.5 mg/m ² IV
Week 9	Doxorubicin 25 mg/m ² or 1 mg/kg IV
Week 11	Vincristine 0.5 mg/m ² IV
Week 13	Cyclophosphamide 250 mg/m ² IV
Week 15	Vincristine 0.5 mg/m ² IV
Week 17	Doxorubicin 25 mg/m ² or 1 mg/kg IV
Week 19	Vincristine 0.5 mg/m ² IV
Week 21	Cyclophosphamide 250 mg/m ² IV
Week 23	Vincristine 0.5 mg/m ² IV
Week 25	Doxorubicin 25 mg/m ² or 1 mg/kg IV



Figure 45-6: Lymphoma of the gastrointestinal tract may be due to the more common small cell lymphoma variant, or the more rapidly progressing large or intermediate cell type. The latter is often associated with transmural extension, often with large intra-abdominal lymph nodes. The diagnosis of either form is best determined by a full thickness biopsy, however endoscopic biopsies or ultrasound-guided aspirates can sometimes be helpful. The images depicted here show a thickened bowel wall due to high grade lymphoma. The mass was resected and CHOP chemotherapy was instituted with an excellent response to therapy.

2-2019) days, respectively. Cats assessed as having a complete response (CR) to therapy had significantly longer PFI and MST than those with partial or no response (PFI 205 versus 54 versus 21 days, respectively, and MST 318 versus 85 versus 27 days, respectively⁶⁹).

- Another study was done to assess the efficacy and toxicity of a short-term, maintenance-free 12-week chemotherapy protocol in 26 cats with high and intermediate-grade lymphoma. These cats were treated with a 12-week protocol consisting of cyclic administration of L-asparaginase, vincristine, cyclophosphamide, doxorubicin and prednisolone. Complete (CR) and partial remission (PR) rates were 46 and 27%, respectively. Median duration of first complete remission was 394 days, compared with a median partial remission duration of 41 days. Median survival in those cats that developed a complete remission was 454 days.



Figure 45-7: Cats may present with posterior paresis due to lymphoma. The cats, as the one pictured above, may drag or scuff their hind limbs during ambulation. These cats generally have excellent femoral pulses with an extradural compressive lesion that may be evident on MRI. These cats are often FeLV-positive and may have lymphoma in the bone marrow. Radiation to the compressive site and/or multiagent chemotherapy has the best chance for restoring function.

The cats that had a partial remission had a median survival of 82 days. Toxicities were mainly low grade with anorexia seen most frequently.⁷⁰

- Sixty cats with lymphoma were treated with a CHOP protocol using L-asparaginase, vincristine, cyclophosphamide, doxorubicin, methotrexate and prednisolone. The median survival time for these 60 cats was 116 days. Of the 60 cats, 48 rapidly went into complete remission (complete remission rate 80%) and these cats had a median survival of 187 days. Twenty cats were classed as 'long-term survivors' based on survival time in excess of one year. Long-term survivors were more likely to be less than 4-years and to have tumors of the T-cell phenotype. Eighty-five percent of clients expressed complete satisfaction with their decision to pursue chemotherapy, and 70% believed their cat's health status improved during the first two weeks of treatment. Methotrexate, while used in this study, is generally not used by others as it is thought to be minimally effective.⁷¹



Figure 45-8: Nasal lymphoma often responds extraordinarily well to either localized radiation or to systemic multiagent chemotherapy. Long-term remissions often occur with either. If radiation is used, there may be hair color changes as noted in this patient.

Specific comments on the different anatomic types of lymphoma include:

Alimentary lymphoma

- High or intermediate grade lymphoma should be treated with at least CCNU, if not a CCNU-enriched combination protocol or a CHOP protocol.
- Small cell lymphoma should be treated with chlorambucil (6 mg/m² PO daily compounded or 2 mg 2-3 times per week) and prednisolone (1-2 mg/kg/day).

Mediastinal lymphoma

- Combination chemotherapy with or without radiation to the mediastinum is ideal.

Spinal lymphoma

- Combination chemotherapy with or without radiation to the site of involvement of the central nervous system is ideal.

Renal lymphoma

- This extranodal lymphoma generally responds quite well to combination CHOP chemotherapy protocols. Some advocate including cytosine arabinoside or CCNU, as the cats with longer-term remissions may have involvement of the central nervous system.

Nasal lymphoma

- Combination chemotherapy or radiation therapy have been shown to be quite effective for inducing durable remissions.
- The survival times of 97 cats with nasal lymphoma treated with radiation therapy (RT) alone,

chemotherapy alone, or RT + chemotherapy were assessed to identify potential prognostic variables that affected survival. The median survival time, regardless of therapy modality, was 536 days.⁷²

- One hundred and forty-nine cats with extranodal lymphoma were treated and assessed. Sixty-six cats received cyclophosphamide, vincristine, and prednisolone (COP); 25 cats received the Wisconsin-Madison doxorubicin-containing multiagent protocol; 10 prednisolone alone, and nine other combinations. The response rate for the 110 treated cats was 85.5%. Of cyclophosphamide, vincristine, prednisolone treated cats, 72.7% achieved complete remission, with a median survival of 239 days. Sixty-four percent of Wisconsin-Madison treated cats achieved complete remission, with a median survival time of 563 days. Cats with nasal lymphoma achieving complete remission had the longest survival (749 days), and cats with central nervous system lymphoma the shortest (70 days).⁷³

Hodgkin's-Like lymphoma

- Chemotherapy with regional radiation therapy has been advocated for this unusual lymphoma.

Lymphoma of large granular cell lymphocytes

- Combination chemotherapy is preferred for this type of lymphoma.

Rescue Protocols

The treatment protocols listed above are also used to attain second and third, and occasionally fourth remissions. The choice of rescue protocols depends on the response to the prior protocol. If, for example, the patient has a long, durable remission to a modified CHOP protocol, then that protocol can be repeated. If the patient has a poor response to the modified CHOP protocol, then it would be important to choose a protocol or a single agent that does not contain the previously used protocol. For example, a modification of the CHOP protocol where vinblastine is used instead of vincristine, mitoxantrone instead of doxorubicin, lomustine (CCNU) instead of cyclophosphamide, and dexamethasone instead of prednisolone. Alternatively, CCNU can be used as a single agent. In general, the duration of remission for a rescue protocol is half the duration of the previous remission. Options include, but are not limited to:

- Single agents —Lomustine, DTIC, mitoxantrone, Actinomycin-D and doxorubicin.
- MOPP—Mechlorethamine, vincristine, procarbazine and prednisolone.

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Chapter 46

Feline bone marrow neoplasias

FELINE MYELODYSPLASIA (PRELEUKEMIA)

Clinical presentation

- Moderately common and sometimes associated with infection with FeLV.
- Usually not painful.
- Myelodysplasia or preleukemia may progress to a true neoplastic process or leukemia.
- Clinically, it is often important to distinguish chronic leukemias and myeloproliferative diseases from acute leukemias and to differentiate between acute lymphoblastic leukemia (ALL) and acute nonlymphoid leukemia (ANLL).
- Myelodysplasia is distinguished from the acute leukemias by the presence of less than 30% abnormal blast cells and abnormal cellular maturation in the bone marrow aspirate in the former.



Key point

Clinical signs secondary to this disease are often related to the anemia, which results in fatigue, anorexia, lethargy and chronic weight loss.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FeLV serology, T4 testing, biopsy and three-view thoracic radiographs.
- Bone marrow aspiration and cytology is essential to make a definitive diagnosis.



Figure 46-1: Bone marrow aspirates can be done safely, easily and with little training or expertise. There are several types of bone marrow needles that are commercially available including Illinois bone marrow needles and disposable plastic-handled marrow needles. When doing a bone marrow in a cat, a 20 gauge bone marrow needle is preferred.



Figure 46-2: The marrow in this bone is almost completely replaced by neoplastic cells. Obtaining a sample from this site may be the only way of making a diagnosis of bone marrow neoplasia. Reprinted with permission from: Ogilvie GK, Moore AS. *Feline Oncology: A Comprehensive Guide for Compassionate Care*. Trenton NJ, Veterinary Learning Systems. 2002.

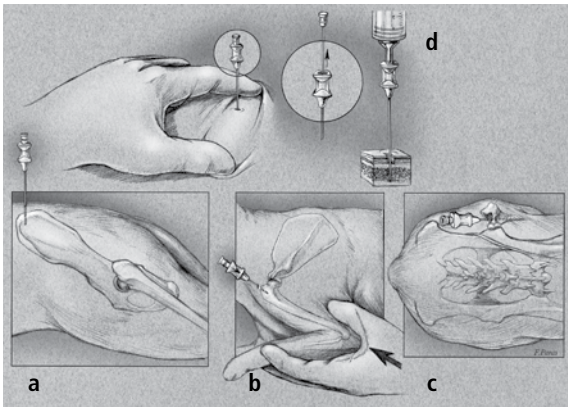


Figure 46-3: A bone marrow aspirate can be done in many bony locations in an anesthetized cat that has been given appropriate analgesia. The area to be sampled is clipped and prepared for anesthesia. A lidocaine block is administered for local analgesia. The bone marrow needle is placed through the skin and directed toward the iliac crest (a), proximal humerus (b) or femoral fossa (c) as depicted above. Once the needle is secured into bone, the stylette is removed and the syringe is attached (d). The marrow is immediately aspirated and slides are quickly prepared to ensure the marrow is smeared into a thin film. Most acute and chronic leukemias cannot be accurately diagnosed without a bone marrow aspirate and review by an accomplished pathologist. Reprinted with permission from: Ogilvie GK, Moore AS. *Feline Oncology: A Comprehensive Guide for Compassionate Care*. Trenton NJ, Veterinary Learning Systems. 2002.

Key point

Impossible to diagnose or to differentiate from other lymphoproliferative diseases without an analysis of the cytology obtained from a bone marrow aspirate or histopathology from a bone marrow core biopsy.

Treatment

This section is divided into two options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.

Comfort

- Therapy to enhance comfort and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine). Transfusions, erythropoietin therapy and steroids may be helpful in some cats.

Comfort and control

Above mentioned therapy for comfort plus:

- Bone marrow transplantation, however this is experimental.
- Cytosine arabinoside or synthetic retinoids have been used as differentiating agents.

FELINE ACUTE NON-LYMPHOID LEUKEMIA

Clinical presentation

- Relatively uncommon.
- This type of leukemia may develop from myelodysplastic syndrome.
- May be uncomfortable or associated with pain, especially at end stages of the disease.
- Young cats seem to predominate.
- FeLV antigenemia is common.
- Rapidly progressive and often associated with anorexia, lethargy and weakness.
- Cytopenias, hepatosplenomegaly common.

Key point

Lethargy, anorexia and weight loss.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology,



T4 testing, biopsy, three-view thoracic radiographs or, if available, computerized tomography of the chest.

- Bone marrow aspirate and cytology.
- Anemia and an increased number of nucleated red blood cells are commonly seen on the complete blood count.
- Hypercalcemia of malignancy is occasionally seen.

Treatment

This section is divided into two options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).
- Transfusions or blood product therapy and/or erythropoietin may be very helpful to treat anemia or thrombocytopenia.
- Neutropenia may be associated with the development of infections that may respond to antibiotics.
- Thrombocytopenia may result in bleeding that may respond to Yunnan Baiyao.

Comfort and control

Above mentioned therapy for comfort plus:

- Bone marrow transplantation, however this is experimental.
- Cytosine arabinoside or synthetic retinoids have been used as differentiating agents.

FELINE ACUTE LYMPHOID LEUKEMIA

Clinical presentation

- Moderately common, but less common than lymphoma.
- May be painful.
- Young cats (median age, 5 years); no breed or gender predilection.
- Most cats are FeLV antigenemic.
- Rapid onset of anorexia and weight loss; lymphadenopathy is common, which may make differentiating acute lymphoid leukemia from lymphoma difficult.



Figure 46-4: All leukemias can cause pancytopenia requiring whole blood transfusion support. Blood can be harvested from a larger healthy adult cat and given to the recipient to ensure that the patient has the best chance to respond well to therapy. All cells degrade with time, especially white blood cells and platelets. Therefore fresh whole blood is preferred to treat pancytopenic cats.

Key point

Clinical signs for cats with acute lymphoid leukemia are often nonspecific and include anorexia, weight loss and lethargy.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- Ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the tumor may be preferable.
- Bone marrow aspirate and cytology.
- Blast cells may be found in the circulation in most cats, or in the bone marrow aspirates, but they may be difficult to identify definitively on morphologic criteria alone. Therefore immunocytochemical staining, flow cytometry or PPAR of peripheral blood or bone marrow is indicated.



Key point

Some cats with acute lymphoid leukemia have only hematologic changes noted on CBC (anemia, thrombocytopenia, leukemia? or leukopenia) and bone marrow aspirate cytology, whereas others may also have intra-abdominal lymphadenopathy as well as involvement of the liver and spleen.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Comfort

- Therapy to enhance comfort (e.g.: tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).
- Transfusions or blood product therapy and/or erythropoietin may be very helpful to treat anemia or thrombocytopenia.
- Neutropenia may be associated with the development of infections that may respond to antibiotics.
- Thrombocytopenia may result in bleeding that may respond to Yunnan Baiyao.

Comfort and control

Above mentioned therapy for comfort plus:

- COP protocol (vincristine, 0.75 mg/m² IV; cyclophosphamide, 300 mg/m² PO every 3 weeks; and prednisolone, 40 mg/m² PO daily) with a median remission of 7 months.⁵¹

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- CHOP protocol.

FELINE CHRONIC LYMPHOCYTIC LEUKEMIA

Clinical presentation

- Relatively uncommon.
- Usually not painful.
- Patients may be asymptomatic, however anemia is commonly seen with this disease, therefore weakness, lethargy, weight loss and anorexia is occasionally seen.



Key point

Most cats with CLL have a long, clinically silent period that is followed by vague clinical signs of weakness, lethargy, anorexia and infections.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- Determining the causes of lymphocytosis should include evaluation of signalment, concurrent disease conditions, lymphocyte morphology, lymphocyte distribution in bone marrow, and immunophenotype by PPAR or flow cytometry.
- Cats with chronic lymphocytic leukemia tend to be older, and lymphocytes are often T-cells, slightly larger than expected and have cleaved or lobulated nuclei.
- Cats with a B-cell immunophenotype that are often described as a reactive lymphocytosis are usually associated with immune-mediated anemias and inflammatory diseases.
- Bone marrow aspirate and cytology.
- Infiltration of the bone marrow with more than 15% mature lymphocytes confirms the diagnosis of CLL in cats. Unlike dogs, normal cats may have lymphocytes accounting for as much as 5% of their bone marrow.
- Mature lymphocytes may have infiltrated other organs.

Treatment

This section is divided into two options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.



Key point

Most cats with CLL positively respond to chlorambucil and prednisolone therapy, however complete remissions may take months to occur.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).



Comfort and control

Above mentioned therapy for comfort plus:

- Chlorambucil and prednisolone.
- In one study of cats treated with chlorambucil and prednisolone or a CHOP protocol, complete and partial remissions were confirmed in 88% of cats, with a median overall remission duration of 15.7 months and a median overall survival of 14.4 months. The authors concluded that CLL affects older-aged cats and responds favorably to treatment with oral chlorambucil and prednisolone.⁴⁹

FELINE HYPEREOSINOPHILIC DISEASE

Clinical presentation

- Relatively uncommon.
- May be associated with discomfort.
- Adult cats (median age, 8 years).
- Females may be predisposed.
- May have widespread organ infiltration.
- Chronic history of vomiting, diarrhea and weight loss is relatively common.
- Differential diagnoses include allergies, eosinophilic granuloma complex, and parasitic disease.
- Physical examination may reveal thickened loops of bowel, abdominal masses, pyrexia, pruritus, and hepatosplenomegaly.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- Abdominal ultrasound.
- Bone marrow aspirate.

Treatment

This section is divided into two options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation, especially for those with extension into surrounding structures or regional metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.

FELINE PRIMARY ERYTHROCYTOSIS (POLYCYTHEMIA VERA)

Clinical presentation

- Uncommon.
- May be uncomfortable.
- Polycythemia (increase in PCV, hemoglobin and number of red blood cells) may be primary (polycythemia vera) or secondary (disorders due to an increase in erythropoietin).
- Polycythemia vera is an abnormal clonal expansion of the red blood cell line independent of erythropoietin.
- Secondary polycythemia may be caused by systemic hypoxia from cardiorespiratory disease, high altitude, altered hemoglobin or erythropoietin producing tumors, most commonly renal tumors.
- Middle-age (median 6 years old) male cats may predominate.
- Hyperviscosity syndrome causes signs of neurologic disturbances (e.g., seizures and ataxia) and dark mucous membranes.



Key point

Cats with feline primary erythrocytosis may occur secondary increased amounts of endogenous erythropoietin or secondary to a malignancy of red blood cell precursors that causes an increased number of red blood cells.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography or magnetic resonance imaging of the chest and abdomen.
- Bone marrow aspiration.
- Eliminates secondary causes with cardiac ultrasound, aspiration of any masses, echocardiography, serum erythropoietin concentration, as well as pulse oximetry or blood gas determination at rest and exercise.



Key point

Complete staging for cats with primary erythrocytosis may include chest radiographs, abdominal ultrasound, blood work, and a bone marrow aspirate and/or bone marrow core biopsy.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.



Key point

Elimination of the underlying cause, phlebotomy and, if needed, hydroxyurea may be helpful for some cats with primary erythrocytosis.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and control

Above mentioned therapy for comfort plus:

- Phlebotomy.
 - PCV drops by ~15% for each 20 mls of blood removed per kg of body weight.
- Intermittent use of leeches.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Hydroxyurea, however dosage required to induce a remission is variable.
 - Some consider 125 mg/cat every 2 days for 2 weeks, followed by 250 mg/cat twice weekly for 2 weeks, and then as often as needed to maintain a normal hematocrit.
 - Methemoglobinemia is an uncommon adverse effect, however it may be life-threatening.
 - Survival of 1-6 years has been reported.⁶⁰

FELINE MULTIPLE MYELOMA

Clinical presentation

- Relatively uncommon.

- Usually not painful, but cats with this disorder may exhibit signs associated with lethargy, anorexia, weight loss, epistaxis, congestive heart failure, mental confusion, blindness and melena.
- In contrast to people and dogs, up to 67% of cats with multiple myeloma have well-differentiated tumors that often have clinical signs associated with extramedullary involvement and the subsequent hyperviscosity syndrome.⁶⁴
- Cats with neoplasia involving abdominal organs, bone marrow, or both often develop systemic clinical signs and paraproteinemia. These respond to chemotherapy with a median survival time of 12.3 months.
- Cats with skin masses associated with this malignancy may be paraproteinemic, with rapidly worsening systemic signs that may improve when the skin lesions are excised with a median survival time of 2.4 years.
- In marked contrast to dogs and people, lytic bone lesions are rarely seen in cats (8%).



Key point

Most cats have clinical signs due to the hyperviscosity syndrome that is often caused by a well-differentiated tumor made up of plasma cells.

Staging and diagnosis

- Minimum data base (MDB): includes a fundic examination CBC, biochemical profile, urinalysis, FIV/FeLV serology, T4 testing, biopsy and three-view thoracic radiographs.
- Ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the chest and abdomen may be preferable.
- Bone marrow aspirate and cytology.
- Tumor biopsy and histopathology.
- Serum and urine electrophoresis.
- Flow cytometry or PPAR of peripheral blood or bone marrow.
 - Classically, a diagnosis of multiple myeloma can be made with two of the following four criteria: malignant plasma cells in the bone marrow are found in conjunction with a monoclonal gammopathy, lytic bone lesions, or light-chain (Bence-Jones) proteinuria.
 - One study concluded that some of the more common clinicopathologic findings included hyperglobulinemia (87.5%), with (78.5%) monoclonal and (21.4%) biclonal gammopathies; hypoalbuminemia (25%); light chain proteinuria, (44.4%); hypocholesterolemia (68.7%); hypercalcemia, (20%); nonregenerative anemia, (68.7%); regenerative anemia, (6.2%); neutropenia (33.3%); thrombocytopenia (50%); and marrow plasmacytosis (93.3%).⁶⁵



Key point

Lytic bone lesions are not commonly identified in cats with multiple myeloma.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.



Key point

Long-term remissions and survival times have been reported in cats treated with melphalan and prednisolone.

Comfort

- Therapy to enhance comfort and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cypripheptadine). Prednisolone is likely to be helpful in some cats.
- Transfusions and or erythropoietin therapy may be needed in those with severe or clinically evident anemia.
- Sepsis is occasionally seen in patients with neutropenia, therefore appropriate antibiotic therapy is indicated.
- Apheresis or plasmapheresis may be quite helpful when globulin levels are quite high. An alternative is to harvest blood with re-transfusion after the plasma has been removed and the red blood cells are re-suspended in saline.

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation to skin or extramedullary tumors, especially for those with extension into surrounding structures or regional metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.
- Surgery to localized tumors, especially in cats with cutaneous lesions, may be helpful. Cats with skin masses may improve when the skin lesions are excised, with a median survival time of 2.4 years.⁵⁴

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Melphalan and prednisolone are most commonly used.
- Treatment has been associated with a median survival time of 12.3 months in cats with multiple myeloma.⁶⁴
- Cyclophosphamide, vincristine and prednisolone have been used with variable results.

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Chapter 47

Feline tumors of bone

FELINE OSTEOSARCOMA

Clinical presentation

- Moderately common.
- May be painful.
- Appendicular and axial skeleton equally affected.
- As in dogs and humans, fractures or repair thereof has been associated with tumor formation, although this is quite rare.
- Hind limb and skull most common sites.
- Extraosseous osteosarcoma may be associated with injections (i.e.: injection site sarcomas).
- Metastases are uncommon.
- Pathologic fracture at the site of an appendicular osteosarcoma is common in cats.
- Hypertrophic osteopathy may occur with pulmonary metastases.



Key point

Lameness and/or change in the structure of the bone is common in cats with osteosarcoma.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- Ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the tumor may be preferable in some cases.
- While metastases are uncommon, regional lymph nodes and the thoracic cavity should be carefully assessed for metastases.
- Taking a sample with a 16 or 18 gauge needle through the center of the lesion may allow a



Figure 47-1: Cats with appendicular osteosarcoma may have a history of lameness of one limb or another. If osteosarcoma is the cause, a mass or thickening of the metaphysis of long bones or elsewhere is commonly found, as depicted in this image. Fortunately, osteosarcoma in the cat rarely metastasizes. Differentials that must be considered in these types of cases include infectious, inflammatory, degenerative or neoplastic conditions.



Figure 47-2: Radiographs, CT or MRI of the bony lesions often confirm a lytic, proliferative lesion. An aspirate or biopsy of the lesion confirms the diagnosis. Note the lysis of the metaphyseal region of the tibia (A) and proximal femur (B). Removal of the entire tumor and surrounding tissue often results in long-term control. Imaging courtesy of Lenore Anderson Mohammadian, DVM, MSpVM, Diplomate ACVR.

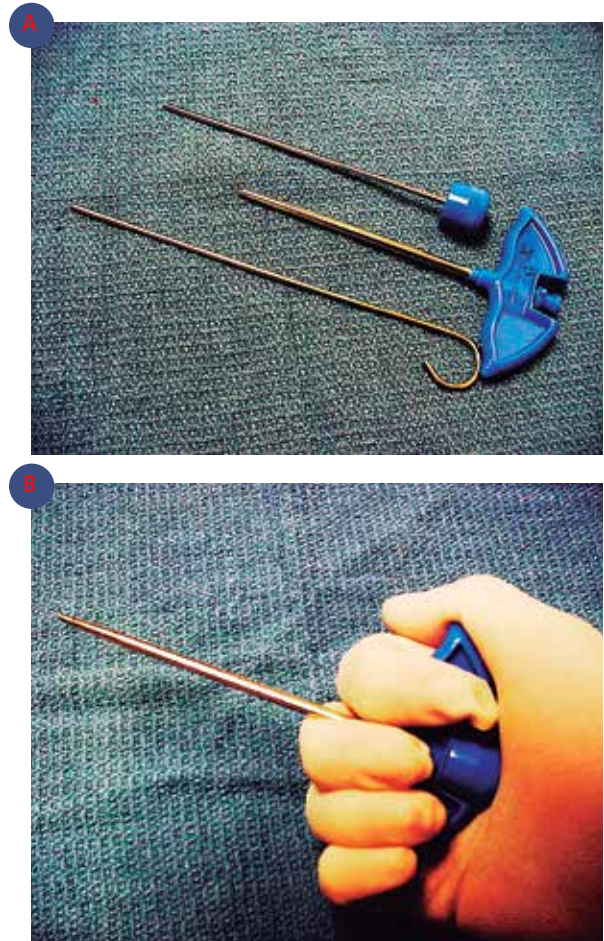


Figure 47-3: Once a bony lesion is identified on physical examination, radiographs or CT, a sample of that bone must be acquired to determine the diagnosis. The “gold standard” is a bone biopsy that can be secured with a bone marrow biopsy needle. This biopsy system comes complete with a biopsy needle, a stylette within the needle, and a wire to push the biopsy from the tip of the biopsy needle out the “back” of the biopsy apparatus (47e). The assembled biopsy needle with the stylette within the needle is prepared for the actual biopsy (47f). A comfortable handle allows for the clinician to begin the biopsy system.

clinical pathologist to confirm that the lesion in question is likely due to a malignancy. This can be an inexpensive way of confirming a diagnosis of a malignancy. The specific type of malignancy may require either an excisional or incisional biopsy.

- Biopsies, either needle core, Jamshidi, wedge or excisional may be helpful. If removal of the tumor is attempted, the entire specimen should be submitted for a definitive diagnosis and to evaluate margins for completeness of excision.
- The presence of metastases is a poor prognostic indicator, although this is rare.

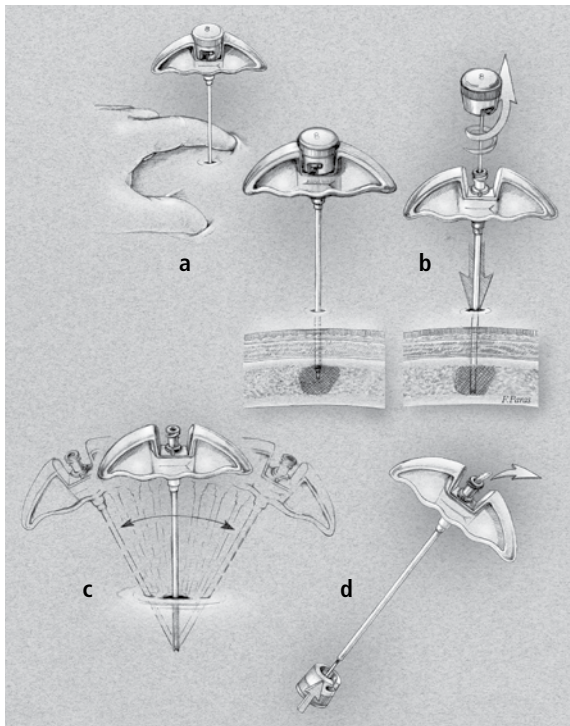


Figure 47-4: Cytology from the lytic bony lesion may allow the clinician to confirm malignancy of a bony lesion, however histopathology is considered the gold standard. The bone biopsy needle is used to secure a biopsy sample. The biopsy needle is advanced through the skin and underlying structures, up to the level of the bone to be biopsied (a). The objective is to secure at least one core of the lesion going through the center of the bony growth. Once the needle is resting on top of the bony lesion, the cap is removed (b) and the needle is then advanced through the center of the bone by rotating the handle back and forth while applying direct downward pressure. Once the needle has been advanced to the appropriate depth, the needle is then rotated laterally to the left and to the right several times (c). The bone biopsy needle is removed from the patient and the wire is used to push the biopsy core from the tip of the needle out the back end at the handle (d). Reprinted with permission from: Ogilvie GK, Moore AS. *Feline Oncology: A Comprehensive Guide for Compassionate Care*. Trenton NJ, Veterinary Learning Systems. 2002.

Key point

A histopathologic biopsy or fine needle aspirate cytology of osteosarcoma is ideal to make the diagnosis, however the sample should be taken within the center of the bony change.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.

- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Key point

Analgesics, radiation and/or surgical removal of the involved lesion often results in long-term progression-free survival in cats with osteosarcoma.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation, especially for those with extension into surrounding structures or regional metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Surgery such as amputation for tumors of the extremity, or mass removal with wide and deep margins for tumors of soft tissues. Tumors of the skull and flat bones may require CT-guided surgical excision.
 - Survival times for cats with axial osteosarcoma may be greater than 1 year, even with incomplete resection.
- Definitive radiation if there is evidence of tumor extending beyond the surgical margins (e.g.: 16-19 dosages of radiation).
- Stereotactic radiosurgery (e.g.: IMRT, CyberKnife or Trilogy based) may be helpful in certain situations as an alternative to surgery.
- Carboplatin is used by some, however there is little evidence that it may help improve progression-free survival.

FELINE GIANT CELL TUMORS OF BONE

Clinical presentation

- Uncommon.
- May be painful, especially if it involves an extremity.



- May be a variant of osteosarcoma or synovial sarcoma; appendicular more common than axial.
- Metastases, while apparently rare, may be found in regional lymph nodes or lungs.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- Computerized tomography or magnetic resonance imaging of the tumor may be quite helpful to guide the surgeon to a successful excision.
- Biopsies, either needle core, Jamshidi, wedge or excisional may be helpful. If removal of the tumor is attempted, the entire specimen should be submitted for a definitive diagnosis and to evaluate margins for completeness of excision.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation, especially for those with extension into surrounding structures or that have regional metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Surgery such as amputation for giant cell tumors of the extremity, or mass removal with wide and deep margins for tumors of soft tissues. Tumors of the skull and flat bones may require CT-guided surgical excision.
- Definitive radiation if there is evidence of tumor extending beyond the surgical margins (e.g.: 16-19 dosages of radiation).

- Stereotactic radiosurgery (e.g.: IMRT, CyberKnife or Trilogi based) may be helpful in certain situations as an alternative to surgery.

FELINE OSTEOMA

Clinical presentation

- Moderately common.
- May be painful.
- May be seen throughout the body, including and especially where osteosarcomas occur.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- Computerized tomography or magnetic resonance imaging of the tumor may be quite helpful to guide the surgeon to a successful excision.
- Biopsies, either needle core, Jamshidi, wedge or excisional may be helpful. If removal of the tumor is attempted, the entire specimen should be submitted for a definitive diagnosis and to evaluate margins for completeness of excision.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation, especially for those with extension into surrounding structures or regional metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Surgery such as amputation for tumors of the

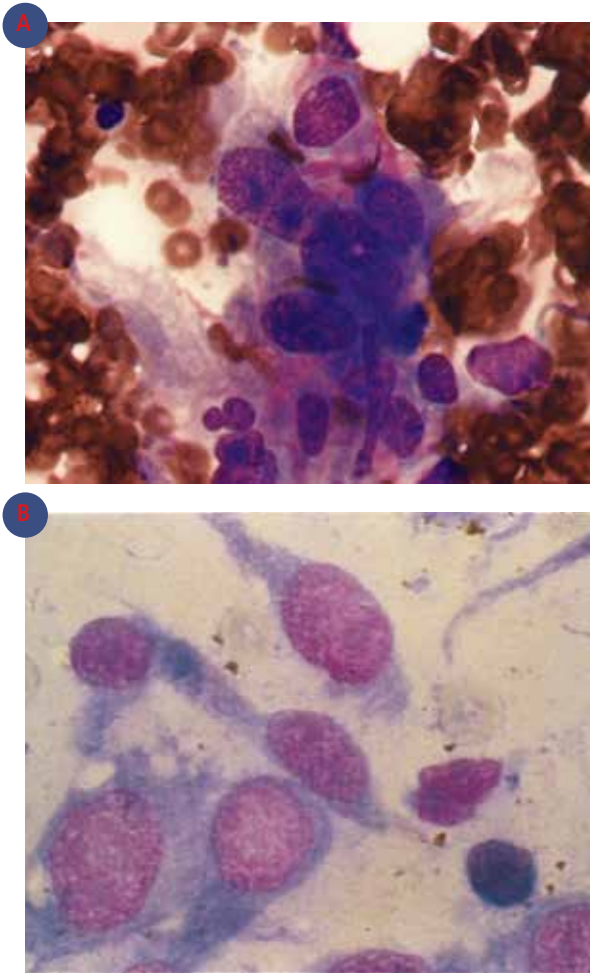


Figure 47-5: Cytology obtained by advancing an 18 gauge needle through the center of the bony lesion may allow the clinician to confirm malignancy of a bony lesion. Notice the elongated, streaming cells that have variable sized nuclei, often with nucleoli. A histopathological biopsy may be needed to distinguish the specific diagnosis.

extremity, or mass removal with wide and deep margins for tumors of soft tissues. Tumors of the skull and flat bones may require CT-guided surgical excision.

- Definitive radiation if there is evidence of tumor extending beyond the surgical margins (e.g.: 16-19 dosages of radiation).

FELINE CHONDROSARCOMA

Clinical presentation

- Moderately common.
- May be painful.
- Symptoms related to the location of the tumor.
- Rarely metastasizes, but if it does, it can spread to lungs and lymph nodes.

- Second most common tumor of bone after osteosarcoma.
- Slow growing malignancy that involves the axial skeleton more commonly than the appendicular skeleton.

Key point

Generally a slowly growing malignancy that may cause discomfort and functional abnormalities associated with clinical signs relating to the location of the tumor.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- Ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the tumor may be preferable in some cases.
- Biopsies, either needle core, Jamshidi, wedge or excisional may be helpful. If removal of the tumor is attempted, the entire specimen should be submitted for a definitive diagnosis and to evaluate margins for completeness of excision.

Key point

While cytology may be suggestive of a chondrosarcoma, a biopsy is often required to accurately diagnose this malignancy.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Key point

Analgesia, radiation or complete removal of the tumor can be quite helpful for the treatment of chondrosarcoma.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea



(e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation, especially for those with extension into surrounding structures or regional metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Surgery, with progression-free survival and overall survival times exceeding 1-2 years quite common.
- Definitive radiation if there is evidence of tumor extending beyond the surgical margins (e.g.: 16-19 dosages of radiation).

FELINE OSTEOCHONDROMATOSIS

Clinical presentation

- Uncommon in cats; not seen in other species.
- May be painful and rapidly growing in adult animals, with some being in older adults.
- Clinical signs depend on the number, size, and location of tumors.
- Signs due to appendicular and rib lesions are lameness and discomfort, while cats with skull lesions may be presented for dyspnea, sneezing, or dysphagia.⁹
- Solitary lesions are found in older, FeLV-negative cats, whereas multiple lesions are often found in younger, FeLV-positive cats.
- Solitary and multiple tumors may affect both the appendicular and axial skeleton.
- Lesions sometimes quite large, smooth and firm.
- Siamese cats may be predisposed.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- Radiographs, computerized tomography, or magnetic resonance imaging of the tumor. Because the tumor may be multifocal, imaging the entire skeletal system is strongly recommended.
- Biopsies, either needle core, Jamshidi, wedge or excisional may be helpful. If removal of the tumor is attempted, the entire specimen should be submitted for a definitive diagnosis and to evaluate margins for completeness of excision.
- Multiple lesions in FeLV-positive cats suggests a poorer prognosis.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, gabapentin) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation, especially for those with extension into surrounding structures or regional metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Surgery. Definitive radiation if there is evidence of tumor extending beyond the surgical margins (e.g.: 16-19 dosages of radiation).

FELINE HEMANGIOSARCOMA OF BONE

Clinical presentation

- Rare primary bone tumor primarily of the appendicular skeleton, although nasal hemangiosarcomas have been reported.
- May be painful.
- May metastasize to lungs

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- Ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the tumor may be preferable in some cases.
- Biopsies, either needle core, Jamshidi, wedge or excisional may be helpful. If removal of the



tumor is attempted, the entire specimen should be submitted for a definitive diagnosis and to evaluate margins for completeness of excision.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Comfort

- Therapy to enhance comfort and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation, especially for those with extension into surrounding structures or regional metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Surgery.
- Definitive radiation if there is evidence of tumor extending beyond the surgical margins (e.g.: 16-19 dosages of radiation).
- Chemotherapy, while unproven, may be helpful in some cats and may involve doxorubicin.

FELINE SYNOVIAL TUMORS

Clinical presentation

- Uncommon.
- May be painful.
- May be confused with other mesenchymal tumors.
- Metastases are uncommon.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- Ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the

tumor may be preferable in some cases.

- Biopsies, either needle core, Jamshidi, wedge or excisional may be helpful. If removal of the tumor is attempted, the entire specimen should be submitted for a definitive diagnosis and to evaluate margins for completeness of excision.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Comfort

- Therapy to enhance comfort and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation, especially for those with extension into surrounding structures or regional metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Surgery, especially amputation, to attain wide margins. Local resection is rarely successful because these tumors are invasive into surrounding structures.
- Definitive radiation if there is evidence of tumor extending beyond the surgical margins (e.g.: 16-19 dosages of radiation).

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Chapter 48

Feline tumors of the nervous system

FELINE MENINGIOMA

Clinical presentation

- Meningiomas are the most common brain tumor in cats, with most occurring in the cerebral meninges above the temporal, frontal, parietal, or occipital regions of the brain.
- Rarely painful.
- Usually solitary.
- Multiple tumors seen in up to 20% of cats.
- Most common in older male cats.
- Slow growing, but changes in behavior, weakness, circling, or blindness may appear acutely.
- Paresis, usually tetraparesis, occurs in 60% to 80% of cats.^{12,13}
- Seizures are not common.



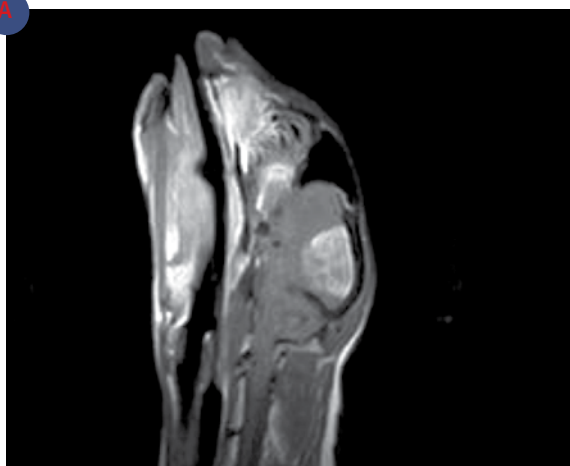
Key point

While subtle neurologic signs including behavioral changes do occur in cats with meningiomas, most present with paresis and seizures.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of chest.
- Metastases are rare but they have been reported in the lungs.
- Radiographs of skull rarely helpful, however in some cats, hyperostotic, sclerotic or lytic lesions may be seen.
- Computerized tomography or magnetic resonance imaging of the tumor is important.

A



B

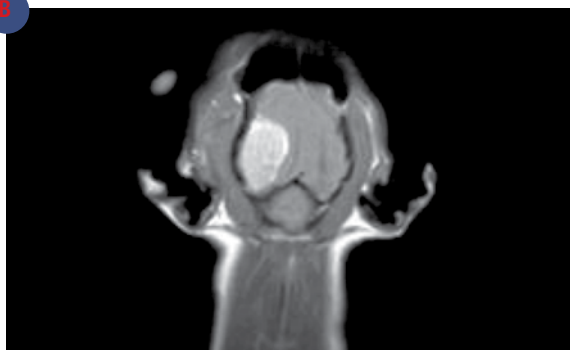


Figure 48-1: This MRI defines a large mass in the brain that is broad based and associated with the meninges. This is most consistent with a meningioma that is a common tumor in the brain of a cat. Surgery or radiation is generally quite effective at controlling most patients with this slowly growing tumor. Imaging courtesy of Lenore Anderson Mohammadian, DVM, MSpVM, Diplomate ACVR.

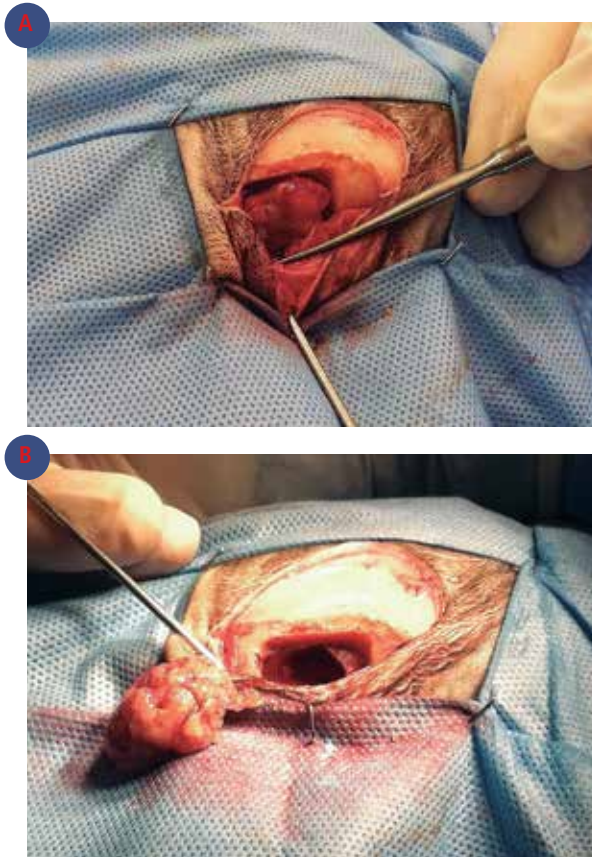


Figure 48-2: Surgery is often quite effective for removing meningiomas as imaged in A and B. Tumors can often be removed and the incision closed simply with no implants or replacement of bone. Survival time is generally excellent.



Key point

CT or MRI is important to make the diagnosis and to direct therapy in cats with meningioma.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.



Key point

Surgery or radiation can result in long-term improvement in cats with meningioma.

Comfort

- Therapy to enhance comfort and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine). Prednisolone and/or mannitol can be quite helpful for reducing edema of the central nervous system. Phenobarbital or levetiracetam may be helpful if seizures are a clinical concern.

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation, especially for those with extension into surrounding structures or regional metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Craniotomy to remove the involved bone and dura may be quite helpful and may be repeated if the tumor recurs. Some meningiomas may be seen on standard radiographs due to the presence of the lysis or thickening of bone.
 - Intraoperatively, hyperventilation (16 to 18 breaths/minute) decreases carbon dioxide concentration, thereby reducing cerebral blood flow, which in turn can help to reduce CNS edema and resultant postoperative complications.¹⁶
 - Prednisolone sodium succinate (25-50 mg/kg IV) may reduce postoperative inflammation associated with a craniotomy.
 - The incidence of herniation in studies is 10% to 20%.^{12,16,17}
 - Survival beyond 1 year is common.^{8,16,17,19,20,28} In one study, the median survival for cats that were released from the hospital was 22 months, with 66% of the cats alive 1 year and 50% 2 years after surgery.¹²
 - Incomplete excision may be treated with postoperative definitive radiation.
- An alternative to surgery is stereotactic radiosurgery via IMRT, Trilogy or CyberKnife therapy.

OTHER FELINE BRAIN TUMORS: EPENDYMOMA, OLIGODENDROGLIOMA, ASTROCYTOMA AND LYMPHOMA

Clinical presentation

- Uncommon.
- May be painful.



- Ependymomas arise from the wall of the ventricles.
 - Growth can be rapid, thus resulting in rapid onset or change in clinical signs, especially vestibular signs.
 - Interference with CSF distribution can lead to hydrocephalus, blindness, disorientation, and incoordination or tetraparesis with normal spinal reflexes.^{30,34,35}
- Gliomas (oligodendrogliomas) are uncommon in the cat but they do cause many of the clinical signs typical for intracranial masses, including hemiparesis, head tilt, circling and ataxia, aggressive behavior and seizures.^{8,37,39}
- Astrocytomas are uncommonly diagnosed tumors that have been shown to affect the frontal and parietal lobes of the cerebrum, the ventricular wall and the thalamus, resulting in abnormal behavior, facial deformity, blindness, and hemiparesis.⁴¹
- Lymphoma uncommonly involves the brain but it does cause compression of the spinal cord, usually via an extradural lesion. Clinical signs of brain involvement are not specific and are as noted with the other brain tumor types.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- Computerized tomography or magnetic resonance imaging of the brain is important.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Comfort

- Therapy to enhance comfort and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine). Prednisolone and mannitol may be quite helpful in managing clinical signs in the short term.

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation, especially for those with extension into surrounding structures or regional metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of

growth and third, occasionally to reduce the size of the brain tumor. The most marked responses are seen with lymphoma.

- CCNU penetrates through the blood brain-barrier, and therefore this drug may be beneficial in some patients.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Surgery for tumors other than lymphoma.
- Definitive radiation if there is evidence of tumor extending beyond the surgical margins (e.g.: 16-19 dosages of radiation).
- Stereotactic radiosurgery may be quite helpful in select patients via Trilogy or CyberKnife therapy.

FELINE SPINAL CORD TUMORS

Clinical presentation

- Relatively uncommon.
- May be painful.
- Lymphoma is most common; meningioma, ependymoma, astrocytoma, and sarcomas are less commonly diagnosed.
- Paresis, paralysis, gait abnormalities, diminished spinal cord reflexes and back pain are observed, regardless of the tumor type involved.
- Cats with lymphoma may be FeLV-positive and can have involvement of the bone marrow and other sites.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- A myelogram, or preferably contrast enhanced computerized tomography or magnetic resonance imaging of the spinal cord, is needed to localize the lesion beyond a physical examination.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.



Key point

Surgical decompression and/or radiation may improve clinical signs after the spinal cord lesion is localized and imaged via CT, MRI or myelogram.

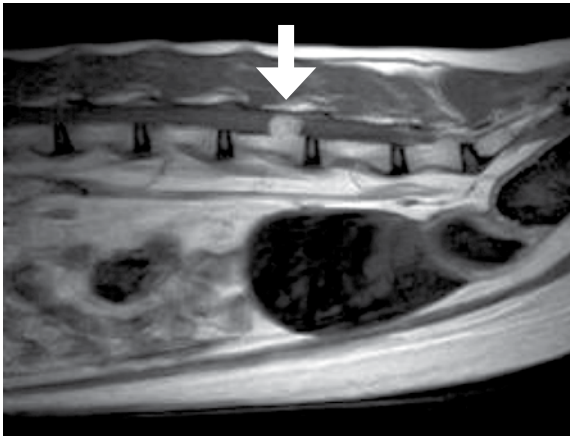


Figure 48-3: This MRI image confirms the presence of an intradural, extramedullary tumor in a cat with posterior paresis. The tumor was removed surgically and the cat recovered uneventfully. The histologic diagnosis was a meningioma. Imaging courtesy of Lenore Anderson Mohammadian, DVM, MSpVM, Diplomate ACVR.

Comfort

- Therapy to enhance comfort and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyploheptadine). Prednisolone or other steroids may be ideal to reduce cord compression.

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation (e.g.: 2-5 dosages of radiation) to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the spinal cord tumor.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Surgical decompression of the cord compression.
- Definitive radiation (e.g.: 16-19 dosages of radiation).

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Chapter 49

Feline tumors of eyes and ears

FELINE TUMORS OF THE EAR AND EAR CANAL

Clinical presentation

- Moderately common and may be bilateral.
- May be uncomfortable.
- Tumors of the pinna are covered elsewhere, but squamous cell carcinoma, basal cell tumors and mast cell tumors are common.
- Ceruminous adenocarcinomas are most common.
- One-third of all tumors (and 40% of all malignant tumors) of the ear canal in a large survey.³
- Neurologic signs such as facial nerve paralysis, head tilt, circling, anisocoria (Horner's syndrome), and ataxia occur in 25% to 35% of cats.^{3,6}
- In one study,¹ 28 of 56 malignant ear canal tumors appeared invasive. Nine of the tumors invaded the subcutis, while 19 invaded cartilage of the ear and canal.
- Vestibular signs may signal invasion of the middle ear.
- Metastasis most commonly to deep parotid, retropharyngeal, and prescapular lymph nodes.
- Adenomas and other carcinomas are less common.
- In a large study that included 56 cats with malignant tumors of the ear canal, 20 tumors were squamous cell carcinoma and 13 were undifferentiated carcinoma.
- Cats with SCC or undifferentiated carcinoma usually have evidence of bulla involvement on radiographs or CT scan.^{1,8,10-14}



Figure 49-1: The most likely tumor of the pinna in this cat with white hair is the solar induced squamous cell carcinoma. A biopsy, either incisional or excisional is required to specifically diagnose the problem, however a partial or total pinnectomy is often required to resolve the disease.



Key point

Malignant ear canal tumors are almost always invasive and frequently cause clinical signs referable to an unresponsive otitis externa.



Key point

Squamous cell carcinoma of the pinna commonly causes a crusty, ulcerative condition, most commonly in white-haired cats with pink skin.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FeLV/FIV serology, T4testing, culture and cytology of the ear contents, biopsy and three-view thoracic radiographs or computerized tomography of the chest.
- Radiographs, computerized tomography, or magnetic resonance imaging is important to determine the local extent of the disease and to determine if it has metastasized.



Key point

A CT of the skull in cats with ear canal tumors often increases cure rates and often decreases the overall cost of patient management.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Comfort

- Therapy to enhance comfort and freedom from nausea and vomiting that may be seen secondary to involvement of the middle and inner ear (e.g.: maropitant and/or metoclopramide), diarrhea that may be seen with stress or secondary to other medication (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine). Special attention should be directed toward ensuring that the patient is free from localized infection and discomfort.

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation, especially for those with extension into surrounding structures or regional metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Surgery. Localized surgery +/- cryotherapy for benign tumors may be effective. Most tumors invade into surrounding tissues, requiring an ear canal ablation and bulla osteotomy for tumor control.
- Surgical resection of the ear canal in cats with ceruminous gland adenocarcinoma may be sufficient in cats with a tumor that affects only the vertical ear canal and has no bulla involvement.
 - One study involving 6 cats that were treated in this way showed a median disease-free period of 10 months (range, 1 to 14 months).⁶
- Cats that have more invasive ceruminous gland adenocarcinomas require an ear canal ablation and lateral bulla osteotomy.
 - In one study⁶ involving 16 cats, the median

disease-free period treated in this manner was 42 months (range, 4 to 60 months).

- Cats with squamous cell carcinoma or undifferentiated carcinoma do not do as well, with one study⁸ confirming a median survival of 3.8 months for 20 cats with squamous cell carcinoma of the ear canal and 5.7 months for 13 cats with undifferentiated carcinoma.
- Definitive radiation if there is evidence of tumor extending beyond the surgical margins (e.g.: 16-19 dosages of radiation).
- The median survival for cats with ceruminous gland carcinoma was longer than 49 months.³

FELINE OCULAR MELANOMA

Clinical presentation

- Moderately common.
- May be painful, especially if glaucoma occurs.
- Uveal melanoma is more common than limbal.
- Most often unilateral and associated with chronic uveitis, pigment change, buphthalmos, cloudy eye, and glaucoma.
 - Pigment change may precede more serious changes by months^{21,27} to years.^{18,22,28}
- In one study of 128 cats with glaucoma, 38 had uveal melanoma causing obliteration of the trabecular meshwork.²⁹
- Metastases may be widespread and have been reported in brain, lungs and liver, as well as the mediastinum, pericardium, pleura, diaphragm, adrenals, peritoneum, spleen, stomach, intestine, tonsils, and regional and distant lymph nodes.
- Differentials for uveal melanomas include iris freckles (iris not thickened, indistinct margins) and iridial cysts (often at pupillary margin with smooth margins).
- Patients with limbal melanomas often present for an ocular mass or swollen eyelid.
- Widespread metastases may be seen with this form of the disease, especially to regional lymph nodes. Aspiration cytology of regional lymph nodes (mandibular, retropharyngeal, and parotid) should be performed.^{18,39,41}

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy via enucleation and three-view thoracic radiographs or computerized tomography of the chest.
- Ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the tumor can be done but is most helpful for determining the presence of distant metastases.
- In one study, survival appeared to be longer in cats with tumors limited to the iris and ciliary body.¹⁸



Figure 49-2: Uveal melanomas as in this cat with a left ocular tumor with invasion into surrounding structures can cause glaucoma, pain, mydriasis and blindness. Analgesia and supportive care are always indicated, while determining the extent of the disease and the presence of metastases with either radiographs, ultrasound, computerized tomography or magnetic resonance imaging. Removal of the eye and/or the entire orbit may be required for local tumor control.

- The number of mitotic figures on histopathologic sectioning has been shown to correlate with increasing tumor invasion of the surrounding sclera in one study.³⁵



Key point

Widespread metastases may be present in cats with ocular melanoma, therefore evaluation of chest radiographs, blood work and aspirates of regional lymph nodes is often required.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Comfort

Therapy to enhance comfort by specifically addressing local discomfort and by resolving the presence of glaucoma. Similarly freedom

from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine) must always be done.

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative or course fractionated radiation, especially for those with extension into surrounding structures or regional metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Enucleation, including invasion into surrounding tissues.
- One study found that cats with tumors involving only the iris and ciliary body had a median survival of 383 days, compared with 122 days for cats with tumors invading beyond these structures, and 14 days for those with tumors involving the whole eye.¹⁸
- Lamellar sclerokeratectomy alone or followed by cryosurgery for limbal melanomas has been reported to be associated with long-term survival (>30 months).^{38,42}
- Definitive radiation if there is evidence of tumor extending beyond the surgical margins (e.g.: 16-19 dosages of radiation).
- Carboplatin or the Merial DNA xenogeneic melanoma vaccine may be considered for systemic effects.

FELINE OCULAR SARCOMA

Clinical presentation

- Moderately common.
- May be painful.
- May occur after ocular trauma and/or inflammation.
- Biological behavior similar, regardless if the tumor is a fibrosarcoma, osteosarcoma, or undifferentiated sarcoma.
- Clinical signs include increasing size of the globe, displacement or discoloration of the iris, presence of glaucoma, and a highly invasive mass. Metastases to regional lymph nodes or lungs may be noted.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy of the tumor via enucleation or a preoperative biopsy, and three-view thoracic radiographs or computerized tomography of the chest.
- Computerized tomography or magnetic resonance imaging of the head and tumor is optimal.



- Degree of local invasion of the primary tumor and presence of metastases are important.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Comfort

- Therapy to enhance comfort via local and systemic analgesics and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine). Medical treatment of uveitis or glaucoma.

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation, especially for those with extension into surrounding structures or regional metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Enucleation via removal of the tumor and a margin of surrounding tissue.
 - Follow-up information after enucleation was available for 21 cats.^{43, 44, 46-48} Nineteen cats were dead within 8 months of surgery, and two cats lived more than a year after surgery.^{44, 48} Metastasis with or without tumor recurrence was seen in 8 cats 2-17 months after surgery, and extension to involve the CNS was seen in 8 cats.^{43, 44, 48}
- Definitive radiation if there is evidence of tumor extending beyond the surgical margins (e.g.: 16-19 dosages of radiation).

FELINE ORBITAL/RETROBULBAR TUMORS

Clinical presentation

- SCC is most common, usually as an extension of a maxillary or nasal tumor. Other tumors include fibrosarcoma, plasma cell tumor, and lymphoma. Exophthalmos and anterolateral globe deviation are commonly seen.
- Moderately common.



Figure 49-3: This cat had an orbitectomy for a sarcoma of the eye and surrounding structures followed by definitive radiation therapy five years ago. Soft tissue sarcomas are highly invasive but are unlikely to spread to distant sites.

- Often painful.
- Often associated with facial deformity, epiphora, nasal obstruction, exophthalmos, glaucoma, etc.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- Ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the tumor may be preferable in some cases.
- An aspirate or biopsy is essential.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.



Figure 49-4: Cat prepared to start radiation therapy for a nasal tumor that has invaded the left orbit and caused some significant changes to the globe. The radiation resulted in substantial improvement in comfort and vision.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, gabapentin and/or opiates) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cypheptadine).

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation, especially for those with extension into surrounding structures or regional metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Orbitectomy with or without definitive radiation if there is evidence of tumor extending beyond the surgical margins (e.g.: 16-19 dosages of radiation).

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Chapter 50

Feline tumors of the gastrointestinal tract

FELINE ORAL SQUAMOUS CELL CARCINOMA

Clinical presentation

- Squamous cell carcinoma represents 60-80% of all oral tumors in cats.
- Passive smoking may increase risk of developing squamous cell carcinoma.
- Often seen in older cats.
- Squamous cell carcinoma often involves the tongue. Occasionally invades mandible or maxilla.
- Dysphagia and ptyalism are common.
- Often painful.
- Weight loss due to reduced intake of food is common and is best resolved with an esophagostomy tube early in the management of this disease.



Key point

Exposure to cigarette smoke may increase the risk of cats developing oral squamous cell carcinoma.



Figure 50-1: Sublingual squamous cell carcinoma results in weight loss, ptyalism, dysphagia, lethargy and debilitation. This tumor is almost always incurable. The single greatest thing that can be done for these cats is to place a feeding tube and to manage their pain. Many therapies have been tried, including radiation, surgery, chemotherapy and targeted therapy with drugs such as toceranib, with limited results.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- Ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the oral cavity that contains the tumor.
- Bone involvement and appropriate therapy are positive.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.



Figure 50-2: This cat presented for anorexia and dysphagia due to a tonsillar squamous cell carcinoma. A feeding tube was placed and the region treated with radiation therapy with supportive care.

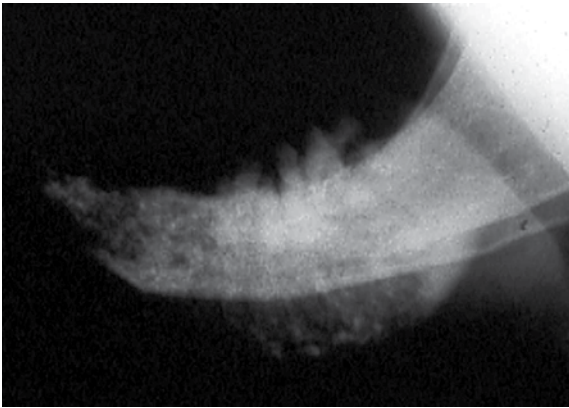


Figure 50-3: Mandibular squamous cell carcinomas can be quite invasive into surrounding bone. A mandibulectomy and radiation for tumors that are confined just to that region may be helpful. Nutritional support via an esophagostomy tube is often indicated.



Key point

Cats with sublingual squamous cell carcinoma generally respond poorly to therapy, whereas tumors that involve bone without lingual tissues generally respond well to surgery and/or radiation therapy.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

A



B



Figure 50-4: Tumors of the tongue, tonsils, lips, pharynx and surrounding structures can be biopsied a number of ways, including with cup biopsy instrument (A). Once the sample is obtained, it can be placed into a cassette and then into formalin for fixation (B).

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation may provide transient benefit (e.g.: 2-5 dosages of radiation) to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.
- A retrospective study was conducted⁵ to describe outcomes for cats with oral squamous cell carcinoma that were treated with palliative radiation therapy with or without chemotherapy. Forty-nine patients had an overall mean and median survival times of 127 and 92 days. Mean and median survival times of cats receiving palliative radiation therapy alone were 157 and 113 days. Mean and median survival times of patients receiving both radiation therapy and chemotherapy were 116 and 80 days, although it could be argued that these cats tended to have more advanced disease. The median survival time for cats with sublingual tumors was 135 days versus 80 days for those with mandibular



tumors. Sixty-five percent of clients stated their cat had a subjectively improved quality of life.

- In another study, 31 cats were treated twice daily for 14 fractions of 3.5 Gy given within a 9-day period with the addition of carboplatin given at 90-100 mg/m² on day 1 and day 4.⁶ The median survival time was 135 days. Cats with tumors of tonsillar origin or cheek responded best to therapy and were long-term survivors with a mean survival of 724 days, and the median had not been reached.
- Clinician scientists did a study and concluded that their accelerated hypofractionated radiation therapy protocol (10, 4.8 Gy once-daily fractions given Monday through Friday) was well tolerated in cats with oral SCC, with manageable adverse events.⁷ The median progression-free survival was 105 days (1 year PFS of 23%), median local progression-free survival was 219 days (1 year LPFS of 41%), and median overall survival was 174 days (1 year overall survival of 29%).

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Cures are obtained only in a small subset of cats whose tumors are amenable to complete resection, or where resection with microscopic residual disease is followed by definitive radiation therapy (e.g.: 16-19 dosages of radiation).

FELINE ORAL FIBROSARCOMA

Clinical presentation

- Moderately common.
- May be painful.
- Fibrosarcomas represent 10-20% of oral tumors.
- Often results in ptyalism, dysphagia, weight loss, anorexia, facial deformity, and exophthalmos.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- Radiographs, computerized tomography, or magnetic resonance imaging of the head.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.



Key point

Wide surgical removal of oral fibrosarcoma can result in long-term control of the disease.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation, especially for those with extension into surrounding structures or regional metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Surgery with or without definitive radiation if there is evidence of tumor extending beyond the surgical margins (e.g.: 16-19 dosages of radiation).
- Surgical excision possible with wide excision that includes bone.
 - Maxillectomy needs to be aggressive in order to assure adequate surgical margins. Tumor recurrence was noted in one study 3.5 months after maxillectomy in one cat with a lesion centered around the upper canine,²⁶ whereas another cat had no evidence of tumor 24 months after a unilateral premaxillectomy.³²
 - Medical records of 42 cats treated with mandibulectomy for oral neoplasia, including fibrosarcoma, were reviewed.³³ The progression-free and survival rates at 1 and 2 years were 56% and 49%, and 60% and 57%, respectively. Cats with fibrosarcoma or osteosarcoma had a longer survival time than cats with squamous cell carcinoma. Despite acute morbidity including dysphagia and anorexia, 83% of the owners providing information were satisfied with the outcome of mandibulectomy.
- Carboplatin, doxorubicin, and vincristine have shown efficacy and could be considered if radiation is not available.

FELINE ORAL MELANOMA

Clinical presentation

- Uncommon. In three surveys totaling 146 oral tumors in cats, only 4 were melanomas.³⁻⁵
- May be painful.



- There is a moderate chance of metastases, primarily to regional lymph nodes or lung.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- Ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the tumor may be preferable in some cases.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative or coarse fractionated radiation, especially for those with extension into surrounding structures or regional metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.
- In one study involving 5 cats with melanoma of the oral cavity that were treated with hypofractionated radiation therapy (three fractions of 8.0 Gray for a total dose of 24 Gy), 3 cats had a response to radiation, including one complete response and two partial responses, with a median survival time of 146 days (range 66-224 days) from the start of radiation.⁴⁴

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Surgery.
- Definitive radiation if there is evidence of tumor extending beyond the surgical margins (e.g.: 16-19 dosages of radiation).

FELINE ODONTOGENIC TUMORS

Clinical presentation

- Moderately common.
- Non-neoplastic lesions in the mouth, such as eosinophilic granuloma or inflammatory polyps, may mimic malignant lesions. Always do a biopsy.
- May be painful.
- Inductive fibroameloblastoma are more commonly seen in cats less than 18 months of age; calcifying epithelial odontogenic tumor and epulides in older cats.
- Epulides are much less common in cats than in dogs, accounting for 3 of 89 oral neoplasms in one study⁹ and 29 of 371² in a second study.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- Ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the tumor may be preferable in some cases.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation, especially for those with extension into surrounding structures or regional metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.

Comfort and longer-term control

Above mentioned therapy for comfort plus:



- Surgery with complete margins is likely curative.
- Surgery is the treatment of choice, particularly for small inductive fibroameloblastomas. Localized excision may not be successful because of the high probability of bony invasion.
 - In 5 of 10 cats treated surgically, there was no recurrence 6 to 36 months after surgery.^{52,54,56,57} Local recurrence was seen within 2 to 6 weeks of surgery in 3 of the remaining cats^{56, 57} and at 42 months after surgery in a fourth.⁵²
- Surgery should be curative for an epulis. Wide excision is essential as these tumors arise from the periodontal ligament, and thus the tooth with its socket must be removed to prevent recurrence.
- Definitive radiation alone or if there is evidence of tumor extending beyond the surgical margins (e.g.: 16-19 dosages of radiation).
- Three cats with incompletely resected odontogenic tumors were treated with orthovoltage radiation therapy to a total radiation dose of 48-52 Gy over a period of 26-29 days.⁵⁶ Acute toxicities were mild and all cats had long-term (>35 months) control of their tumor.

FELINE TUMORS OF THE SALIVARY GLAND

Clinical presentation

- Moderately common.
- Most salivary gland tumors are adenocarcinomas, accounting for 89 of 106 tumors.^{70,71}
- Carcinomas of other types are less common.
- Adenomas comprise approximately 5% of salivary tumors.^{9,70-72}
- Mixed tumors (carcinosarcomas) are rare^{73,74} and may occasionally be benign.⁷¹
- Some carcinomas appear to arise from the salivary duct rather than the glandular tissue.⁷⁵
- Ulceration of the overlying skin is common, which may be exacerbated by secondary otitis externa from parotid tumors; deeper invasion may result in facial nerve damage⁹ or vestibular signs.⁷²
- Signs of hypersalivation, dysphagia, and weight loss are common, as is the case with other oral tumors such as SCC. Tumors can be very large, reaching more than 8 cm in diameter.^{9,73,74}
- May be painful.
- Surgical excision curative if adenoma.
- Carcinomas are invasive and thus are rarely completely removed.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- Ultrasonography and/or radiographs are practical

and cost effective, however computerized tomography or magnetic resonance imaging of the tumor may be preferable in some cases.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Key point

Treatment of cats with salivary gland adenocarcinoma with surgery, radiation and chemotherapy has been shown to result in survival times that exceed a year.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation, especially for those with extension into surrounding structures or regional metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Surgery.
- Definitive radiation if there is evidence of tumor extending beyond the surgical margins (e.g.: 16-19 dosages of radiation).
- Doxorubicin chemotherapy resulted in greater than 50% reduction in the size of a salivary adenocarcinoma for 9 months.³⁷
- Combination therapy using surgery, radiation therapy, and chemotherapy with doxorubicin (or possibly carboplatin) is most likely to be successful in cats with salivary adenocarcinomas. A median survival of 516 days was achieved in 31 cats treated with any combination of these modalities.⁷⁸



FELINE ESOPHAGEAL TUMORS

Clinical presentation

- Epithelial tumors of the esophagus are more common than mesenchymal tumors but are still considered very rare.
- Common locations are thoracic inlet or intrathoracic, but tumors can be anywhere in the esophagus.
- Regurgitation, ptyalism, gagging and weight loss are very common.
- May be painful.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- Endoscopy and biopsy are often key for making a diagnosis.
- Ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the tumor may be preferable in some cases.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation, especially for those with extension into surrounding structures or regional metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Surgery.
- Definitive radiation if there is evidence of tumor extending beyond the surgical margins (e.g.: 16-19 dosages of radiation).

FELINE GASTRIC TUMORS

Clinical presentation

- Lymphoma is most common gastric tumor.
- Carcinomas and adenomas are uncommon. Other tumors are also seen.
- Vomiting and weight loss are common with all tumor types.
- May be painful.



Key point

Cats with gastric tumors often lose weight and may vomit.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- Endoscopic or ultrasound-guided biopsy.
- Ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the tumor may be preferable in some cases.



Key point

Cats with lymphoma of the stomach often have lymphoma of the intra-abdominal lymph nodes and small intestine, all of which should be assessed by abdominal ultrasound or CT imaging.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.



Key point

Lymphoma of the gastrointestinal tract may respond well to combination chemotherapy.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

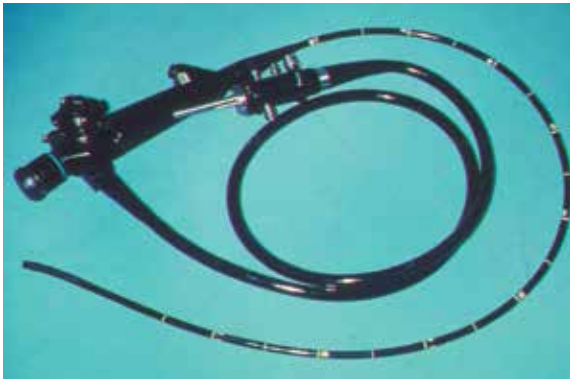


Figura 50-5: Upper and lower gastrointestinal tract masses can be best visualized by endoscopy if they involve the mucosa or underlying structures. This non-invasive procedure is ideal for determining the location and extent of disease and for performing biopsies within the GI tract. Flexible endoscopy is a practical way of exploring the esophagus, stomach, as well as the large and small intestine.

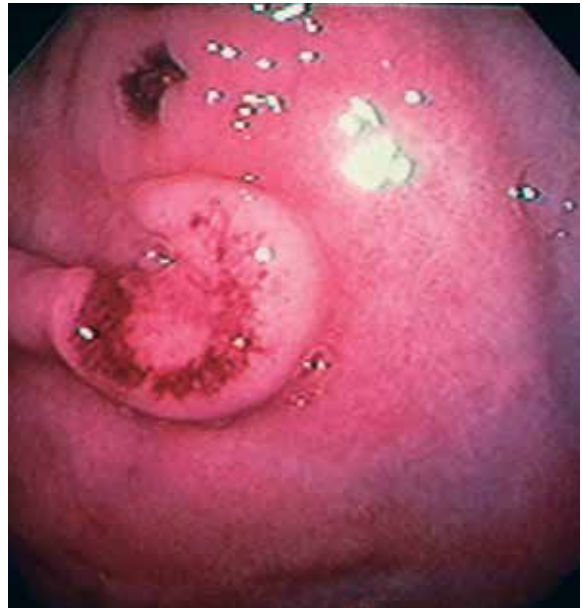


Figure 50-7: A pyloric antral mass was observed during gastroscopy. Biopsies confirmed the presence of a gastric carcinoma. The tumor was removed and the cat recovered uneventfully.



Figura 50-6: Upper GI endoscopy was performed in this cat with chronic vomiting and weight loss. Endoscopy confirmed the presence of diffuse thickening of the stomach. Endoscopic biopsies confirmed lymphoma. The modified CHOP protocol was given and the cat improved dramatically.

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation may be helpful but one must take into account the exquisite radiosensitivity of the liver. Consider radiation, especially for those with extension into surrounding structures or regional metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Surgery with non-lymphoid malignancies.
- CHOP chemotherapy is recommended for lymphoma.

FELINE ADENOMATOUS POLYPS OF THE INTESTINE

Clinical presentation

- May be seen anywhere in the intestinal tract.
- Must less commonly diagnosed than intestinal adenocarcinoma.
- The most common location of intestinal polyps is in the duodenum. May be uncomfortable due to the vomiting and weight loss associated with the condition.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- Biopsies often secured via exploratory or via endoscopy.
- Ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the tumor may provide information about the extent of the disease.



Treatment

This section is divided into two options:

- Comfort for those who want to improve quality of life.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Surgical removal of the involved intestine.

FELINE INTESTINAL, COLONIC OR RECTAL ADENOCARCINOMA

Clinical presentation

- Most tumors are palpable and affect the ileum more commonly than the colon and duodenum.
- Siamese cats are predisposed and have been associated with up to 70% of cases.
- Anorexia, vomiting or diarrhea, melena, and tenesmus often occur, depending on tumor location.
- Moderately common.
- May be painful.
- Metastases may arise long after definitive treatment.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, endoscopic or surgical biopsy, three-view thoracic radiographs or computerized tomography of the chest.
 - Chest metastases are uncommon at the time of initial staging.
- Endoscopic-guided biopsy, ultrasound-guided aspirate or surgical biopsy at the time of an exploratory is often required to make a diagnosis.
- Ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the tumor may be preferable in some cases.
 - Radiographs may demonstrate gas filled loops of intestine in an “obstructive pattern,” outlining a prestenotic dilation of the bowel rostral to an intestinal stricture.
- Ultrasonography is often superior to contrast radiography in identifying a mass involving the intestinal wall or metastatic disease, although



Figure 50-8: Rigid endoscopy is ideal for visualizing and biopsying rectal or colonic masses that involve the mucosa.



Figure 50-9: Tumors of the rectum or colon may be accessible via a pull-through technique, where the tumor and the associated colonic and rectal tissue are prolapsed through the anus. The tumor and involved normal tissue are removed and the colon and rectum, if involved, are anastomosed. Care should be taken to ensure that the rectal sphincter is not harmed or incontinence will ensue. The tumor imaged here was an adenocarcinoma that was completely removed, with no recurrence years after the procedure.

it may be difficult to locate the lesion to a specific area of the bowel.

- Ultrasound is an important diagnostic tool for identifying intra-abdominal metastases. This is important, as up to 70% of cats with this malignancy have metastases.
- The most common metastatic sites are regional lymph nodes (50%), carcinomatosis (40%), hepatic metastases (8%), and pulmonary metastases (7%).^{59,88,90,102,104–106,110}
- The presence of metastatic disease is a negative prognostic indicator.



Treatment

This section is divided into two options:

- Comfort for those who want to improve quality of life.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.



Key point

Resection of intestinal adenocarcinoma with or without lymph node metastases has been shown to result in long-term (>1 year) control of the disease, even if there is lymph node metastases.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Surgical excision of a small intestinal carcinoma is best accomplished by resecting a minimum of 5 cm of normal-appearing bowel on either side of the lesion. Removal of possible metastatic lesions may be helpful. Rectal “pull-through” may be quite helpful for colonic tumors.
- Cats with intestinal adenocarcinoma that survive the postoperative period have been reported with no evidence of tumor 6 to 54 months after surgery.^{9,59,88,90}
- Median survival of cats with intestinal adenocarcinoma that underwent surgical excision was 365 days and 22 days for those with suspected adenocarcinoma that did not undergo surgery.¹⁰⁸ Median survival of cats was 843 days for those without evidence of metastatic disease at the time of surgery and 358 days for those that had metastases.
- Doxorubicin or carboplatin may be beneficial to delay or prevent metastases or tumor growth.

FELINE INTESTINAL MAST CELL TUMORS

Clinical presentation

- The third most common tumor of the intestine.
 - Most mast cell tumors are in the small intestine.
- Clinical signs include vomiting, diarrhea, inappetence and weight loss.
- Most tumors are palpable.
- May be painful.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, tumor aspirate or biopsy and three-view thoracic radiographs or computerized tomography of the chest.
- Abdominal ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the tumor may be preferable in some cases. Bone marrow aspirate.
 - More than half of cats with GI mast cell tumors have metastases to sites such as mesenteric lymph nodes, spleen, liver, bone marrow and, less commonly, the lung.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and control

Above mentioned therapy for comfort plus:

- CCNU or vinblastine therapy with or without treatment with a tyrosine kinase inhibitor such as toceranib or masitinib may be helpful.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Surgical resection of the involved bowel with 5-10 cm margins on either side followed by CCNU or vinblastine therapy with or without treatment with a tyrosine kinase inhibitor, such as toceranib or masitinib, may be helpful.¹²³ If metastases can be surgically concurrently downsized, that would be ideal.

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Chapter 5 I

Feline tumors of liver, pancreas, and spleen

FELINE VISCERAL MAST CELL TUMORS

Clinical presentation

- Most common in older, non-purebred cats.
- Cats with visceral mast cell disease may present for nonspecific malaise, inappetence, weight loss, or vomiting, the latter of which is presumably due to gastroduodenal ulceration following the release of vasoactive amines (e.g., histamine, serotonin) that cause gastric parietal cell hyperplasia and increased gastric acid production.^{5,8,9}
- The principle site for visceral mast cell tumor is the spleen.
- Moderately common.
- May be painful.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FeLV serology, T4 testing, aspirate or biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- Ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the tumor may be preferable in some cases.
 - While the spleen is the most common primary site for visceral MCT, the liver is involved in up to 90% of affected cats followed by visceral lymph nodes, bone marrow, lung, intestine, and kidney.^{2,7}
 - Marrow, splenic and hepatic aspirates may be indicated.

Key point

The spleen is the most common primary site for visceral MCT, however liver, visceral lymph nodes, bone marrow, lung, intestine, and kidney metastases are seen in up to 90% of cats.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Key point

Surgery, CCNU and tyrosine kinase inhibitors have been shown to be beneficial in the management of cats with visceral mast cell tumors.

Comfort

- Therapy to enhance comfort (e.g.: prednisolone, Pepcid, diphenhydramine and if needed, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and control

Above mentioned therapy for comfort plus:

- Tyrosine kinase inhibitor such as toceranib or masitinib.
- CCNU has been used with success with an overall response rate of 50%. Median response duration was 168 days (range, 25 to 727 days). The most common toxicoses were neutropenia and thrombocytopenia.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

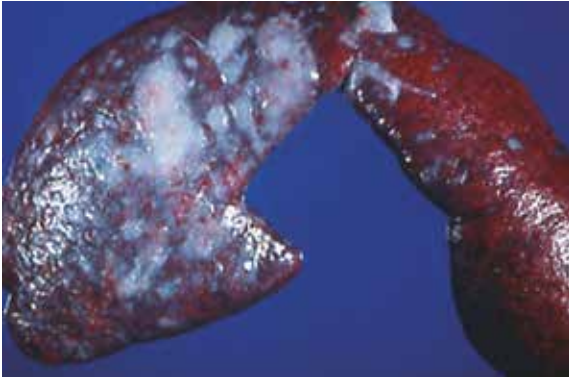


Figure 51-1: Cats with splenic mast cell tumors can do well after a splenectomy. The spleen often has a darker color with “white icing” over the surface. It is common to have concurrent involvement of the liver, lymph nodes and bone marrow. Systemic therapy with CCNU and/or a tyrosine kinase inhibitor postoperatively may be indicated.

- Splenectomy, even if there is concurrent disease in liver, lymph nodes and marrow, can result in improvement in quality of life and overall survival. Concern over the release of vasoactive amines due to surgical manipulation during splenectomy has led to the recommendation that cats be treated with corticosteroids and both H1 and H2-blocking antihistamines for 48 hours prior to surgery.
- Postoperative adjuvant therapy with toceranib, masitinib and/or CCNU or vinblastine has been helpful.

FELINE HEMANGIOSARCOMA

Clinical presentation

- Moderately common, aggressive and invasive.
- Mesenteric hemangiosarcomas more common than those of spleen, liver, mediastinum, oral and nasal cavity.
- Hemangiosarcoma is the most often diagnosed neoplasm (60%) in cats, with the spleen as the most common location for neoplasia (37%).²⁵
- Hemoabdomen is common.
- Clinical signs secondary to blood loss and ascites are common and include lethargy, anorexia, collapse and death.
- Not usually painful.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, surgical biopsy and three-view thoracic radiographs or computerized tomography of the chest; with a coagulation panel is ideal.
- Ultrasonography and/or radiographs are practical and cost effective, however computerized

tomography or magnetic resonance imaging of the tumor may be preferable in some cases.

- Ultrasonography is the imaging modality of choice, particularly in cats in which peritoneal effusion obscures radiographic details. The ultrasonographic appearance is most often that of multiple cavernous splenic nodules and in some cases, metastases to intraabdominal organs.
- In one study, 82% of cats were anemic, aspartate transaminase was increased in 53%, and metastatic lung disease was noted in 33% of affected cats.²⁶

Treatment

This section is divided into two options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine). Transfusions and/or fluid therapy is often needed due to bleeding and volume depletion.

Comfort and control

Above mentioned therapy for comfort plus:

- Splenectomy. This surgical procedure has been reported in five cats.^{21,23} Four of these cats died between 8 and 35 weeks after surgery, and one did not die and was alive 19 weeks after surgery.
- Adjuvant chemotherapy may be helpful. Doxorubicin is the most commonly mentioned in literature.

FELINE LYMPHANGIOMA AND LYMPHANGIOSARCOMA

Clinical presentation

- Rare.
- Similar biologic behavior to hemangiosarcoma.
- May be painful.
- Most often diagnosed on the skin, however it may involve the liver,³² mediastinum,^{33,34} abdominal serosa,²⁹ cranial mesentery,³⁴ oral cavity,³² and tongue.³²
- Chylous ascites or abdominal effusion may be found.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology,



T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.

- Ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the tumor may be preferable in some cases.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation for localized disease, especially for those with extension into surrounding structures or regional metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, to reduce the size of the tumor.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Surgery.
- Definitive radiation if there is evidence of tumor extending beyond the surgical margins (e.g.: 16-19 dosages of radiation).
 - Doxorubicin may be helpful as an adjuvant treatment.

FELINE MYELOLIPOMA

Clinical presentation

- Uncommon benign liver tumor in older domestic cats; rarely affects the spleen.
- Tumors may be solitary and large or multiple.
- Usually asymptomatic, incidental finding.

Staging and diagnosis

- These tumors are benign, however they must be differentiated from malignant tumors that can and do metastasize
- Minimum data base (MDB): includes a CBC,

biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.

- Ultrasonography is often the best diagnostic tool, however radiographs, computerized tomography, or magnetic resonance imaging of the tumor may be preferable in some cases.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Comfort

- Therapy to enhance comfort if needed (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation for localized disease, especially for those with extension into surrounding structures or regional metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Splenectomy if indicated.

FELINE TUMORS OF THE LIVER PARENCHYMA

Clinical presentation

- Hepatoma and hepatocellular carcinoma may be part of a disease spectrum rather than distinct entities and may be seen at the same time.
- Uncommon in older cats.
- Nonspecific clinical signs including weakness due to a paraneoplastic syndrome causing hypoglycemia.
- Abdominal mass may be palpable.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.



- Ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the tumor may be preferable in some cases.
- Metastases, if they occur, are usually to regional lymph nodes.



Key point

The routine access to ultrasound has increased the long-term cure and control rate of cats with liver tumors due to earlier detection and diagnosis.

Treatment

This section is divided into two options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.



Key point

Resection of hepatocellular carcinoma has resulted in survival times in excess of two years post resection.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and control

Above mentioned therapy for comfort plus:

- Surgery.
- In one study, hepatocellular carcinoma was found equally in the left and right lobes, with survival time post resection of 2.4 years.⁵⁰

FELINE TUMORS OF THE BILIARY SYSTEM

Clinical presentation

- Relatively uncommon.
- Spectrum of diseases from cholangiocarcinoma, bile duct or biliary adenocarcinoma, and biliary carcinoma.
- Can cause abdominal distension, anorexia, depression, vomiting, and weight loss.
- May be palpable.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology,



Figure 51-2: Primary and metastatic neoplasia of the liver in the cat is often associated with nonspecific clinical signs, elevated liver enzymes and occasionally, a palpable cranial abdominal mass. Radiographs of the chest and abdomen are good screening tests, however an ultrasound and ultrasound-guided biopsy or aspirate are often helpful at defining the specific diagnosis. If the liver malignancy is caused by a mast cell tumor or lymphoma, chemotherapy is often indicated. If it is a carcinoma or adenocarcinoma, then surgery may be helpful in some cases. If the disease is multifocal, as depicted here, surgery is not likely helpful for prolonging life significantly. Reprinted with permission from: Ogilvie GK, Moore AS. *Feline Oncology: A Comprehensive Guide for Compassionate Care*. Trenton NJ, Veterinary Learning Systems. 2002.

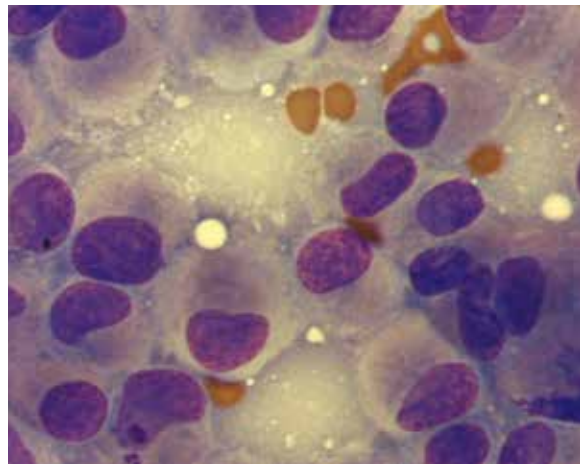


Figure 51-3: Aspirates of the liver mass may be diagnostic, as in this sample. Note large epithelial cells with abundant cytoplasm, diffuse cytoplasmic borders, tendency to clump, varying nuclear:cytoplasmic ratios and the occasional prominent nucleoli. While the cytology is suggestive of a carcinoma, cytology can occasionally be misleading. Therefore, whenever possible, a histologic biopsy should be obtained to confirm the diagnosis.



T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.

- Ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the tumor may be preferable in some cases.
- The pattern of metastasis did not seem to differ among the three sites of origin; the most common sites of metastasis were the peritoneum, lungs, and regional lymph nodes,^{2,25}

Treatment

This section is divided into two options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and control

Above mentioned therapy for comfort plus:

- Surgery. Complete resection has been reported to result in median survival times exceeding two years.

FELINE CARCINOMA OF THE EXOCRINE PANCREAS

Clinical presentation

- Uncommon or unrecognized.
- Usually seen in older cats.
- Nonspecific clinical signs predominate including anorexia, severe weight loss, lethargy, and listlessness.
- May be painful.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy by ultrasound guidance or surgery and three-view thoracic radiographs or computerized tomography of the chest.
- Ultrasonography is the most practical imaging technique, however, radiographs, computerized tomography, or magnetic resonance imaging of the abdominal tumor are also effective.
- Metastases to the liver, peritoneum, and regional lymph nodes are most commonly described,^{62,71,74,75,77} however lung, spleen, diaphragm, GI tract, ovaries, kidneys, and pleura are all reported.^{62,73,75,77,78}



Figure 51-4: This necropsy specimen confirms the presence of a pancreatic carcinoma that involves almost the entire pancreas. Close inspection reveals thickening of the liver that is associated with hepatic metastases. The routine use of diagnostic ultrasound has resulted in an increase in the diagnoses of early stage pancreatic tumors, many that are low grade and associated with periods of anorexia and vomiting. The increase in the identification of these low grade tumors brings about the opportunity to increase the progression-free survival of cats with this condition by intervening surgically before the condition becomes inoperable. Reprinted with permission from: Ogilvie GK, Moore AS. *Feline Oncology: A Comprehensive Guide for Compassionate Care*. Trenton NJ, Veterinary Learning Systems. 2002.

Treatment

This section is divided into two options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and control

Above mentioned therapy for comfort plus:

- Surgery. Is not an option if metastases are present but may be palliative if not. Gastrojejunostomy or enteral feeding (jejunostomy) tube placement is required.
- Carboplatin and toceranib may be used adjuvantly.



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Chapter 52

Feline tumors of the urinary tract

FELINE RENAL TUMORS

Clinical presentation

- Relatively uncommon.
- Benign tumors are rare.
- Nephroblastomas are rare and typically seen in young cats.
- Renal lymphoma is relatively common. Other less common malignancies include transitional cell carcinoma (TCC) and renal cell carcinoma.
 - Azotemia may be present, particularly with bilateral tumors. Nonspecific signs of lethargy, anorexia, and weight loss are common.
- May be painful.



Key point

Cats with renal tumors often have nonspecific clinical signs often referable to renal insufficiency.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy or aspirate by ultrasound-guided or surgical approaches. Three-view thoracic radiographs or computerized tomography of the chest may be wise. Azotemia is common.
- Ultrasonography, computerized tomography, or magnetic resonance imaging of the abdomen may identify the local disease and assist in determining the presence of metastases.
 - Metastasis is very common for TCC, less so for renal carcinoma and nephroblastoma.
 - Lymphoma may cause dramatic lymphadenopathy that may include regional lymph nodes. An ultrasound-guided aspirate may be diagnostic.

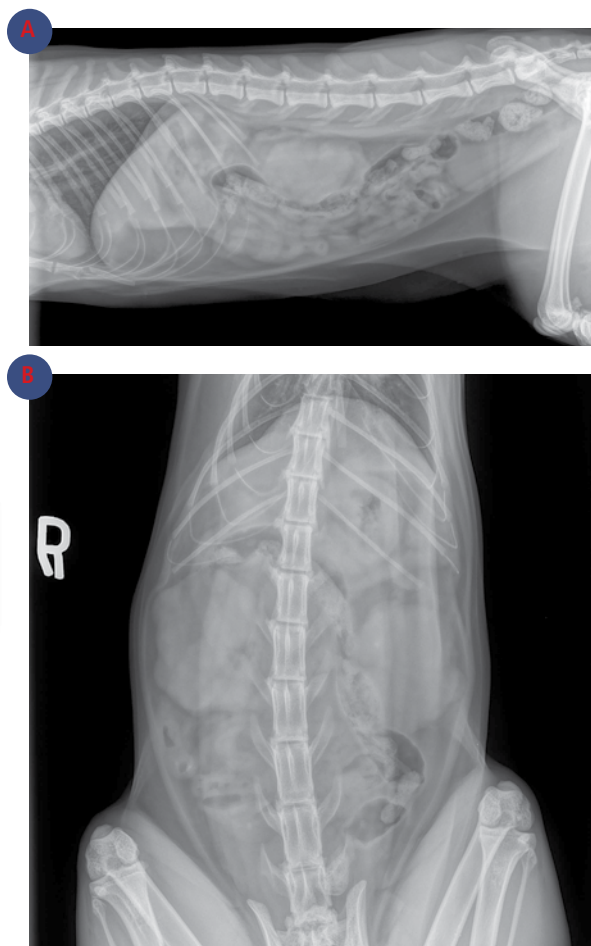


Figure 52-1: These radiographs confirm the presence of irregular kidneys. The differentials for this finding include neoplastic and nonneoplastic findings. Additional imaging, a biopsy or aspirate, blood work and a urinalysis are indicated as part of the diagnostic workup. Imaging courtesy of Lenore Anderson Mohammadian, DVM, MSpVM, Diplomate ACVR.

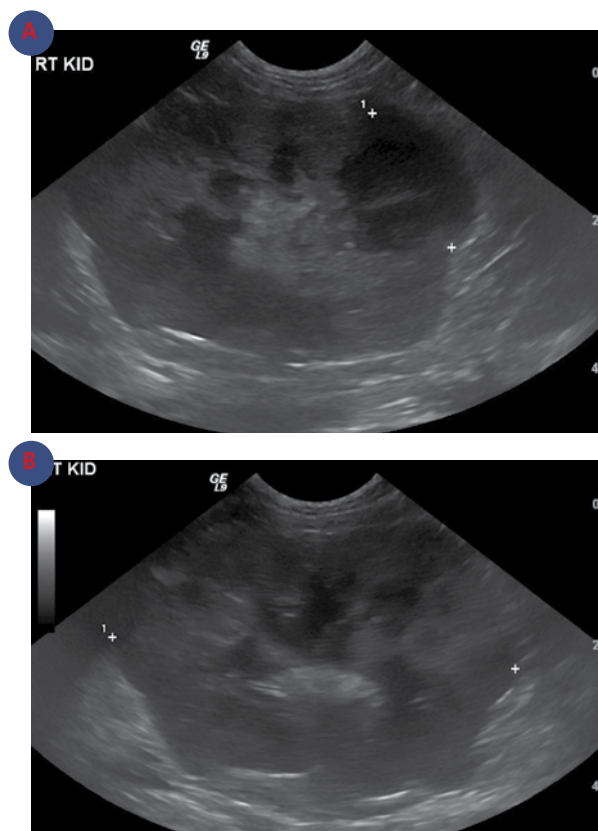


Figure 52-2: Ultrasound images of the right kidney of the same cat in figure 52-1. Note the altered echogenicity of the renal parenchyma. An ultrasound-guided aspirate was taken and blood work was secured that conformed a diagnosis of bilateral renal lymphoma and an elevated BUN and creatinine. Aggressive fluid therapy and treatment with the modified CHOP protocol resulted in complete remission and a resolution of azotemia within 3 weeks. Cats with renal lymphoma that are FeLV-negative can do well long-term with appropriate support and treatment. Imaging courtesy of Lenore Anderson Mohammadian, DVM, MSpVM, Diplomate ACVR.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Key point

Cats with renal lymphoma should be treated with combination chemotherapy, whereas those cats with renal carcinoma should be treated with surgery if renal function of the contralateral kidney is projected to be adequate.

Comfort

- Adequate hydration and supportive care is important to prevent or to treat azotemia. Therapy to enhance comfort (e.g.: prednisolone if the cat has renal lymphoma, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine). Prednisolone can be quite helpful if renal lymphoma is the underlying cause.

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation is being explored, especially for those with extension into surrounding structures or regional metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.
- If lymphoma is diagnosed, prednisolone with or without COP chemotherapy may be important.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Renal lymphoma: CHOP chemotherapy with renal care if needed is indicated. Mitoxantrone should be substituted for doxorubicin if the patient is azotemic.
 - The overall estimated 1-year survival rate in all cats was 48.7%, and the 2-year survival rate was 39.9%.
- Nephrectomy may be helpful for carcinomas that involved one kidney and if the contralateral kidney has enough function to support the patient.
- Investigational: mitoxantrone or carboplatin for transitional cell carcinoma; doxorubicin or carboplatin for renal cell carcinoma; and vincristine, doxorubicin, and actinomycin D for nephroblastoma.

FELINE URINARY BLADDER TUMORS

Clinical presentation

- Increasing in prevalence, likely due to the common use of abdominal ultrasonography.
- Hematuria, pollakiuria, and stranguria are common clinical signs.
- Transitional cell carcinoma is the most common tumor type followed by leiomyoma and less commonly, leiomyosarcoma or squamous cell carcinoma.
- May be painful.
- Clinical signs similar to cystitis such as hematuria, pollakiuria and stranguria.^{2,15,16,18-22}

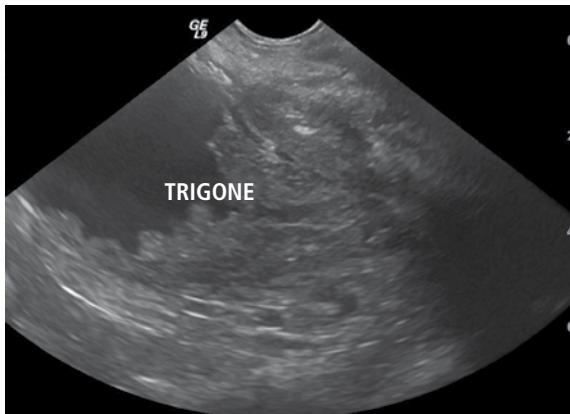


Figure 52-3: The more frequent use of diagnostic ultrasound in practice has dramatically increased the number and frequency of diagnoses of bladder tumors, specifically transitional cell carcinomas. These tumors should be biopsied to secure a specific diagnosis. Care should be taken not to “seed” the tumor along the biopsy tract. Imaging courtesy of Lenore Anderson Mohammadian, DVM, MSpVM, Diplomate ACVR.



Key point

Many cats with transitional cell carcinoma of the bladder have clinical signs that are indistinguishable from those with lower urinary tract infections.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, urine culture and sensitivity if indicated, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- Ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the tumor may be preferable in some cases.
- Tumors may appear to be apical rather than trigonal.
- Iliac lymph nodes and regional extension (and rarely lungs) are sites of metastasis for carcinomas.
- Metastasis appears to be rare for leiomyosarcomas.



Key point

A biopsy is necessary to definitively diagnose transitional cell carcinoma of the bladder. Every attempt should be made to prevent seeding tumor cells from a bladder tumor into the surrounding tissue via cystocentesis or surgery.

Treatment

This section is divided into three options:

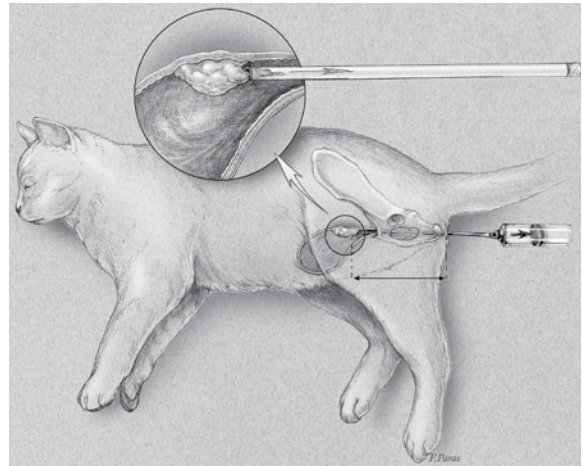


Figure 52-4: One minimally invasive way of obtaining a biopsy of a bladder mass is to insert an open ended urinary catheter up the urethra to the mass. Suction is applied with a syringe attached to the catheter while pulling the biopsy apparatus in and out to tear away pieces of the growth for submission for histopathology. Reprinted with permission from: Ogilvie GK, Moore AS. *Feline Oncology: A Comprehensive Guide for Compassionate Care*. Trenton NJ, Veterinary Learning Systems. 2002.



Figure 52-5: Cystoscopy can also be used to visualize the bladder for biopsy. This can be done in large cats through the urethra, or via a tiny stab incision through the bladder wall made during surgery. This cat had a benign polypoid condition of the bladder. Reprinted with permission from: Ogilvie GK, Moore AS. *Feline Oncology: A Comprehensive Guide for Compassionate Care*. Trenton NJ, Veterinary Learning Systems. 2002.

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.



Figure 52-6: Surgery is generally not effective for the treatment of transitional cell carcinoma of the bladder, as the disease is often multifocal. Benign masses are more often localized and more successfully treated with resection.

- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).
- In one study involving cats with transitional cell carcinoma of the bladder, reduction of hematuria and/or dysuria was noted in 80% of cats treated with meloxicam, with a mean survival time of 311 days (range 10–1064); 1-year survival of 50%.²⁸

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation, especially for those with extension into surrounding structures or regional metastases (e.g.: 2–5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.
- Carboplatin or mitoxantrone may be helpful as an adjuvant treatment.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Surgery is the prime therapeutic modality, although tumors may recur even with a partial cystectomy.
- Radiation and/or mitoxantrone or carboplatin may be helpful in some cases.

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Chapter 53

Feline tumors of the endocrine system

FELINE THYROID ADENOMAS

Clinical presentation

- Moderately common, especially in older cats.
- Thyroid adenomas are quite common and often hyperfunctional, resulting in clinical signs of thyrotoxicosis. In contrast, adenocarcinomas are comparatively rare and often nonfunctional.
- A diet of canned food and an indoor lifestyle may increase the risk of developing hyperthyroidism due to a parathyroid adenoma.
- Thyrotoxic cats often steadily lose weight despite being polyphagic, can be either hyperactive or lethargic, and may develop clinical signs due to hypertrophic cardiomyopathy.
- Almost never painful.

Key point

This very common non-malignant condition is almost always associated with elevated thyroid hormone levels and clinical signs associated with thyrotoxicosis.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing (T4 and T4 done by equilibrium dialysis, thyroid scintigraphy will help rule out a functional carcinoma., excisional biopsy and three-view thoracic radiographs or computerized tomography of the chest if an adenocarcinoma is suspected.
- Cardiac echocardiography, radiographs, computerized tomography, or magnetic resonance imaging of the chest, especially if a thyroid carcinoma is suspected.
- Advanced renal disease may be a confounding factor because when thyrotoxicosis is resolved, renal blood flow declines and renal values can worsen.
- Cardiomyopathy can complicate survival.

Key point

Thyroid scintigraphy and blood work is considered essential to stage cats with thyrotoxicosis.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Key point

Surgery, medical management and radioactive iodine-131 are all very effective treatments for cats with thyrotoxicosis.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).
- Stabilize cardiac disease medically (could include short-term medical management of hyperthyroidism) prior to definitive treatment. Treatment of hyperthyroidism will worsen concurrent renal disease; consider methimazole, carbimazole or ipodate, as they are associated with high rate of control. Provide adequate nutrition to increase weight.



Figure 53-1: Thyroid adenomas can be treated by either medical management, radioactive iodine-131 or surgery. Surgery is generally quite effective, although hypocalcemia can delay or complicate recovery. Every attempt should be made to identify and re-implant the external parathyroid glands to prevent prolonged hypocalcemia.

Comfort and control

Above mentioned therapy for comfort plus:

- Intrathyroid injection of 95% ethanol may be effective for thyroid adenomas.
- Palliative radiation for thyroid carcinomas, especially for those with extension into surrounding structures or regional metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Extracapsular thyroidectomy. Bilateral disease is common; postoperative hypocalcemia due to removal of parathyroid tissue is usually transient but mandates monitoring and treating serum calcium.
- IV, SC or PO administration of ^{131}I is generally a very effective treatment and the treatment of choice if available.

FELINE THYROID ADENOCARCINOMA

Clinical presentation

- Moderately common.
- May be painful.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.

- Ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the tumor may be preferable in some cases.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation, especially for those with extension into surrounding structures or regional metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Surgery.
- Definitive radiation if there is evidence of tumor extending beyond the surgical margins (e.g.: 16-19 dosages of radiation).
- IV, SC or PO administration of ^{131}I is generally a very effective treatment and the treatment of choice if available.
 - Some carcinomas will not uptake the ^{131}I , therefore surgery with or without definitive radiation may be indicated if there is evidence of tumor extending beyond the surgical margins (e.g.: 16-19 dosages of radiation).

FELINE THYROID CARCINOMA

Clinical presentation

- Relatively uncommon compared to thyroid adenomas.
- Almost always hyperfunctional and cause hyperthyroidism.
- Some are irregular in shape, multiple and

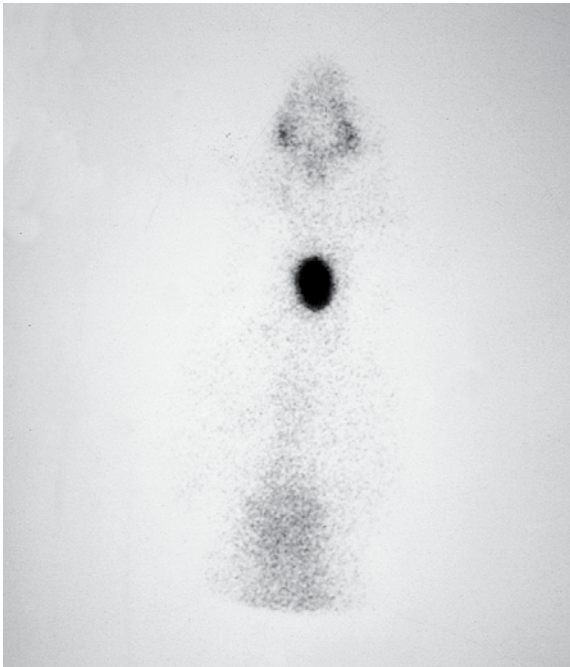


Figure 53-2: A nuclear $^{99m}\text{TcO}_4^-$ scan was done on this cat with a large peritracheal mass that was thought to be a thyroid malignancy and was adherent to surrounding tissues. The image shows intense uptake of the radiopharmaceutical without any evidence of metastases to surrounding tissues. The thyroid adenocarcinoma did uptake radioactive iodine 131, however this is not always true. The tumor resolved and the cat remained in remission for years. Reprinted with permission from: Ogilvie GK, Moore AS. *Feline Oncology: A Comprehensive Guide for Compassionate Care*. Trenton NJ, Veterinary Learning Systems. 2002.

encapsulated,⁷⁶ whereas others are large and may surround the trachea and esophagus and may cause dyspnea or dysphagia.⁷⁵

- Functional papillary carcinoma predominate.⁸³
- Rarely bilateral but often highly metastatic.^{4,84}
- Usually not painful.
- The prevalence of severe hyperthyroidism, large thyroid tumors, multifocal disease, intrathoracic thyroid masses and suspected malignant disease all increase with disease duration in cats referred for radioiodine therapy.⁸⁵

Key point

Thyroid carcinoma in the cat often presents as a large, irregular, lobulated mass in the peritracheal region.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs

or computerized tomography of the chest. Since cardiomyopathy may be seen in thyrotoxic cats, an echocardiogram and ECG may be helpful.

- Ultrasonography, radiographs, computerized tomography, magnetic resonance imaging of the tumor.
- A nuclear $^{99m}\text{TcO}_4^-$ scan may show multiple cervical masses, extension of tumor into the thoracic inlet, mediastinal masses, or lung metastases.

Key point

Thoracic and regional lymph node metastases can occur in cats with thyroid carcinomas.

Treatment

This section is divided into two options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.

Key point

Surgery, external beam radiation or radioactive iodine-131 can be used to treat cats with thyroid carcinomas.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole), lack of appetite (e.g.: mirtazapine or cyproheptadine), clinical signs of thyrotoxicosis (e.g.: methimazole) and, if indicated, congestive heart failure (e.g.: atenolol, furosemide, enalapril).

Comfort and control

Above mentioned therapy for comfort plus:

- ^{131}I therapy or palliative radiation, especially for those with extension into surrounding structures or regional metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.
- Survival generally ranges from 8 to 39 months (average, 19 months).^{78,79}
- Another group of investigators reported that single high-dose radioiodine therapy was successful in 6/8 cases of thyroid carcinoma, with complete resolution of hyperthyroidism, and was associated with prolonged survival times (181-2381 days).⁷⁶ They confirmed that the prognosis for feline thyroid carcinoma successfully treated with radioiodine is good, with extended survival times commonly achieved.



- Surgical excision, even if incomplete, may result in euthyroidism and clinical improvement.
- Definitive radiation or ^{131}I may then be indicated if there is evidence of tumor extending beyond the surgical margins.

FELINE PANCREATIC ISLET CELL TUMORS

Clinical presentation

- Insulinomas are uncommon and are often known to cause hypoglycemia and subsequent neurologic signs such as nervousness,⁹⁴ inappetence,⁹⁵ episodic staggering, twitching of the leg, skin, and facial muscles^{90, 91} and seizures.^{90, 94}
- Gastrinomas are very rare and are associated with chronic vomiting due to the production of gastrin.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FeLV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- Insulinomas.
 - Insulin: glucose ratio to rule in or out insulinomas.
 - Confirming presence Whipple's triad (i.e., hypoglycemia with neurologic signs that respond to glucose administration).
 - Glucagon tolerance test has been used to diagnose insulinoma,⁹⁰ but it is not recommended due to the risk of developing life-threatening clinical signs.
- Gastrinoma.
 - Gastrin levels to rule in or out a gastrinoma.
- Ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the abdomen tumor that may be multiple.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cypheptadine). Prednisolone may be helpful to raise glucose levels in those cats with

insulinomas. Many cats with insulinomas require the administration of glucose intravenously to maintain glucose homeostasis until more definitive therapy is employed. Gastrinomas may cause vomiting, which can be treated with maropitant citrate and/or metoclopramide.

Comfort and control

Above mentioned therapy for comfort plus:

- Medical palliation of signs of hypoglycemia using prednisolone may be successful. Diazoxide use not reported. H2 antihistamines may be effective to reduce gastric acid secretion associated with gastrinoma.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Surgery to remove pancreatic mass or masses if localized.
- Tyrosine kinase inhibitors and/or gemcitabine are investigational but promising.

FELINE PARATHYROID TUMORS

Clinical presentation

- Uncommon.
- May be associated with a palpable parathyroid mass 2 to 6 cm in diameter.¹⁰¹
- May range histologically from hyperplasia to adenoma to parathyroid carcinoma.
- The tumors may be nonfunctional or may be functional and cause hypercalcemia.
- Clinical signs often non-specific, such as polyuria/polydipsia, lethargy, weight loss and anorexia.
- Not usually painful.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile including an ionized calcium, urinalysis, FIV/FeLV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
 - Productive parathyroid tumors may cause an elevated serum ionized calcium, low phosphorus and an elevated parathormone level.⁹⁹
- Ultrasonography of the cervical region is practical, however computerized tomography or magnetic resonance imaging is a higher resolution diagnostic tool.



Key point

An elevated ionized calcium is often the first indication of a parathyroid tumor.



Treatment

This section is divided into two options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine). Fluid therapy (e.g.: 0.9% NaCl) may help induce calciuresis and reduce a hypercalcemic-induced nephropathy.

Comfort and control

Above mentioned therapy for comfort plus:

- Surgical excision of adenoma may be curative. Check other parathyroid glands, as multiple adenomas and concurrent adenocarcinomas are reported. Monitor serum calcium for hypocalcemia or return of hypercalcemia after surgery.
- Definitive radiation may be helpful at reducing regrowth of any residual disease.

FELINE PITUITARY TUMORS

Clinical presentation

- Relatively uncommon.
- Adenomas predominate that more arise from the anterior lobe of the pituitary that secrete growth hormone (GH) or thyroid stimulating hormone (TSH).
 - Most cats are presented due to insulin-resistant diabetes.^{107,109,115}
 - Some present with increased body mass with organomegaly causing an enlarging abdomen.
 - Some cats are arthritic and have a large head and tongue, organomegaly, and a protruding lower jaw (prognathia inferior).
- Clinical signs associated with a space-occupying mass in the region of the pituitary gland (vision problems, anisocoria, pacing, aimless wandering, etc.) are uncommon as tumors are most often small.
- Other endocrine tumors may be present, fulfilling the criteria of multiple endocrine neoplasia (MEN).
 - In a series of 18 cats diagnosed at necropsy with pituitary tumors, 13 had thyroid adenomas and 13 had hyperplasia of the adrenal gland; 5 cats were diabetic and 5 had congestive heart failure thought to be due to excess growth hormone. One cat had a microscopic pheochromocytoma.

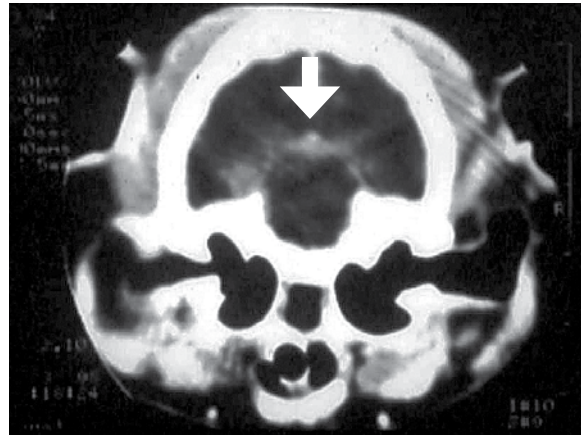


Figure 53-3: This cat with acromegaly, diabetes mellitus that is difficult to control, and mental dullness was imaged with a computerized tomography scan, which confirmed the presence of a pituitary macroadenoma. The cat was successfully treated with definitive radiation therapy and made a full recovery.

In another study of 14 cats, 6 had parathyroid hyperplasia.¹⁰⁷

- Not usually painful.

Key point

While relatively uncommon, some cats with pituitary adenomas also have acromegaly that results in coarse, thickened facial features and diabetes mellitus that is difficult to regulate.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest. An echocardiogram and ECG should be performed if cardiac disease is suspected.
- Computerized tomography or magnetic resonance imaging of the head and thus the tumor, the latter of which is usually quite small.
 - Acromegalic cats with CT or MRI evidence of a pituitary tumor often have frontal bone thickness greater than age-matched controls with and without a history of upper airway disease.¹⁰⁹ Evidence of soft tissue accumulation in the nasal cavity, sinuses, and pharynx may also be noted.
 - In one study, the CT findings of 16 cats with insulin-resistant diabetes were compared with findings in cats that had controlled diabetes; all resistant cats had a pituitary mass.¹¹⁷
- If acromegaly and arthritis is suspected, radiographs of the affected region may be helpful.^{107,114}



Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine). All concurrent endocrine, neurologic and metabolic disease should be identified and treated. Steroids and/or mannitol may be helpful if the patient has increased intracranial pressure. Diabetes and cardiac disease, if present, must be treated.

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative megavoltage radiation done after computerized tomography is used with radiation treatment planning (e.g.: 2-5 dosages of radiation) and can be helpful at limiting clinical signs by first enhancing comfort, second, reducing the rate of growth and third, occasionally reducing the size of the tumor.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Surgery via transphenoidal hypophisectomy.¹²⁵ This surgical procedure requires unique training and expertise.
- Radiation therapy should be definitive and can be delivered by a standard linear accelerator or via highly precise, targeted stereotactic radiosurgery (e.g.: CyberKnife). Monitor serum profile and GH levels or perform a CT scan for macroadenomas.
- Somatostatin analogues may have effects that can reduce pituitary GH production, however the efficacy is unknown.
- Cryoablation of the tumor via transphenoidal approach has been done but is considered experimental.

FELINE HYPERADRENOCORTICISM

Clinical presentation

- Moderately common.
- Hyperadrenocorticism due to a pituitary adenoma

that secretes ACTH is more common than hyperadrenocorticism due to an adrenal tumor.

- Most adrenal tumors are adenomas. Adrenal carcinomas have the potential to metastasize.
- Common signs are PU/PD due to insulin resistant diabetes mellitus, thin skin that tears easily, poor healing and, less commonly, CNS signs due to large pituitary tumors.
- Not usually painful.

Key point

Feline hyperadrenocorticism is often associated with PU/PD and unregulated diabetes mellitus.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- The diagnostic plan should include an ACTH response test, low and high dose dexamethasone suppression tests (0.015 and 1.0 mg/kg IV, respectively), and a determination of ACTH levels, if available, to help determine if there is a pituitary or adrenal-dependent hyperadrenocorticism.^{108,118–123,126–131,134–145}
 - Low-dose dexamethasone suppression test results were shown in one study to be consistent with hyperadrenocorticism in 96% of cats, whereas ACTH stimulation testing was suggestive of hyperadrenocorticism in 56% of cats.¹¹⁴
- Ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the brain or abdomen, or both to assess the tumor.
- Investigators showed that the ultrasonographic appearance of the adrenal glands was consistent with the final clinical diagnosis 93% of cats with hyperadrenocorticism.¹¹⁴

Key point

Abdominal ultrasound is critical to identify abnormal adrenal gland size and shape, which is often associated with adrenal or pituitary-dependent hyperadrenocorticism.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.



Box 53-1. Testing for hyperadrenocorticism in cats* 108,118-123,126-131,134-145

ACTH Response Test

The ACTH response test is a good screening test; results supported a diagnosis of hyperadrenocorticism in 14 of 18 cats.¹²⁶⁻¹²⁸ The use of synthetic ACTH (cosyntropin or tetracosactrin) is preferred for this test. In normal cats, IV administration of 0.125 mg (125 µg) per cat should result in a 200% to 1400% increase in cortisol over baseline.^{121,135-138}

IV administration gives greater stimulation and a longer duration of response (6 hours) than IM injection (2 hours), and IM injection of synthetic ACTH is painful.¹³⁹ A basal serum cortisol level should be obtained, and a second sample is collected 2 to 3 hours after IV administration of synthetic ACTH.¹³⁹ Lower doses of cosyntropin (1.25 or 12.5 µg/cat) will also cause a response, but the peak is earlier and short lived.¹⁴⁰ Likewise, dosages higher than 125 µg have no real advantage.¹⁴¹ Cosyntropin can be diluted to a concentration of 5 µg/ml of saline and stored refrigerated for more than 4 months.¹⁴⁰

ACTH gel (2.2 U/kg IM) has a similar effect.¹⁴² ACTH gel induces an earlier peak that may return to baseline quickly.^{136,142}

Dexamethasone suppression tests

Dexamethasone administered as an IV bolus should cause “negative feedback” suppression of ACTH secretion by the pituitary and a reduction in serum cortisol. Dexamethasone is chosen because it will not cross-react with cortisol measurements.

In dogs, the low dose dexamethasone suppression test (LDDST) is a good method of screening for hyperadrenocorticism. In cats, a dose of 0.01 mg/kg suppresses serum cortisol for 1 to 12 hours after administration, but levels return to baseline by 24 hours.^{141,143,144} Samples are collected prior to dexamethasone administration and 6 to 10 hours afterward.¹⁴¹ Lack of suppression does not confirm hyperadrenocorticism, as some normal cats will not experience a reduction in serum cortisol, possibly due to stress associated with concurrent diseases.^{141,144} Despite limitations, this is still a preferred screening method.^{108,119-121,123,126,127}

Some authors suggest that a dose of 0.015 mg/kg is more useful.¹⁴⁴ An even higher dose of dexamethasone (0.1 mg/kg), with samples collected on the same schedule, was not completely consistent in suppressing cortisol secretion in all normal cats.¹⁴¹ This test, however, has been widely used to distinguish ATs from pituitary tumors. While suppression of cortisol secretion should occur with pituitary tumors, the autonomous secretion of cortisol by ATs should allow the cortisol to rise again after initial suppression (“escape”).^{118,126,127} This test is not always diagnostic in cats,^{120,121} leading some authors to recommend a dexamethasone dose of 1.0 mg/kg (i.e., the high-dose dexamethasone suppression test [HDDST]) in cats.^{131,134,142,145} This dose consistently causes cortisol suppression in all normal cats.^{141,145}

Determination of ACTH and hormonal levels

ACTH levels can be measured, although samples need to be chilled immediately and handled carefully, and thus reducing the practicality of this test in many private practices. In normal cats, endogenous ACTH levels range from 10 to 60 pg/ml.^{121,141} In cats with pituitary-dependent hyperadrenocorticism, ACTH levels have ranged from 90 to over 1000 pg/ml.^{108,118,119,121,122,126,127} Cats with ATs should have low or normal serum ACTH levels.¹³⁰ Since pre- and postoperative hypocortisolemia and since hypersecretion of more than one adrenal hormone has occurred in cats with adrenal tumors, adrenal panels prior to surgery may be beneficial as part of the preoperative work-up.

Urinary cortisol

In cats, most cortisol is excreted in the bile. Therefore the ratio of urinary cortisol to urinary creatinine is quite low (13×10^{-6}),¹²⁹ making it a potentially useful screening test. In one study, all six cats with hyperadrenocorticism had a urinary cortisol:creatinine ratio above the reference range (median, 122×10^{-6}).¹²⁹

* Adapted from and reprinted with permission from: Ogilvie GK, Moore AS. *Feline Oncology: A Comprehensive Guide for Compassionate Care*. Trenton NJ, Veterinary Learning Systems, 2001.



Key point

Surgical removal of adrenal tumors or treatment of hyperplastic adrenal glands with trilostane can be quite effective.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine). Management of diabetes and secondary infections is essential.

Comfort and control

Above mentioned therapy for comfort plus:

- Mitotane has been used in the past and is specifically toxic to the adrenal cortex and may improve symptoms and wound healing at doses ranging from 25 to 50 mg/kg/day in two divided doses. Some recommend starting at the lower dosage and still others suggest the concurrent administration of the mineralocorticoid fludrocortisone (0.01 mg/kg daily) and the glucocorticoid prednisolone (0.3 mg/kg daily).¹⁹
- Trilostane¹⁵² (30 mg PO q24h) is generally considered the drug of choice and has been associated with a good response to therapy. ACTH stimulation testing recommended 3-4 hours post-administration at 1, 3, 6, 12 weeks and then every 6 months. Target cortisol concentration 1-2 mcg/dl.
- Palliative radiation for either adrenal or pituitary-induced hyperadrenocorticism has not been commonly used but has been suggested by some to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the adrenal or pituitary tumor.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Adrenalectomy is treatment of choice for both AT and PDH. Radiation is treatment for PDH with large tumor. Monitor adrenal function to avoid hypoadrenal crisis.

FELINE NON-CORTISOL SECRETING TUMORS

Clinical presentation

- Uncommon.
- Adrenal tumors may produce a number of hormones that may cause clinical signs that are nonspecific (weakness, blindness or gastrointestinal signs)

or directly related to the hormonal abnormality induced by the tumor.

- Aldosterone producing tumors may cause sodium retention and increased blood volume, which may cause hypertension, retinal hemorrhage, cardiac disease, weakness and depression.
- Epinephrine secreting tumors such as pheochromocytomas and paragangliomas are rare and often incidental, whereas others are PU/PD, exhibit vomiting or diarrhea and listlessness.
- Progesterone secreting tumors are rare and are associated with insulin resistance, in addition to alopecia, thinning of the skin, and poor wound healing.
- Not painful.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- Ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the tumor may be preferable in some cases.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine). Symptomatic medical treatment with potassium chloride, amlodipine, and spironolactone for aldosterone-secreting tumors may be palliative. Presurgical stabilization is important for pheochromocytoma.

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation, especially for those with extension into surrounding structures or regional metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.



Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Adrenalectomy with supportive care postoperatively.
- In one study¹⁶³ with cats with hypokalemia and an aldosterone secreting adrenal tumor, elevated concentrations of plasma aldosterone and adrenocortical neoplasia were documented in ten cats. Seven cases had adrenal adenomas and six had unilateral adrenal carcinomas. Three cases underwent medical treatment only with amlodipine, spironolactone and potassium gluconate, with two cats surviving 304 and 984 days. Ten cases underwent surgical adrenalectomy with cases remain alive between 240 and 1803 days.
- In another study¹⁶⁴ of 10 cats that had surgery for an aldosterone secreting tumor that caused hypokalemia and hypertension, eight survived and were discharged from the hospital post adrenalectomy. The overall median survival was 1,297 days.

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Chapter 54

Feline tumors of the reproductive system

FELINE TUMORS OF THE PROSTATE AND TESTICLE

Clinical presentation

- Uncommon.
- Often an incidental finding.
- Seminomas, interstitial cell tumors and teratomas predominate.¹⁻⁷
- Prostatic tumors may cause dysuria and hematuria.
- Usually not painful.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- Ultrasonography, radiographs and abdominal ultrasound may be helpful to stage the patient, however metastases have rarely been seen except in teratomas.

Treatment

This section is divided into two options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and control

Above mentioned therapy for comfort plus:

- Castration for testicular tumors.
- Radiation may be beneficial for prostatic tumors.
- Prostatectomy. One cat was treated by prostatectomy alone and lived 3 months before it was euthanized due to local metastasis that occluded the ureter and caused hydronephrosis.¹²
- Carboplatin or mitoxantrone have been used to treat cats with metastatic disease, however the efficacy remains unknown.

FELINE OVARIAN TUMORS

Clinical presentation

- Relatively uncommon.
- Large tumors may occur and cause signs related to size.
- Most often unilateral, however bilateral tumors have been documented.
- Granulosa cell tumors predominate followed by dysgerminomas, interstitial cell tumors, carcinomas, teratomas, sex-cord tumors, and a cystadenoma.
- Granulosa cell tumors may produce hormones and cause a persistent or irregular estrus, behavioral changes including aggressiveness, alopecia, anorexia and lethargy.
 - Abdominal distention may be noted and intra-abdominal or thoracic metastases have been noted.^{14,15,18,19}
- Ovarian granulosa cell tumors and carcinomas appear to be highly malignant, while teratomas may be less likely to metastasize.
- May be painful.

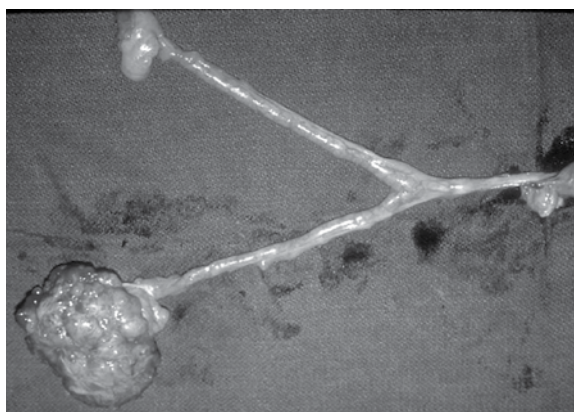


Figure 54-1: This ovarian tumor was removed from a cat that presented for a dermatologic problem. The ovarian mass was palpable on physical examination and visible on abdominal ultrasound. Resection resolved the cat's clinical signs. The histopathologic diagnosis was an ovarian carcinoma. Carboplatin was given adjuvantly and the cat did well long-term. Reprinted with permission from: Ogilvie GK, Moore AS. *Feline Oncology: A Comprehensive Guide for Compassionate Care*. Trenton NJ, Veterinary Learning Systems. 2002.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- Peritoneal metastases are most common, therefore ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the abdomen, and thus the tumor, may be helpful to determine the extent of the disease.



Key point

Ovarian granulosa cell tumors and ovarian carcinomas may be quite malignant with a high metastatic rate, whereas teratomas are usually less aggressive.

Treatment

This section is divided into two options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or

metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and control

Above mentioned therapy for comfort plus:

- Surgery.
- Adjuvant carboplatin chemotherapy may be helpful when the tumor has metastasized or if it is malignant.

FELINE UTERINE TUMORS

Clinical presentation

- Relatively common.
- Adenomas or endometrial polyps, fibromas, leiomyomas, squamous cell carcinoma are more commonly seen than adenomyosis and lymphoma.
 - Adenoma may progress to adenocarcinoma, which can then metastasize.
 - Leiomyomas may be associated with cystic ovaries.
 - Carcinomas may metastasize and can cause a pyometra.
 - Adenomyosis is described as proliferation of ectopic endometrium within the myometrium that causes enlargement of the uterus.
- May be painful.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- Ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the abdomen, and thus the tumor, may be helpful to determine the extent of the disease.
- If abdominal effusion is present, then fluid analysis and cytology is important.

Treatment

This section is divided into two options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).



Comfort and control

Above mentioned therapy for comfort plus:

- Ovariohysterectomy is curative for benign tumors but only palliative for malignant tumors.
- Carboplatin or doxorubicin have been shown to help some patients with malignant tumors.

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Chapter 55

Feline mammary neoplasias

FELINE MAMMARY FIBROADENOMATOSIS

(Synonyms include pericanalicular fibroadenoma, total fibroadenomatous change, benign mammary hypertrophy, mammary adenomatosis, fibroglandular hypertrophy, fibroepithelial hyperplasia, and fibroadenomatous hypertrophy)

Clinical presentation

- This uncommon condition is due to a very rapid proliferation of ectopic endometrium within the myometrium that causes enlargement of the uterus.
- Usually seen in young, intact females including some that are pregnant, or those cats of either sex treated with progestins.
- Younger cats usually have multiple affected glands with discoloration of overlying skin, whereas older cats often have hypertrophy of only one or two mammary glands, often in the inguinal region.
- May be painful.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest. Cats with this condition may have a coagulopathy and may be best assessed with a coagulation profile.
- Ultrasonography and radiographic imaging of the tumor is not done commonly, but it could determine the extent of the disease.

Treatment

This section is divided into two options:



Figure 55-1: This young, intact female cat presented for dramatic enlargement of the mammary glands. A biopsy confirmed the presence of fibroepithelial hyperplasia. While some insist that this condition will resolve after an ovariohysterectomy or ovariectomy via a flank approach, others insist that the disorder of young, intact female cats will resolve on their own with time. Analgesics are often indicated, as they can be quite painful. Reprinted with permission from: Ogilvie GK, Moore AS. *Feline Oncology: A Comprehensive Guide for Compassionate Care*. Trenton NJ, Veterinary Learning Systems. 2002.

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.



Comfort

- Therapy to enhance comfort that is often present (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine), although these are rarely seen.

Comfort and control

Above mentioned therapy for comfort plus:

- Ovariohysterectomy or ovariectomy is usually curative, however the rate of regression is slow. Some believe that these regress without therapy. Mastectomies are often associated with a high rate of complications and are not required to treat this condition.

FELINE BENIGN MAMMARY TUMORS

Clinical presentation

- Quite uncommon.
- Adenomas, intraductal papillomas and benign mixed mammary tumors have been described. Because they are often indistinguishable from the more common malignant mammary tumors, all mammary tumors should be assessed as if they were malignant.
- May be painful.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- Ultrasonography or radiographs to assess for intra-abdominal disease and to determine the extent of the local tumor may be helpful in some cases.
- Any solitary mammary tumor in a cat should be staged as if it were a malignant tumor before proceeding with surgical excision.

Treatment

This section is divided into two options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea

(e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and control

Above mentioned therapy for comfort plus:

- Mastectomy. If surgical excision is complete and the lesion is benign, no further treatment is necessary. Veterinary examinations should be scheduled every 6 months to check for recurrence or new, potentially malignant tumors.

FELINE MALIGNANT MAMMARY TUMORS

Clinical presentation

- Quite common in older unsprayed cats, or cats that were spayed late in life.
- Male cats uncommonly develop mammary tumors unless they are treated with progestins.
- Adenocarcinomas and solid carcinomas are the most common type, followed by mixed mammary tumors⁶ and mammary sarcomas, the latter of which may be slow to metastasize.¹⁹⁻²²
- Often large at the time of diagnosis, with one study confirming a median of 3 cm³ with some tumors up to 13 cm³.²⁴
- Approximately half of the tumors are ulcerated at the time of presentation.^{24,38,39}
- Axillary and inguinal lymph node metastasis is common, with even normal sized lymph nodes being infiltrated in approximately 27% of cats.²⁴
- Ovariohysterectomy but not parity may prevent mammary tumor development, with one study suggesting that the relative risk for a spayed female developing mammary carcinoma was approximately half that of an intact cat.¹⁷
- Purebred cats, especially Siamese and Persian cats, may be at increased risk.^{6,15,17, 2425,28,29}
- The post excisional survival period of affected cats is inversely proportional to tumor size, with cats with tumors greater than 3 cm in diameter had a 12-month median survival period, whereas those with tumors less than 3 cm in diameter had a 21-month survival period.
- Other prognostic factors for a favorable outcome include domestic shorthair breeds, increasing youth, absence of metastases, a well differentiated tumor (low mitotic count, nuclear and cellular pleomorphism, and tubule formation), lack of lymphovascular invasion, low AgNOR and Ki67 scores, and complete resection.
- May be painful.



Key point

Almost every tumor in the mammary gland of a cat must be considered as a malignant condition worthy of detailed staging and swift, definitive therapy.



Figure 55-2: This 10 year old, intact female cat was presented on emergency for a raised, red, draining mass near a left first mammary gland. Chest radiographs and blood work were within normal limits and fine needle aspiration confirmed the presence of a carcinoma. The size of the tumor at the time of diagnosis can be very predictive of outcome.



Figure 55-3: This ulcerated, firm, draining mammary gland is quite characteristic of a mammary adenocarcinoma. Cytology or a biopsy (excisional or incisional) can be used to confirm the diagnosis. A complete examination should be done in each case, to include careful palpation of all mammary glands and the regional axillary or inguinal lymph nodes.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy of regional lymph nodes and three-view thoracic radiographs or computerized tomography of the chest.
- Necropsy revealed evidence of metastases in 120 of 129 cats that had undergone surgery to treat mammary carcinoma with axillary or inguinal lymph nodes affected in more than 80% of cats, while the sternal node was involved in 30% of cats. The majority of cats with sternal lymph node involvement also had pleural or pulmonary metastases.^{43,44}
- Since metastases to the spleen, kidney, adrenal gland, peritoneal surfaces, and heart have been reported^{6,15,16,38-40} abdominal ultrasonography, computerized tomography, or magnetic resonance imaging may be wise.



Key point

Chest radiographs and aspirates of any and all enlarged lymph nodes must be considered.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.

- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).



Key point

Removal of the entire mammary chain that contains the tumor and the regional lymph nodes, if available, is recommended for cats with mammary tumors.

Comfort and control

Above mentioned therapy for comfort plus:

- Complete removal of the entire mammary chain with wide margins is the standard of care, however it is unlikely to be curative due to high rate of lymphatic invasion but may be palliative.¹⁶
- The surgeon should submit the entire specimen for histologic review to ensure that complete margins have been obtained.¹⁶
- When conservative surgery (removing only the affected gland and adjacent tissue) was compared with radical surgery (unilateral or bilateral mastectomy), there was no difference in survival between the two groups,^{26,28} however

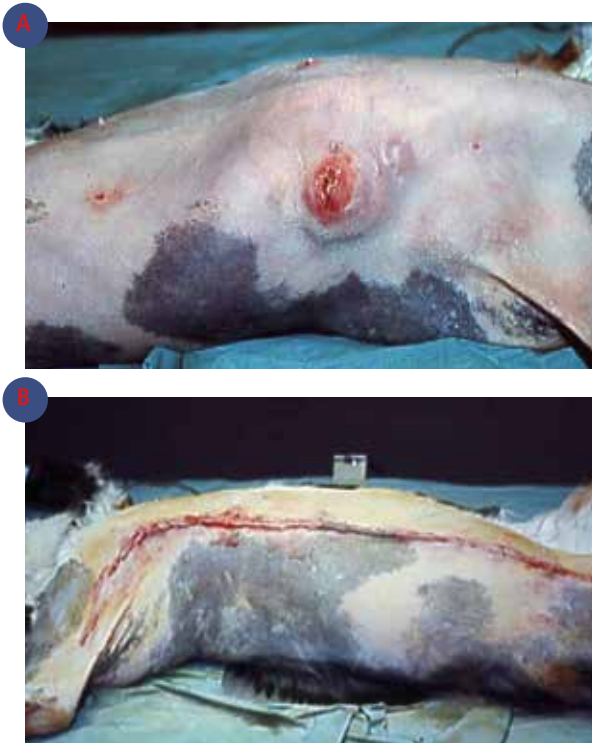


Figure 55-4: The patient with the mammary tumor is prepared for surgery by identifying all palpable tumor within the mammary tissue and by ensuring that there are no metastatic lesions in the lung, regional lymph nodes or elsewhere. If any one gland on one side is involved, that entire chain is removed. If there are tumors on the left and the right mammary chains, a unilateral mastectomy may need to be done to allow the skin to stretch adequately to allow a second radical mastectomy to be successfully performed several weeks later.

there was a marked difference in recurrence rates (0% and 43.4%, respectively). Given that recurrence is associated with a greater cost to the client due to additional therapy, including surgery, doing the more definitive radical surgery is definitely recommended.

- Survey data and histologic features for 108 carcinomas from 97 cats were analyzed with respect to overall survival and confirmed a median survival time of 31 months for cats with grade I tumors, 14 months for cats with grade II tumors, and 8 months for cats with grade III tumors.²⁷
- Cats with World Health Organization stage II or III mammary carcinoma that were treated by radical full-chain mastectomy had no recurrence a median of 10.4 months after surgery; median survival time was 21.3 months.⁵⁵

Comfort and longer term control

Above mentioned therapy for comfort and control plus:

- Chemotherapy, with most studies suggesting that doxorubicin may be the drug of choice, however mitoxantrone, carboplatin, cyclophosphamide, and paclitaxel may have efficacy. Radiation therapy unproven but may improve local control.
- Twenty-six cats received five doses of doxorubicin (1 mg/kg IV every 3 weeks) following surgery, with the overall median survival being 25 to 41 weeks.⁵⁶ Cats with stage II disease that had not been previously treated with surgery appeared to be most benefitted, as they had the longest survival times (median 73 weeks).
- In another study, 14 cats with measurable tumors were treated with doxorubicin (30 mg/m² IV every 2 weeks) for five treatments following biopsy. Nine cats had a partial response and 2 cats had some reduction in tumor size.⁵⁷ The cats lived 10 to 61 weeks (median, 31 weeks).
- Doxorubicin (30 mg/m² IV every 3 weeks) was combined with cyclophosphamide (100 mg/m² daily for 4 days) to treat 14 cats with inoperable or metastatic mammary carcinomas. Three cats with lung metastases had a complete response to treatment for 26 to 49 weeks, and 2 cats had shorter partial responses (one for 7 and the other for 21 weeks).²⁵
- In yet another study evaluating the benefit of doxorubicin therapy, 37 cats treated with surgery alone were compared to 36 treated with surgery plus doxorubicin chemotherapy. While not statistically significant, the median disease-free survival in the surgery group was 372 days versus 676 days in the group of cats with surgery for the mammary cancer plus doxorubicin. The median survival times were 1,406 and 848 days, respectively. Cats that underwent a unilateral radical mastectomy had a survival time that was significantly longer for the surgery + chemotherapy compared to those who just had surgery (1,998 versus 414 days).³⁰
- Other investigators confirmed that the Kaplan-Meier median survival time of cats that received surgery and doxorubicin was 448 days, whereas the Kaplan-Meier median DFI was 255 days.³¹
- Data from cats treated with mastectomy with or without carboplatin chemotherapy was assessed. Patients treated with surgery and chemotherapy presented a longer overall survival than those treated only with surgery.³²

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Chapter 56

Feline tumors of the respiratory tract

FELINE NASOPHARYNGEAL POLYPS

Clinical presentation

- Usually young cats (<2 years of age).
- Cough, gagging after eating, nasal signs, or otic discharge, sneezing, snuffling, and stertor; often mild but progressive.^{1,3,6,8}
- Large polyps may cause ventral deviation of the soft palate.
- Rarely bilateral.
- Peripheral vestibular disease may be present.
- Rarely uncomfortable.

Staging and diagnosis

- MDB; otic and oral examination; skull radiographs including bullae; CT or MRI scan of the head, including the bullae if radiographs equivocal. Endoscopy of nasopharynx and otic examination with biopsy. One approach to more adequately visualize the polyp is to use a spay hook to pull the soft palate forward.
- CT was shown by one set of investigators⁹ to be an excellent imaging tool for the supportive diagnosis of nasopharyngeal polyps in cats. CT findings of a well-defined mass with strong rim enhancement, mass-associated stalk-like structure, and asymmetric tympanic bulla wall thickening with pathologic expansion of the tympanic bullae are highly indicative of an inflammatory polyp.



Key point

Staging should include an evaluation of bulla involvement via skull radiographs or CT imaging. Involvement of the bullae provides reasoning to surgically address this involvement with a bulla osteotomy.

Treatment

Initial

- The polyp is grasped and pulled via gentle, uniform traction.
- A bulla osteotomy, drainage and bacteriologic culture and sensitivity sampling should be performed if there are signs or images confirming tympanic bulla involvement.^{3,7,10}
 - One study in cats confirmed that cats that have a ventral bulla osteotomy for removal of inflammatory polyps or masses is unlikely to affect hearing as measured via air-conducted brainstem auditory evoked response. They also showed that cats developed short-term Horner's syndrome.¹⁰
- A lateral ear resection may be required when polyps involve the otic canal.⁴
- Most cats are cured with appropriate therapy.
 - Regrowth following surgery was noted in only 6 of 31 cats in one series.³

FELINE INTRA-NASAL TUMORS

Clinical presentation

- Moderately common.
- Benign nasal tumors include adenomas, fibromas, fibropapillomas, chondromas are quite rare.
- Malignant nasal tumors include the more common adenocarcinoma, undifferentiated carcinoma, squamous cell carcinoma and lymphoma (discussed below). Sarcomas are uncommon.
- Nasal discharge, epiphora, facial deformity and epistaxis are less common than snuffling, and sneezing. Seizures due to intracranial invasion are rare.
- May be painful.



Key point

Snorting, snuffling, nasal bleeding, anorexia and open mouth breathing may suggest a nasal tumor or other space-occupying mass in that region.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, transnostril biopsy, needle aspirate of regional lymph nodes and three-view thoracic radiographs or computerized tomography of the chest. Titers for cryptococcus may be helpful in ruling out this differential.
- Skull radiographs are less valuable than computerized tomography or magnetic resonance imaging of the skull, and thus the tumor.
- Obtaining a biopsy through the nostril via curettage, biopsy cup, endoscopic biopsy or high pressure saline nasal lavage is recommended. Obtaining a biopsy through the skin is not encouraged, as radiation dosage to the skin at the region of the incision would be high, resulting in increased morbidity.



Key point

Skull radiographs or CT of the head is required to define intranasal involvement. Chest radiographs should be secured, and a biopsy should be done through the nose or an approach via endoscopy over the soft palate should be performed.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.



Key point

Most cats with nasal tumors respond quite well to radiation therapy.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).



Figure 56-1: While CT or MRI are the diagnostic methods of choice for nasal or skull tumors, radiographs are practical and cost effective. This image shows a highly destructive lesion of the left nasal cavity and the surrounding structures. A biopsy or an aspirate are required to determine the underlying cause of this destructive disease (infectious, inflammatory, neoplastic or other causes). Imaging courtesy of Lenore Anderson Mohammadian, DVM, MSpVM, Diplomate ACVR.

Comfort and control

Above mentioned therapy for comfort plus:

- Radiation, either definitive or palliative.
 - Radiation therapy markedly improved the prognosis for most cats. Surgical debulking of the tumor followed by orthovoltage radiation to doses of 25 to 50 Gy was used to treat six cats with nasal carcinoma.²¹ No recurrence was seen in four cats. One was still alive 26 months after treatment and another died without evidence of tumor 40 months after treatment.
 - The median overall survival time and progression-free survival in 65 cats with tumors treated with palliative hypofractionated radiation therapy were 432 days and 229 days, respectively.¹⁹ No significant difference between overall survival time of cats with nasal lymphoma and that of cats with other tumors was observed.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Chemotherapy. Carboplatin likely to be the most effective.

FELINE OLFACTORY NEUROBLASTOMA

Clinical presentation

- Quite uncommon.
- Sneezing, dyspnea, unilateral nasal discharge, wheezing, and cough have been described.^{28,29}



- Many cats in the past have been FeLV-positive.
- Responses to therapy are generally short-term.
- May be painful.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FeLV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- Radiographs may be of some help, however computerized tomography or magnetic resonance imaging of the head, and thus the tumor, is important.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation, especially for those with extension into surrounding structures or regional metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Definitive radiation therapy.

FELINE NASAL LYMPHOMA

Clinical presentation

- Moderately common.
- In a survey investigating the causes of nasopharyngeal disease in cats, lymphoma, seen in 26 of 53 (49%) cats, was the most common diagnosis.³¹
- Most common clinical signs include nasal discharge, dyspnea, epistaxis, stertor, facial



Figure 56-2: Rhinoscopy may be helpful at identifying the location of an intranasal disease or disorder and to obtain specific biopsies, aspirates or cultures.

deformity, anorexia, epiphora, exophthalmos, and sneezing.³⁴

- Rarely involves tissues outside the nasal cavity, including the retropharyngeal tissue, chest or abdomen, however that should be considered during staging.
- Usually not painful.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, bone marrow aspirate, abdominal ultrasound, FIV/FeLV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- Skull radiographs may be helpful, however computerized tomography or magnetic resonance imaging of the head, and thus the tumor, is preferable.
- Obtaining a biopsy through the nostril via curettage, biopsy cup, endoscopic biopsy or



Figure 56-3: Once the location of the intranasal disease or disorder has been identified, a biopsy can be obtained with a curette or a cup biopsy instrument. Regardless of the method used, to reduce the risk of damaging the brain, the biopsy instrument is never advanced beyond the level of the medial canthus of the eye.



Figure 56-4: Cats with localized intranasal lymphoma respond well to radiation therapy and/or chemotherapy. If radiation is employed, the skin and hair color may be changed in the irradiated field, as depicted here.

brushings or high pressure saline nasal lavage is recommended. Obtaining a biopsy through the skin is not encouraged, as radiation dosage to the skin at the region of the incision would be high, resulting in increased morbidity.



Key point

Cats with nasal lymphoma should be staged to determine if the disease has spread to the liver, spleen, lymph nodes and marrow.

Treatment

This section is divided into two options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.



Key point

Most cats with nasal lymphoma respond quite well to radiation therapy and/or systemic chemotherapy.



Comfort

- Therapy to enhance comfort (e.g.: NSAID OR prednisolone, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and control

Above mentioned therapy for comfort plus:

- Radiation therapy or chemotherapy alone or in combination is equally effective for nasal disease, but chemotherapy is needed for cats with systemic disease. Long survivals possible in FeLV-negative cats.
- Coarse fractionated radiation therapy may have the same efficacy as conventional fractionation in the treatment of feline nasal lymphoma.³⁸
- The median overall survival time and progression-free survival in 65 cats with tumors treated with palliative hypofractionated radiation therapy was 432 days and 229 days, respectively. No significant difference between overall survival time of cats with nasal lymphoma and that of cats with other tumors was observed.¹⁹
- The records of 19 cats treated for stage I nasal lymphoma with megavoltage radiation therapy (median dose = 42 Gy) and combination chemotherapy given over 6 months were reviewed to confirm a median progression-free interval for all cats being 945 days (31 months).²¹
- Cats with nasal lymphoma achieving a complete remission in response to combination chemotherapy had a survival time of 749 days.²⁴

FELINE LARYNGEAL TUMORS

Clinical presentation

- Uncommon.
- Lymphoma, SCC, and adenocarcinoma predominate.
- Lymphoma should always be considered a systemic disease and should be evaluated as such.
- SCC may appear as an annular constriction that is invasive deep into laryngeal tissues and the surrounding pharynx in most cats.^{14,42,46}
- Cats with laryngeal adenocarcinoma may have clinical evidence of metastases to the cervical lymph nodes, lungs, spleen, and adrenal glands.⁴⁸
- Dyspnea progressing to respiratory distress with or without dysphonia.
- May be painful.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FeLV serology, T4 testing, laryngeal ultrasonography or endoscopy, abdominal ultrasonography, bone marrow aspirate, lymph node evaluation, biopsy of

the tumor, and three-view thoracic radiographs or computerized tomography of the chest.

- Ultrasound-guided biopsy may be less invasive than the intraluminal route to confirm a diagnosis of laryngeal neoplasia.⁴⁴
- Radiographs or ultrasound of the cervical region may not be as helpful as computerized tomography or magnetic resonance imaging of that region.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID or prednisolone, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).
- A tracheostomy may be necessary prior to definitive treatment if the cat is in acute respiratory distress.

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation, especially for those with extension into surrounding structures or regional metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Multimodal approach for cats with squamous cell carcinoma of the larynx including medical treatment (thalidomide, piroxicam and bleomycin), radiation therapy (accelerated, hypofractionated protocol) and surgery has been reported.²⁶ Treatment was well tolerated, with 3 cats alive and in complete remission at data analysis closure after 759, 458 and 362 days. Cats treated with surgery to provide immediate ability to breathe followed by chemotherapy and radiation therapy can be quite effective.

FELINE TRACHEAL TUMORS

Clinical presentation

- Uncommon.
- Lymphoma, squamous cell carcinoma most common, followed by oncocytoomas or basal cell carcinomas.



- Coughing, dyspnea, cyanosis, increased respiratory sounds most prominent on inspiration. May be painful.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy via fiber optic tracheoscopy or trans-tracheal aspirates and three-view thoracic radiographs or preferably, computerized tomography of the chest.
- Radiographs or ultrasonography of trachea is good, however computerized tomography, or magnetic resonance imaging of the trachea, and thus the tumor, is preferable.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID or prednisolone if lymphoma, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation, especially for those with extension into surrounding structures or regional metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor. This is most effective for the treatment of lymphoma.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Tumor removal by tracheal resection and anastomosis.
 - Thoracotomy and tracheostomy were performed in three cats. One cat had an extensive infiltrative tumor and was euthanized.⁵² Tracheal resection was performed in the other two in which a 2.5⁵¹ or 3⁵³ cm length of trachea needed to be resected. There was no follow-up beyond surgical recovery in one cat,⁵¹ but the other had no evidence of disease 1 year after surgery.



Figure 56-5: Tracheal tumors are often best imaged during tracheoscopy and/or CT imaging. A key aspect of imaging is to determine how extensive the mass is to ensure it can be cured with tracheal resection and anastomosis. An alternative to surgery is radiation therapy or endoscopic guided stenting or laser therapy.

- Definitive radiation may be helpful if there is evidence of tumor extending beyond the surgical margins or if the tumor is lymphoma (e.g.: 16-19 dosages of radiation).
- Multiagent CHOP chemotherapy may be helpful if the tumor is lymphoma. Carboplatin and/or doxorubicin chemotherapy may be helpful if the tumor is a carcinoma.

FELINE LUNG TUMORS

Clinical presentation

- Carcinomas are relatively common, followed by the rare occurrence of sarcomas and benign tumors such as adenoma^{60,61} and adenomatosis.⁶²
- Most affected cats are older with vague clinical signs such as anorexia, lethargy, weight loss, vomiting, and ataxia.^{60,63,66}
- Metastases to the digits causing swelling, permanent exsheathment of multiple nails, paronychia, or cellulitis with loose claws is the cause of lameness in some cats,^{64,70,72-76} while metastases to muscles may cause lameness in others.^{69,77,78}
 - In a series of 64 cats with digital carcinomas, 56 had metastases from a pulmonary tumor and only 8 had a primary nailbed SCC.⁸⁰
- Only half of the cats have clinical signs related to the respiratory tract.

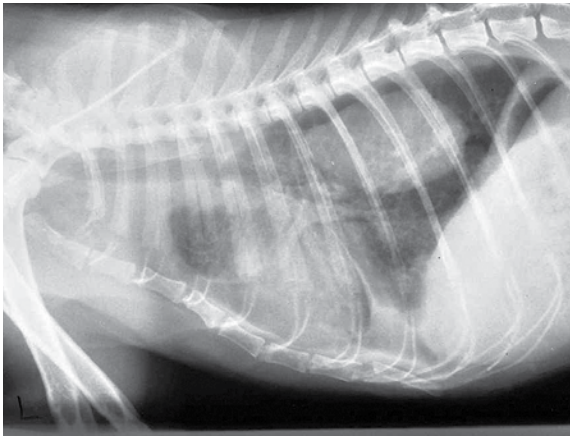


Figure 56-6: Radiograph of a cat with a primary lung tumor with evidence of a small amount of pleural effusion. Removal of the tumor and treatment with intracavitary chemotherapy such as carboplatin or mitoxantrone may be helpful. In general, the presence of pleural effusion is not a positive clinical finding.

- Paraneoplastic syndromes such as hypertrophic osteopathy, neurologic abnormalities and skin lesions are rare.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, and three-view thoracic radiographs or computerized tomography of the chest.
- Preoperative diagnosis may also be obtained by ultrasound-guided fine-needle aspiration, blind aspiration,⁶⁰ fluoroscopic-guided,⁸⁶ and by CT may be the most accurate for small or less peripheral lesions.⁸⁷
- Pleural effusion is seen in up to one-third of cats^{60,66} and may be severe.^{14,60,61,63,66,70} In a series of 82 cats with pleural effusion of all causes, pulmonary carcinoma was confirmed to be the cause in 5 cats.⁸⁵ Cytologic examination of the effusion may be diagnostic for carcinoma and should thus be performed.
- Ultrasonography, radiographs or computerized tomography to assess for intra-abdominal disease or extent of the local tumor may be helpful in some cases.
- Any solitary lung tumor in a cat should be staged as if it were a malignant tumor before proceeding with surgical excision.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who

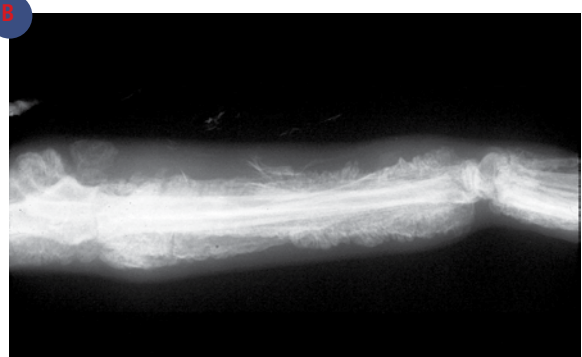


Figure 56-7: The cat in A had a primary lung tumor and thickened painful extremities. The radiograph from this cat (B) confirmed the presence of periosteal new bone growth that is generally perpendicular to the long axis of the bone. This radiograph is highly suggestive of a paraneoplastic syndrome called hypertrophic osteopathy. Treatment of the underlying disorder and analgesics are often helpful.



want to improve quality of life while trying to maximize the chance of controlling the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID or prednisolone if lymphoma, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation, especially for those with extension into surrounding structures or regional metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor. The use of stereotactic surgery enhances the accuracy of this type of therapy.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Lung lobectomy.
 - Primary lung tumors were surgically removed from 21 cats in one study.⁹¹ Eighteen cats died due to metastatic disease between 2 weeks and 51 months after surgery; their median survival was approximately 4 months.
 - The survival time of 20 cats that had their primary lung tumors removed revealed that the presence of clinical signs at the time of diagnosis, pleural effusion, evidence of metastasis at the time of surgery, and moderately and poorly differentiated tumors on histopathology were factors that were significantly correlated with reduced survival times. Of the cats that survived to the time of suture removal, the median survival time was 64 days.⁹²

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Chapter 57

Feline cardiovascular tumors

FELINE CHEMODECTOMA

Clinical presentation

- Rare condition.
- Usually not painful.
- Cats with carotid body tumors may present with as a palpable neck mass.
- Heart base or aortic body tumors sometimes present with pericardial or pleural effusions causing dyspnea.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, bone marrow aspirate, abdominal ultrasound, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or preferably, computerized tomography of the chest.
- Radiographs or ultrasound of the tumor itself may be helpful, however computerized tomography or magnetic resonance imaging is preferable.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID or prednisolone if lymphoma, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide),

diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or ciproheptadine). Thoracocentesis or pericardiocentesis may provide transient improvement in quality of life.

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation (e.g.: 2-5 dosages of radiation) to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Surgery is rarely curative, but it may downsize the tumor and/or improve quality of life.
- Stereotactic radiosurgery is being explored as an option to provide longer-term control of the local tumor.

FELINE CARDIAC LYMPHOMA

Clinical presentation

- The heart is commonly involved by infiltration in cats with multicentric lymphoma; however, such infiltration is rarely of clinical significance.
- Clinical signs may result from pericardial or pleural effusion and include breathing issues, weakness, lethargy, syncope, etc.
- May be uncomfortable.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- Ultrasonography, radiographs, and computerized tomography imaging of the chest, and thus the

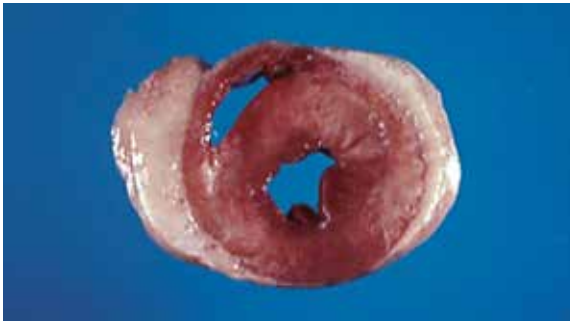


Figure 57-1: Lymphoma involving the epicardium of the heart of a cat that presented with pleural effusion and with an echocardiogram that confirmed a restrictive cardiomyopathy. The best treatment for this type of condition is a modified CHOP protocol with or without thoracic palliative radiation.

tumor, may be helpful. Pericardiocentesis or aspiration of pleural or abdominal effusion may aid in making a diagnosis.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Comfort

- Therapy to provide some benefit for the lymphoma by prescribing prednisolone plus therapy to enhance comfort and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine, cyproheptadine). Therapy including furosemide and enalapril to treat any evidence of heart disease.

Comfort and control (first remission)

Above mentioned therapy for comfort plus:

- CCNU (lomustine) at 60 mg/m² body surface area PO q3 weeks for 5 treatments. Note that treatment delays may be required due to neutropenia and/or thrombocytopenia.
- COP protocol (cyclophosphamide, vincristine and prednisolone) has been shown to be helpful for cats with lymphoma.

- Palliative radiation (e.g.: 2-5 dosages of radiation) to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.

Comfort and longer-term control (first remission)

Above mentioned therapy for comfort plus:

- CHOP chemotherapy to include cyclophosphamide, vincristine, prednisolone, doxorubicin and, in some cases, L-asparaginase.

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Chapter 58

Feline thymoma, mesothelioma, and histiocytosis

FELINE THYMOMA

Clinical presentation

- Relatively uncommon mediastinal epithelial malignancy of the thymus that rarely, if ever, spreads.
- Vomiting, regurgitation, coughing and choking have been described.
- Acute or chronic dyspnea associated with a non-compressible cranial thorax and a caudally displaced heart.
- Paraneoplastic syndromes include myasthenia gravis, a dermatologic disorder and hypertrophic osteopathy.
 - Signs referable to myasthenia gravis including weakness, lethargy, dysphonia, inability to stand and megaesophagus.
 - Dermatologic condition may be seen in cats with a nonpruritic, seborrheic alopecia that involves the ventral neck, abdomen, thorax, medial limbs, and paws, some of which can have a hair coat color change from orange to white.^{23,24}
- Usually not painful.

Key point

Most cats with mediastinal thymomas present with a gradual onset of weight loss, anorexia and, later in the course of the disease, dyspnea.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, and three-view thoracic radiographs or computerized tomography of the chest. A biopsy or aspirate should be done via ultrasonographic, radiographic or CT-guided techniques.

- Ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the tumor can be used to obtain a biopsy or aspirate of the mediastinal mass. On ultrasound, the mass is usually cystic with multiple variably sized cysts or occasionally one very large cyst.³
- Acetylcholinesterase antibody titers (AchRAB) and skin biopsy may be indicated in some cats.
 - A serum AchRAB titer above 0.30 nmol/L is diagnostic for myasthenia gravis,^{27,30} although cats with titers below 10 nmol/L may not show muscular weakness at diagnosis. Early diagnosis will allow appropriate treatment prior to surgery and will improve the chances for an uncomplicated outcome.^{4,10,14}

Key point

Chest radiographs or thoracic CT and either an aspirate or a biopsy of the mediastinal mass is ideal to confirm the suspicion of a thymoma.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Key point

Most cats with a mediastinal thymoma respond very well to surgical removal or radiation therapy.

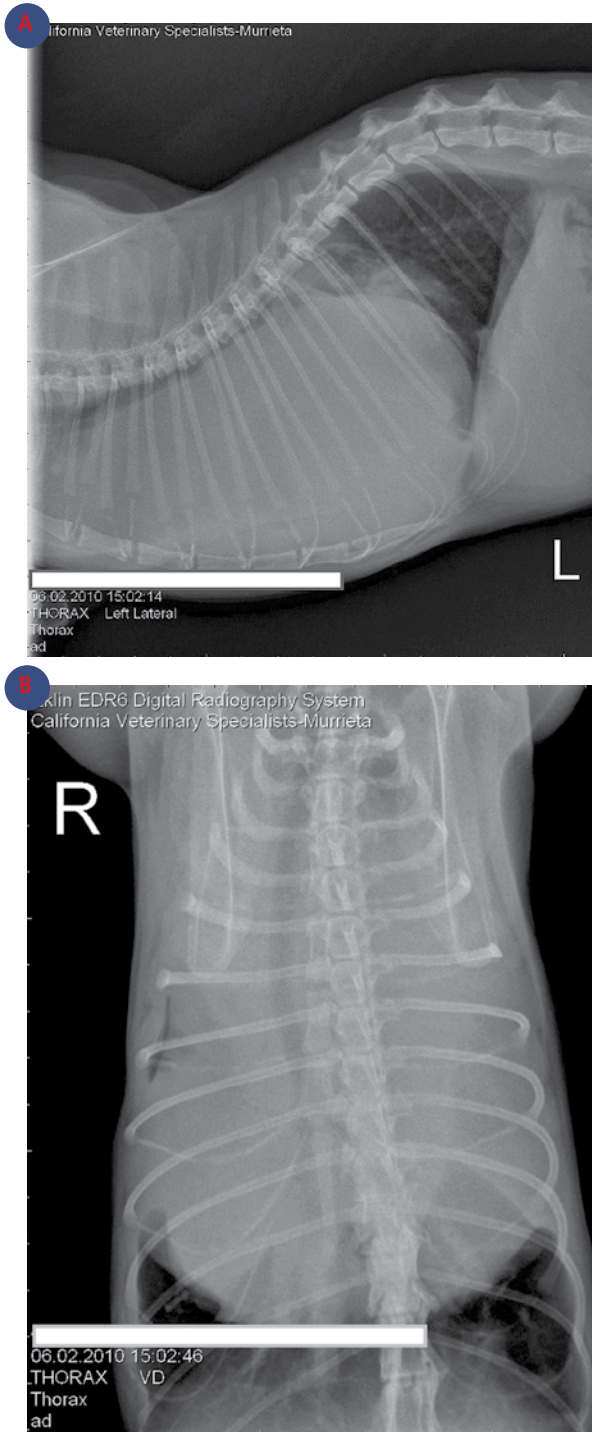


Figure 58-1: Radiographs from a cat with a large, non-compressible mass in the chest that was aspirated and found to contain an admixture of small lymphocytes, mast cells, and a few epithelial cells. The radiographs confirm a large mass within the anterior chest. An ultrasound-guided biopsy was performed to confirm the presence of a thymoma. Resection (see figure 58-3) was successful. Imaging courtesy of Lenore Anderson Mohammadian, DVM, MSpVM, Diplomate ACVR.

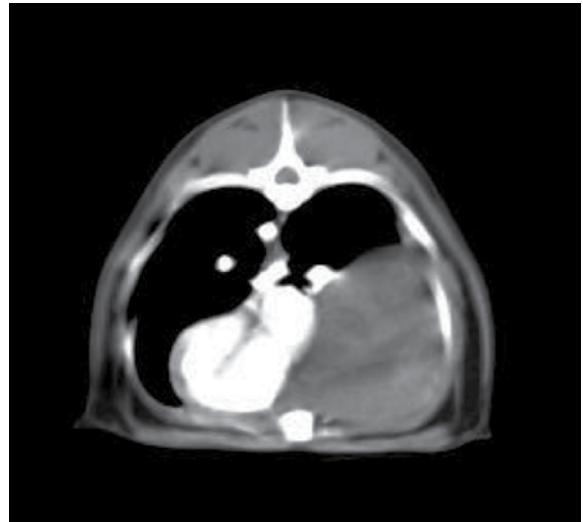


Figure 58-2: Computerized tomography of the chest that contains the thymoma that is deviating the heart. The CT confirms that the tumor is not invading or originating from the lung and that it is localized to the mediastinum. Imaging courtesy of Lenore Anderson Mohammadian, DVM, MSpVM, Diplomate ACVR.

Comfort

- Therapy to enhance comfort (e.g.: NSAID or prednisolone, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine). Prednisolone may reduce the normal lymphocyte population within the malignant epithelial cells.

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation, especially for those with extension into surrounding structures or regional metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.
- Combination chemotherapy (COP or preferably, CHOP) has been successful at resulting in control of some thymomas, especially those with a rich lymphocytic component.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Surgery. Surgical resection often by a median sternotomy approach is usually successful and often curative.¹⁰
- Cats treated with excision of the tumor alone resulted in a median overall survival time of

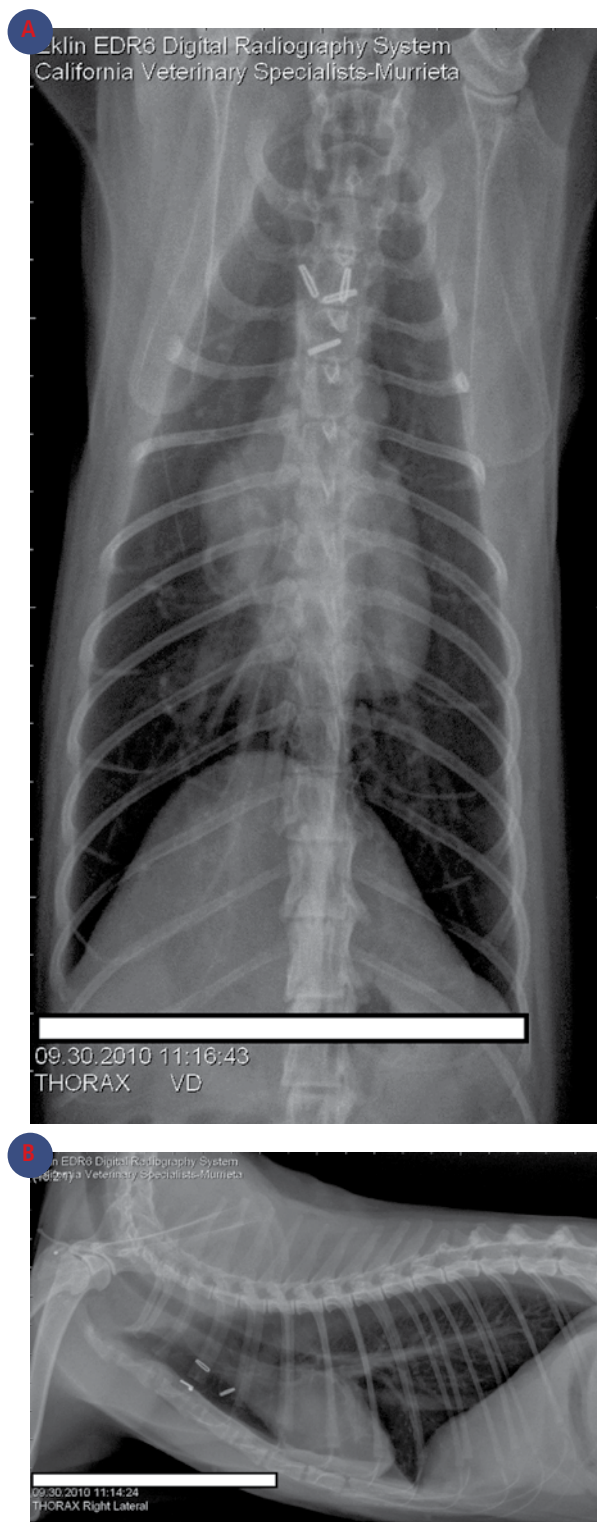


Figure 58-3: Postoperative thoracic radiographs from the same patient with a thymoma imaged in figure 58-1. Feline thymomas are generally resectable, with many being cured with surgery. Another alternative treatment is radiation therapy. Imaging courtesy of Lenore Anderson Mohammadian, DVM, MSpVM, Diplomate ACVR.

1,825 days, with a 1-year survival rate of 89% and a 3-year survival rate of 74%.⁷

- Definitive radiation alone or if there is evidence of tumor extending beyond the surgical margins (e.g.: 16-19 dosages of radiation).
- A retrospective study was performed on seven cats with various stages of thymoma treated with radiation alone or as an adjunctive therapy, with a median survival time of 720 days (range, 485 to 1,825+ days), although complete remissions are rare.⁹

FELINE MESOTHELIOMA

Clinical presentation

- Rare cause of effusion in any of the body cavities in cats.³⁵⁻³⁷
- Emaciation, lethargy, anorexia, dyspnea, discomfort from effusion in the chest or abdomen.
- May be painful.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy of any masses seen or cytology of body cavity effusion, three-view thoracic radiographs or computerized tomography of the chest.
- It is often impossible to distinguish cytologically between reactive and malignant mesothelial cells.
- Ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the region where effusion may be identified may be preferable.

Treatment

This section is divided into two options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine). Serial removal of fluid in the chest or abdomen as needed for comfort is palliative.

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation of the involved cavity may be helpful.
- Intracavitary carboplatin or mitoxantrone may be palliative.



FELINE MALIGNANT HISTIOCYTOSIS

Clinical presentation

- Very rare tumor.
- Nonspecific signs of listlessness, inappetence, and weight loss.
- Organomegaly may be noted on physical examination.
- Begins as localized lesions, which rapidly disseminate to many organs. Primary sites include spleen, lung, skin, brain (meninges), lymph node, bone marrow, and synovial tissues of limbs.⁴⁴
- An indolent localized form originates in the skin of cats.⁴⁴

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, and three-view thoracic radiographs or computerized tomography of the chest. A biopsy or aspirate should be done via ultrasonographic, radiographic or CT-guided techniques.
- Ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the tumor can be used to obtain a biopsy or aspirate of the mediastinal mass. On ultrasound the mass is usually cystic with multiple variably sized cysts or occasionally one very large cyst.³
- Acetylcholinesterase antibody titers (AchRAB) and skin biopsy may be indicated in some cats.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID or prednisolone, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine). Prednisolone may be palliative.

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation, especially for those with extension into surrounding structures or regional

metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.

- Combination chemotherapy (COP or preferably, CHOP) may be palliative in some cases. The true value of chemotherapy has yet to be defined.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Surgery. Surgical resection is rarely curative since most, but not all, cases are multicentric.
- Definitive radiation alone for the rare localized form of the disease or if there is evidence of tumor extending beyond the surgical margins (e.g.: 16-19 dosages of radiation).

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Chapter 59

Feline tumors of skin and surrounding structures

FELINE BENIGN SKIN TUMORS

Clinical presentation

- Hair matrix tumors are rare.
- Papillomas are rare and tend to be viral-induced.
- Benign plasmacytomas are rare and must be distinguished from the malignant variant that present similar to multiple myeloma.
- Lipomas may occur anywhere on body but are uncommon.
- Dilated pore of Winer and trichoepithelioma are characterized by a cystic structure similar to an epidermal inclusion cyst that is derived from the follicular sheath and may present initially as a raised lesion that may “open-up” to leave a crater-like lesion.
- Benign skin tumors are usually not usually painful.



Key point

Basal cell carcinomas are the most common melanocytic-containing tumor of cats.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, and three-view thoracic radiographs or computerized tomography of the chest.
- If the malignant form of plasma cell tumor is suspected, it should be staged as a multiple myeloma, including serum electrophoresis and bone marrow aspirate.
- Ultrasonography and/or radiographs are practical and cost effective.

Treatment

This section is divided into two options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.



Key point

Resection and/or cryotherapy of a benign basal cell tumor is usually curative.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and control

Above mentioned therapy for comfort plus:

- Complete excision.

FELINE BENIGN BASAL CELL TUMORS

Clinical presentation

- The most common skin tumor of cats.
- Accounts for 25-30% of all skin tumors.
- Basal cell tumors are most common melanocytic tumor in cats, and that they are the most common benign skin tumor despite the other terms (e.g., basal cell carcinoma, basosquamous carcinoma, basal cell epithelioma).
 - Must be distinguished from *basal cell carcinoma* and *basosquamous carcinoma*, which are invasive, less common malignant variants,²² some of which were recently reclassified on the basis of their lineage as trichoblastoma.⁹

- Often solitary and small, however some have been 7 cm in size.
- May be painful.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.

Treatment

This section is divided into two options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and control

- Surgery should be curative.

FELINE MALIGNANT BASAL CELL TUMORS

Clinical presentation

- Invasive, nonpigmented, solid tumors usually located on the head and neck that may metastasize to regional lymph node and elsewhere.
- May be painful.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- Ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the tumor may be preferable in some cases.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation, especially for those with extension into surrounding structures or regional metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Surgery.
- Definitive radiation if there is evidence of tumor extending beyond the surgical margins (e.g.: 16-19 dosages of radiation).
- Doxorubicin and carboplatin are the chemotherapeutic agents most likely to delay or prevent metastasis.

FELINE BENIGN GLANDULAR TUMORS

Clinical presentation

- Uncommon.
- Apocrine gland adenomas have a predilection for the head, with nearly 60% of these tumors occurring at this site, with fewer occurring on the back, neck, abdomen, perineum, and hind leg.^{1-3,25}
- Sebaceous gland hyperplasia may be difficult to differentiate from sebaceous adenoma, but both are rare.
- May be painful.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.

Treatment

This section is divided into two options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to be curative of the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting



(e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and control

Above mentioned therapy for comfort plus:

- Surgery should be curative.

FELINE MALIGNANT GLANDULAR TUMORS

Clinical presentation

- Apocrine adenocarcinomas may be ulcerated and are found most commonly on the head, followed by the legs, pinnae, axilla, rump, thigh, thoracic wall and perineum.^{1,3,25}
- May metastasize to regional lymph nodes and elsewhere.
- May be painful.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- Ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the tumor may be preferable in some cases.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation, especially for those with extension into surrounding structures or regional metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Surgery.
- Definitive radiation if there is evidence of tumor extending beyond the surgical margins (e.g.: 16-19 dosages of radiation).

FELINE CUTANEOUS MELANOMA

Clinical presentation

- Moderately common and must be distinguished from pigmented basal cell tumors or lentigo simplex.
- Approximately 80% of cutaneous melanomas in cats are black in color and may be seen as masses that are nodular or papilloma-like in some cats and sessile, pedunculated, or crateriform in others.³¹
- May occur on the head, in particular on the pinna and at the base of the ear, however they have been diagnosed on the trunk, limbs, digits, tail and perineum.^{2,3,28-30,33}
- Cutaneous melanomas of the epithelioid type were malignant in 80% of cases, spindloid tumors were malignant in 29% of cases, and round cell tumors were malignant about half of the time.³⁰
- Most often site of metastasis is the regional lymph node.
- Usually not painful.



Key point

Eighty percent of cutaneous melanomas are pigmented.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- Ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the tumor may be preferable in some cases.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.



Figure 59-1: Basal cell carcinomas can be pigmented, as can cutaneous melanomas. The eyelid tumor depicted here is a melanoma that was diagnosed by cytology. The tumor was treated successfully with cryotherapy. Three rapid freezes were followed each by a slow thaw. Reprinted with permission from: Ogilvie GK, Moore AS. *Feline Oncology: A Comprehensive Guide for Compassionate Care*. Trenton NJ, Veterinary Learning Systems. 2002.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative or coarse fractionated radiation, especially for those that are not amenable to localized therapy or that have with extension into surrounding structures or regional metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.
- Cryotherapy may be of value if the tumor is small.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Surgery.
- Definitive radiation if there is evidence of tumor extending beyond the surgical margins (e.g.: 16-19 dosages of radiation).
- Use of a DNA, xenogeneic melanoma vaccine that was originally developed for the dog has been used to delay or prevent recurrence or spread in the cat.

FELINE CUTANEOUS MAST CELL TUMORS

Clinical presentation

- Moderately common, representing up to 20% of all skin tumors.

- May be single, multiple, or diffuse (miliary), with most also described as hairless, firm, and between 2 and 5 cm in diameter.^{2,38}
- Cats that have multiple tumors do not always develop systemic disease,³⁷ whereas cats with solitary tumors may later develop multiple cutaneous tumors without evidence of systemic disease.
- Approximately half of the tumors appear on the skin of the head and neck.^{2,3}
- Tumors contain vasoactive substances such as histamine and serotonin that may cause some to be pruritic and erythematous,² which may lead to self-trauma and secondary ulceration.^{37,40,42,45,49,52}
- May be painful.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, bone marrow aspirate, biopsy and three-view thoracic radiographs or computerized tomography of the chest.
 - Cytology may confirm the presence of very fine granules within the cytoplasm, however some mast cell tumors do not stain well.
 - Histiocytic MCTs in Siamese cats may regress spontaneously.
 - Histologic biopsies confirm the diagnosis, although grading did not correlate with recurrence or survival.³⁷
- Ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the tumor may be preferable in some cases. Aspirates of liver, spleen and lymph nodes may be indicated.



Key point

Cutaneous mast cell tumors may be single or multiple and occasionally associated with splenomegaly and bone marrow involvement.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID or more likely prednisolone, tramadol, buprenorphine)

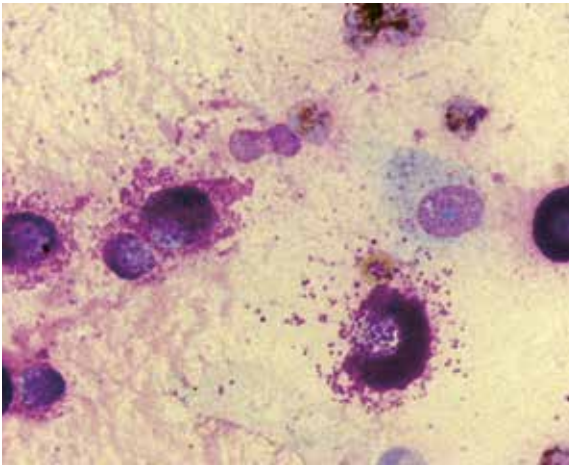


Figure 59-2: Mast cell tumors are composed of cells with granules that are metachromatic in color. Grading from either cytology or histopathology has not been shown to be predictive of outcome.

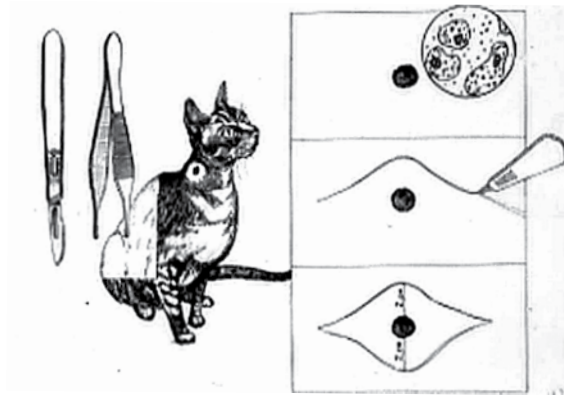


Figure 59-3: Surgery is usually quite effective at resolving feline mast cell tumors. Every attempt should be made to obtain wide and deep margins. Mast cell tumors in cats tend to be more focal than those of the dog. An elliptical incision is made to allow adequate resection. Reprinted with permission from: Ogilvie GK, Moore AS. *Feline Oncology: A Comprehensive Guide for Compassionate Care*. Trenton NJ, Veterinary Learning Systems. 2002.

and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

- Treatment with prednisolone and cimetidine was not successful in reducing the number or size of cutaneous lesions in cats with systemic mast cell disease.⁴³

Comfort and control

Above mentioned therapy for comfort plus:

- Tyrosine kinase inhibitor such as toceranib.
- CCNU may be effective.
- In one study involving 38 cats with mast cell tumors, 7 cats had a complete response and 12 had a partial response, for an overall response rate of 50% and a median response duration of 168 days (range, 25 to 727 days).⁸

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Surgical resection may be curative. Many tumors are only minimally invasive, but it is prudent to obtain wide margins if anatomically possible.
- Thirty cats had cutaneous mast cell tumors excised, 20 with incomplete margins. Only 2 of these 20 tumors recurred and did so within a year of surgery. Sixteen of the cats were followed for more than 3 years, and no cat died due to mast cell disease.³⁹
- Forty two cats with dermal tumors had their dermal mast cell tumors excised, with no tumor recurrence 1 year after surgery in 34 cats.
- If surgery is incomplete, then definitive radiation may be of value for treating some patients with invasive mast cell tumors that may not respond to additional surgery.

FELINE SQUAMOUS CELL CARCINOMA

Clinical presentation

- Approximately 20% of all skin tumors in the USA and Europe, whereas it is the most common skin tumor in cats from Australia and New Zealand, accounting for approximately 50% of all skin tumors.⁶
- Most common in cats that lack skin pigment and in those cats with limited hair coverage.
- White cats are at least five times more likely to develop cutaneous SCC than any other color cat.²²
- In studies involving over 600 cats, the overall incidence of cutaneous SCC varies but the proportion involving the face is between 80% and 90%.^{1,3,6,22}
- Multiple cutaneous SCC of other body sites has been termed *multicentric SCC in situ*, or *Bowen's disease*.
- Cutaneous SCC may often start as epidermal dysplasia following chronic sunlight exposure⁶⁷ that progresses to squamous cell carcinoma in situ and will eventually form an invasive cutaneous tumor.
- Metastases are uncommon until late in the course of the disease. Most common sites include pulmonary and lymph nodes.
- May be painful.



Figure 59-4: Outdoor cats with thin and/or white hair coat are predisposed to developing solar-induced squamous cell carcinoma. These locally invasive tumors often occur on the nose (depicted here), ears and eyelids. Clients should be warned that where there is one squamous cell carcinoma, there are often many others. Diagnosis is made by biopsy. Early resection, treatment with cryotherapy, imiquimod cream or photodynamic therapy with elimination of solar exposure can be helpful.



Key point

This tumor is often seen in white cats and in areas with limited hair coverage.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, bone marrow aspirate biopsy and three-view thoracic radiographs or computerized tomography of the chest.
- Ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the tumor may be preferable in some cases.



Key point

Cutaneous squamous cell carcinomas rarely metastasize.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.



Figure 59-5: Cryotherapy can be used to treat well-defined skin tumors that are smaller than 1.5 cm in diameter. Larger tumors may not freeze uniformly. Liquid nitrogen is added to the cryogun depicted here. Various adapters are added to allow the liquid nitrogen to be applied to the tumor in a spray or via a contact applicator. Three separate quick freezes separated by a slow period of thawing is generally very helpful.



Key point

Surgical excision or cryotherapy may be quite effective if applied appropriately.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine). Precancerous actinic keratosis, or tumors that have not invaded beyond the basement membrane (T_{is}), may respond to retinoic acid derivatives/carotenoids. Etretnate or analogs such as acitretin and Soriatane® have been used at a dose of 10 mg/cat/day and anecdotally appears to result in regression of actinic keratoses and in situ lesions.



Figure 59-6: This eyelid squamous cell carcinoma is being frozen with a contact probe attached to the cryogun. The Chalazion clamp is in place to slow the rate of thaw.

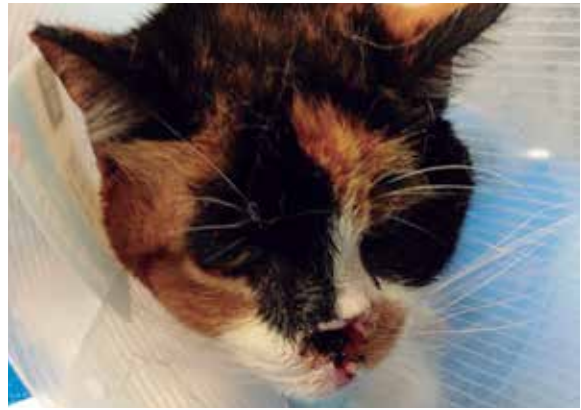


Figure 59-8: This cat had a surgical procedure to remove the nasal planum that was destroyed by a squamous cell carcinoma. Reprinted with permission from: Ogilvie GK, Moore AS. *Feline Oncology: A Comprehensive Guide for Compassionate Care*. Trenton NJ, Veterinary Learning Systems. 2002.



Figure 59-7: Eyelid tumors such as this squamous cell carcinoma can be best frozen by limiting the blood flow to the area. In this case, a Chalazion clamp is applied to the eyelid, slowing the rate of thaw of the liquid nitrogen induced freeze.

Comfort and control

Above mentioned therapy for comfort plus:

- Photodynamic therapy and cryotherapy have both been shown to benefit focal, accessible skin tumors less than 1 cm in diameter.
- Photodynamic therapy requires specific equipment including a laser of a unique wave length and a photosensitizer.
- Liquid nitrogen was used in one study to treat 163 SCC lesions on 102 cats. A cryoprobe was used to monitor the temperature of the tissue, which was frozen to -25°C to -40°C twice with

an intervening thaw cycle.²² Complete resolution was seen in all (50) pinna lesions and all (23) eyelid lesions treated in this manner. Complete resolution was seen in 73 of 90 nasal planum lesions (81%).

- Imiquimod cream 5% has antiviral effects against for genital warts and has been shown to be effective to treat superficial, small squamous cell carcinomas by modulating the immune system locally. A small amount of the cream is rubbed into the region immediately around the tumor daily for up to six weeks.
- Imiquimod 5%, a novel immune response modifier that has been reported as a successful treatment for Bowen's disease in humans, was used to treat cutaneous squamous cell carcinoma in 12 cats. Most cats (75%) developed new lesions that also responded to imiquimod 5% cream in all cats treated. Five cats (41%) had side effects suspected to be associated with the use of imiquimod 5% cream, including local erythema (25%), increased liver enzymes, neutropenia (8%), and partial anorexia and vomiting (8%). Kaplan-Meier median survival time probabilities for cats in this study was 1189 days.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Surgery.
- Surgical excision of the nasal planum (21 cats) or the pinna (18 cats) resulted in complete surgical margins in all but 7 cats. The tumor recurred in 2 of these cats in which surgical margins were incomplete.⁶⁰ The median disease-free interval for all 39 cats was 20 months, which was longer than for cryosurgery (8.5 months) in the same study.



- Radiation
 - Radiation therapy with a strontium-90 handheld source delivers a very high dose of radiation that penetrates only 3 to 5 mm below the skin surface. Strontium-90 was used to treat small (T_{is} and T_1) lesions of the nasal plane in 25 cats.⁷² One year after treatment, 22 cats (89%) were tumor free; the median progression-free survival time was 34 months.
 - Standard orthovoltage or megavoltage radiation therapy has been shown to also be quite effective at the local control of cutaneous squamous cell carcinoma.
 - Ninety cats with SCC of the nasal planum received orthovoltage radiation (40 Gy in 10 fractions). Those cats with T_1 lesions had a mean progression-free survival of 53.2 months, which was significantly better than cats with T_3 or T_4 lesions (18.8 and 15.3 months, respectively).⁶³

FELINE MULTICENTRIC SCC IN SITU (BOWEN'S DISEASE)

Clinical presentation

- Relatively uncommon.
- Sunlight does not seem to be a factor in tumor development.
- Lesions are usually not pruritic, however they are pigmented to ulcerated, small (5 mm to 3 cm in diameter) and can be plaque-like or papillated, partially alopecic, and crusted.
- While the lesions are often multiple and develop over time, they do not commonly metastasize.
- Lesions may occur throughout the body, including the head, neck, thighs, shoulders, ventral abdomen and paws.⁸⁶⁻⁸⁸
- May be painful.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- Ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the tumor may be preferable in some cases.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine). Precancerous actinic keratosis, or tumors that have not invaded beyond the basement membrane (T_{is}) may respond to retinoic acid derivatives/carotenoids. Etretinate or analogs such as acitretin and Soriatane® have been used at a dose of 10 mg/cat/day and anecdotally appear to result in regression of actinic keratoses and in situ lesions.

Comfort and control

Above mentioned therapy for comfort plus:

- Photodynamic therapy and cryotherapy have both been shown to benefit focal, accessible skin tumors less than 1 cm in diameter.
 - Photodynamic therapy requires specific equipment including a laser of a unique wave length and a photosensitizer.
 - Cryotherapy uses liquid nitrogen to do three quick freezes and three slow thaws.
- Imiquimod cream 5% has antiviral effects against genital warts and has been shown to be effective to treat superficial, small squamous cell carcinomas by modulating the immune system locally.¹⁹ A small amount of the cream is rubbed into the region immediately around the tumor daily for up to six weeks.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Surgery.
- Radiation
 - Radiation therapy with a strontium-90 handheld source delivers a very high dose of radiation that penetrates only 3 to 5 mm below the skin surface.
 - Standard orthovoltage or megavoltage radiation therapy has been shown to also be quite effective at the local control of cutaneous squamous cell carcinoma.

FELINE CUTANEOUS HEMANGIOMA

Clinical presentation

- In cats, these tumors commonly occur on the skin.
- Bleeding from the tumor and bruising around the lesion are the most common clinical finding.
- Identification of metastases is not common but may be found in the lung, lymph nodes, liver and spleen.
- Cats with poorly pigmented skin may be predisposed. Possibly actinically induced.
- Usually not painful.



Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- Ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the tumor may be preferable in some cases.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation, especially for those with extension into surrounding structures or regional metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Surgery. In one survey, median survival was 40 weeks, with 5 cats alive 18 to 112 weeks after surgery.⁹²
- Radiation may also be effective for controlling local disease.
- Chemotherapy is as of yet unproven, however it is believed that doxorubicin is likely the drug of choice.

FELINE CUTANEOUS HEMANGIOSARCOMA

Clinical presentation

- Affects older cats; may be more common in males.
- Possibly actinically induced. Cats with poorly pigmented skin may be predisposed.

- Sarcomas are often ulcerated or cause subcutaneous bleeding.

Staging and diagnosis

- MDB and abdominal ultrasonography; evaluate regional lymph nodes. Lungs are the most common site for metastasis, but widespread metastasis is often seen.

Treatment

Initial

- Surgical excision needs to be wide.

Adjunctive

- Incomplete excision may require radiation therapy (no published efficacy).
- Metastatic rate is high, so chemotherapy warranted; doxorubicin, ifosfamide, and carboplatin are potentially active drugs.

Supportive

- Analgesia as needed; anti-inflammatories may be palliative.

FELINE CUTANEOUS LYMPHANGIOSARCOMA/ LYMPHANGIOMA

Clinical presentation

- Rare tumor of the skin and subcutis.
- Metastases to the lung, muscles and regional lymph nodes is possible.
- May be painful.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- Ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the tumor may be preferable in some cases.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.



Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation, especially for those with extension into surrounding structures or regional metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Surgery.
- Definitive radiation if there is evidence of tumor extending beyond the surgical margins (e.g.: 16-19 dosages of radiation).

FELINE CUTANEOUS LYMPHOMA

Clinical presentation

- Moderately common.
- Lymphoma affecting the skin of cats can be epidermotropic (known as mycosis fungoides), while the other is not restricted to this site and may infiltrate more deeply.
- Presents as singular or multiple painful, 1 mm-3 cm diameter cutaneous plaques that are often erythematous and may be seen with generalized scaliness, or crusting due to epidermal exfoliation.^{101,103-106, 109,110,113}
- While many cats are FeLV and FIV-negative, FeLV antigens have been found in the tumor via immunohistochemistry.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FeLV serology, T4 testing, biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- Biopsy is required for definitive diagnosis of cutaneous lymphoma. Histopathologic findings of epidermotrophism and accumulation of atypical pleomorphic lymphocytes in Pautrier's microabscesses is pathognomonic for the variant of cutaneous lymphoma known as mycosis fungoides.^{105,106,109-112}
 - Mycosis fungoides is assumed to be a T-cell variant of cutaneous lymphoma.

- Some cutaneous lymphomas have been shown to be of B-cell derivation.¹¹³

- Ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the tumor may be preferable in some cases.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.

Comfort

- Therapy to enhance comfort (e.g.: NSAID or prednisolone, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine). Neither oral nor topical prednisolone appears to be successful in inducing remission,^{101,106,112} although some reduction in pruritus may occur. Retinoids such as Accutane, isotretinoin or acitretin may be helpful in some cats.¹¹⁰

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative external beam radiation, especially for those with localized lesions or extension into surrounding structures or regional metastases (e.g.: 2-5 dosages of radiation), with the goal to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.¹⁰⁵ Multiple lesions treated with strontium-90 plesiotherapy has been reported to cause complete regression.¹¹⁴

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Surgery or definitive radiation for localized lesions, however it is reasonable to suspect that additional lesions will occur. Enhancing control with chemotherapy is logical.
- Chemotherapy. CCNU as a single agent, COP or a CHOP protocol with or without CCNU may improve quality of life for cats with cutaneous lymphoma.^{115,116}
 - Chemotherapy with vincristine, cyclophosphamide, and prednisolone has caused a dramatic short-term improvement in lesions.^{105,107}



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Chapter 60

Feline soft tissue sarcomas

Clinical presentation

- Moderately common, with injection site sarcomas more likely to appear in the subcutis, while non-injection site tumors occur more frequently in the dermis.⁴³
- Highly locally invasive with a relatively low probability of metastases.⁷
- Firm dermal mass anywhere on body, however they appear to occur more common at injection sites including vaccinations.^{44,47} Injection site sarcomas have also arisen at the site of antibiotic administration, SC fluid administration,^{44,49-51} long-acting corticosteroid injection,⁴⁸ or lufenuron injection (Program® 6 month injectable).⁵²
 - The distribution of tumors appears to be moving away from the intrascapular region due to recent adoption of vaccination guidelines to vaccinate in the extremities or tail.⁷
- Ulceration may occur in large tumors.
- Incidence peaks at 3 and 8 years of age.⁷
 - Injection site sarcomas usually occur in younger cats; increased risk with increased number of vaccinations at one site.⁷
- The virus FeSV may cause multiple tumors in young FeLV-positive cats.⁷
- Approximately 75% of injection sarcomas have been found to contain *p53* and *c-kit* oncogene,⁶¹ whereas approximately one-third of tumors contained both *p53* and *mdm-2*, suggesting these factors and others result in an increased risk of developing the disease.⁷
- Fibrosarcoma is the most common soft tissue sarcoma, followed by osteosarcoma, malignant fibrous histiocytoma (histiocytic sarcoma), giant cell tumor, myofibroblastic sarcoma, rhabdomyosarcoma, leiomyosarcoma, chondrosarcoma, undifferentiated sarcoma, neurofibrosarcoma/nerve sheath tumor, and liposarcoma.
- Tumors are dermal in origin and may vary in size



Figure 60-1: Soft tissue sarcomas can occur anywhere on the body. Injection site sarcomas tend to occur in the site of previous injections, including the intrascapular region. They have a relatively low risk of metastases but are highly invasive into surrounding tissues. Surgery, if done, must be extraordinarily wide and deep. Follow up radiation therapy is often recommended to delay or prevent local recurrence.

from 0.3 to 15 cm in diameter⁷ and are typically not well demarcated or ulcerated.

- Metastasis appears to be uncommon (<28%), regardless of the subtype of soft tissue sarcoma, but may be identified in lungs, skin, spleen, kidney, and lymph node.
- May be painful.



Key point

Injection-site sarcomas occur in sites of prior injection, usually within the subcutis, whereas non-injection site sarcomas often occur in the dermis.

Staging and diagnosis

- Minimum data base (MDB): includes a CBC, biochemical profile, urinalysis, FIV/FelV serology, T4 testing, pre-operative biopsy, three-view thoracic radiographs or computerized tomography of the chest.
- Histologic grade was associated with distant metastasis, with cats having grade 3 tumors being significantly more likely to develop metastasis than cats with grade 1 and 2 tumors.⁷⁵
- Ultrasonography and/or radiographs are practical and cost effective, however computerized tomography or magnetic resonance imaging of the tumor has dramatically enhance the ability to determine the extent of the disease and the presence of metastases.



Key point

Distant metastatic disease occurs in less than 30% of cats with soft tissue sarcomas, however the primary tumor is essentially always highly locally invasive.

Treatment

This section is divided into three options:

- Comfort for those who want to improve quality of life.
- Comfort and control for those who want to improve quality of life while trying to provide some control of the tumor.
- Comfort and longer-term control for those who want to improve quality of life while trying to maximize the chance of controlling the tumor.



Key point

Extensive surgery, radiation therapy, immunotherapy and chemotherapy are often required to provide long-term control of this disease.

Comfort

- Therapy to enhance comfort (e.g.: NSAID, tramadol, buprenorphine) and freedom from nausea, vomiting (e.g.: maropitant and/or metoclopramide), diarrhea (e.g.: metronidazole) and lack of appetite (e.g.: mirtazapine or cyproheptadine).

Comfort and control

Above mentioned therapy for comfort plus:

- Palliative radiation, especially for those with extension into surrounding structures or regional metastases (e.g.: 2-5 dosages of radiation), to first enhance comfort, second, to reduce the rate of growth and third, occasionally to reduce the size of the tumor.



Figure 60-2: An artist's depiction of a cat with a soft tissue sarcoma. The anatomic cross section depicts the local invasion that extends out from the palpable site like tendrils. Surgery is only effective if the palpable site is removed along with the tendrils. Reprinted with permission from: Ogilvie GK, Moore AS. *Feline Oncology: A Comprehensive Guide for Compassionate Care*. Trenton NJ, Veterinary Learning Systems. 2002.

Comfort and longer-term control

Above mentioned therapy for comfort plus:

- Extraordinarily wide and deep surgical excision.
 - In a study of 84 cats surgically treated for soft tissue sarcoma, 60 cats (70%) had tumor recurrence an average of 3.5 months later.⁷
 - A similar recurrence rate of over 80% was seen in another study in which the median tumor-free period following surgical excision was 4 months.³¹
 - Tumors that involve the limb often recur after an attempted local excision, but the likelihood of long-term control following amputation is high.^{4,16,19,27,28,30}
- Radical excision of injection site sarcomas resulted in an overall median survival time of 901 days. Median survival time of cats with and without metastasis was 388 and 1,528 days, respectively. The metastasis rate similar to rates reported previously; the local recurrence rate



appeared to be substantially less than rates reported after less aggressive surgeries, with or without adjuvant treatment.¹¹

- Definitive radiation if there is evidence of tumor extending beyond the surgical margins (e.g.: 16-19 dosages of radiation), or stereotactic body radiation therapy in 2-3 dosages.
- Cats treated with brachytherapy using iridium-192 (¹⁹²Ir) implants after surgery resulted in recurrence rate in one study was 70%, with a median survival of 8 months,²⁴ whereas in the other group of cats, 50% of tumors recurred and the median disease-free interval was 12.5 months.³¹
- In a study of 31 cats treated with orthovoltage radiation to a dose of 51 to 60 Gy following incomplete surgical excision, median tumor-free interval was 18 months and median survival was 22 months.³⁸
- High-dose radiation therapy (57 Gy) was used to treat 25 cats with soft tissue sarcomas and resulted in a median survival time for all cats of 700 days.³⁹
- A study was done evaluate outcomes of stereotactic body radiation therapy (SBRT) in 11 cats with injection-site sarcomas (ISS). Eight of 11 cats either had a partial or complete response, with a median progression-free interval and overall survival time of 242 days and 301 days, respectively.¹⁷
- Seventy-three cats with vaccine-associated sarcoma given postsurgical curative (n = 46, most with clean margins) or coarse fractionated radiotherapy (n = 27, most with either macroscopic disease or dirty margins). The former animals displayed a median survival of 43 months and a median progression free interval (PFI) of 37 months and the latter reached a median survival of 24 months and a median PFI of 10 months.²⁰
- Chemotherapy may delay or prevent recurrence or metastases.
- Twenty-one cats with primary or recurrent soft tissue sarcomas received 3 cycles of neoadjuvant epirubicin (25 mg/m²) chemotherapy followed by a surgical resection of tumor and surrounding musculature.²⁹ This was followed by a further 3 cycles of adjuvant epirubicin chemotherapy. The cases were then evaluated, with a median follow-up time of 1072 days. Three cats had recurrences 264, 664 and 1573 after surgery. A median survival time could not be calculated as over 80% of the study population remained alive or were censored due to death from other causes.
- Sixty-nine cats were treated for injection-site sarcomas and were divided into two subgroups: those subjected to four doxorubicin cycles combined with radical surgical excision 10 days after the second chemotherapy cycle (group A, 49 cats), or those treated with surgery alone (group B, 20 cats). In group A, 28 cats were alive at the end of the follow-up period. In this group, the



Figure 60-3: This cat had her soft tissue sarcoma resected with wide and deep margins followed by radiation, which caused skin and hair color changes. The cat remained tumor free for three years.

recurrence rate was 40.8%, while lung metastasis occurred in 12% of cats. In group B, eight animals were alive at the end of the follow-up period, while the rates of recurrence and metastasis were 35% and 10%. These data suggest that doxorubicin was not effective in this group.³²

- Twenty-eight cats with injection-site sarcomas were treated with various dosages of CCNU, with a median progression-free survival and median duration of response of 60.5 and 82.5 days, respectively.³⁵
- A study was done to determine whether the addition of doxorubicin chemotherapy affected the outcome of cats with incompletely excised, nonvisceral soft tissue sarcomas undergoing postoperative radiotherapy. Median disease-free interval with concurrent radiotherapy and doxorubicin chemotherapy (15.4 months) was significantly longer than the median disease-free interval with radiotherapy alone (5.7 months).³⁶
- Immunotherapy may contribute to longer survival in cats treated with local therapies for fibrosarcoma.
- Tenogenic cells (Vero hIL-2) that secrete human recombinant interleukin-2 (hrIL-2) were infiltrated around feline soft tissue sarcomas at the time of surgical resection and implantation of ¹⁹²Ir seeds for brachyradiotherapy.²⁴ This infiltration was repeated 5 days later and another five times over the next 2 months. Of 16 cats treated by this protocol, two had local recurrence and three had metastases, with an overall median survival of 16 months. In comparison, 11 of 16 cats that did not receive Vero hIL-2 cells had tumor recurrence and a median survival of 8 months.
- A canarypox feline IL-2 therapy has been developed and is marketed for the treatment of soft tissue sarcomas in cats that are concurrently being treated with either surgery or radiation therapy. Results are promising.



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