Regional mastectomy

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**Regional Mastectomy;** **((Breast Cancer, Radical Mastectomy, Mastectomy, Mammectomy, Mammary Adenocarcinoma))**

**-** Mastectomy is the surgical removal of mammary glands in a dog that is conducted when abnormal growths or mammary masses are found. Mammary masses are common in dogs, accounting for almost half of all cancerous tumors in female dogs. Mammary masses tend to be malignant and invasive and require intervention or they are likely to become life-threatening.

When a mammary mass or masses are locally or regionally located around one or between two mammary glands, a local or regional mastectomy may be performed to remove only the mammary gland or glands associated with that mass. This procedure is less invasive than a unilateral or bilateral mastectomy which involves the removal of all mammary glands on one or both sides, however, it may not always be as effective at preventing future disease, as remaining mammary glands are susceptible to abnormal growths. When required for the removal of mammary masses, local or regional mastectomy is performed by a veterinary surgeon under general anesthesia. The mass and associated tissue is removed to ensure that all abnormal cells are removed and prevent the spread of malignant cells.

**Regional Mastectomy Procedure in Dogs**

A plan to address mammary cell masses prior to surgery will be determined by your veterinarian. Usually the least invasive method is used, which, in the case of masses located in only one or two mammary glands, is local or regional mastectomy. However, this needs to be weighed against the likelihood of cancerous spread to remaining mammary tissues. Also, if additional mammary growths are located during the surgery, the surgical plan may need to be revised to involve a unilateral or bilateral mastectomy.

Your veterinarian will advise you to fast your dog from food the night before surgery to prevent complications with general anesthesia administration. Pain killer will be administered along with general anesthetic prior to mastectomy. Once anaesthetized, your dog's mammary region will be clipped and cleaned to prevent contamination. Surgical drapes are also used to maintain a sterile surgical site. An elliptical incision is made around the mammary gland, including healthy tissue, which will also be removed to ensure adequate tissue margins around the mammary mass.

The veterinarian removes the skin, mammary tissue and underlying fat of the affected mammary gland or glands, however the rectus fascia or muscle should be left intact. This procedure is therefore not appropriate if masses are fixed to underlying muscle tissue.

The mass, mammary tissues, and healthy tissue margins are excised with a scalpel. Blood vessels are cauterized or tied off to control bleeding. Tissue removed is preserved and sent for evaluation by a veterinary pathologist.

The surgical wound is closed using absorbable sutures to close internal gaps and the mammary skin incision is closed with sutures or staples. Drains may be placed to allow accumulated fluid in surgically created spaces to drain during healing if required. Drains are secured and held in place with bandaging and pads.

Your dog will be monitored during recovery from anesthesia and assisted as required. Lesions on each mammary gland were identified properly and characterized according to size, adherences, necrosis, and ulceration. Clinical staging (three-view thoracic radiographs and abdominal ultrasound) was performed for each patient. When multiple nodules were present, the largest lesion was considered for staging.

Regional mastectomy was indicated for removal of axillary or inguinal mammary lymphatic connections when a single lesion was larger than 3 cm. Cranial abdominal mammary gland was occasionally removed when performing regional mastectomy to achieve clean surgical margins or when lesions of 1–3 cm also were located in this gland. Radical mastectomy was performed when lesions > 3 cm were located on cranial abdominal gland. Regional and radical mastectomies also were performed despite size of lesions when disperse nodules were present along the mammary tissue, in order to create one single surgical wound. An elliptical incision was made around the mammary glands to be excised and subcutaneous tissue was dissected until exposure of muscle fascia. Major blood vessels were ligated, with a 2-0 or 3-0 poliglecaprone suture, including superficial epigastric vessels, whenever inguinal mammary gland was removed. Poliglecaprone also was used to advance the skin toward the center of the defect with a walking suture (2-0 or 0) and a subcuticular continous suture (3-0). Simple interrupted sutures were used to appose skin with a 3-0 monofilament nailon. Surgical duration was defined as the moment from surgical incision to conclusion of skin suture. Surgical wound was measured after conclusion of procedure, in centimeters.

Antibiotic treatment was performed with sodium cephalothinFootnote1 (30 mg/kg intravenously [IV]) 30 min before and after surgery and every 8 h during hospitalization. After discharge, patients were treated with cephalexinFootnote2 (30 mg/kg orally [VO]) every 12 h until 10 day after surgery.

All dogs were premedicated with acepromazine maleateFootnote3 (0.05 mg/kg intramuscularly [IM]) and morphine sulphateFootnote4 (0.3 mg/kg, IM). Anesthetic induction was performed with propofolFootnote5 (5 mg/kg, IV). After orotracheal intubation, anesthesia was maintained with isofluraneFootnote6 in an inhalant anesthesia machine with vaporizer and a semiclosed circuit for dogs larger than 7 kg, and with a Rees-Baraka system for dogs smaller than 7 kg.

Immediately after surgery, each animal was medicated with morphine sulphate (0.2 mg/kg, IV) and meloxicamFootnote7 (0.2 mg/kg, IV). In the first 24 h, animals were kept in the Veterinary Hospital, with compression bandages. Analgesia was performed with tramadol chlorhydrateFootnote8 (3 mg/kg, IV) 6 h after surgery and every 8 h thereafter. After discharge, patients were medicated with meloxicamFootnote9 (0.1 mg/kg, VO) every 24 h for 4 days and tramadol chlorhydrate (3 mg/kg, VO) every 8 h for 5 days.

**Evaluation of surgical stress**

Patients were evaluated in 10 different times, including preoperative, transoperative, immediate, and late postoperative periods. The first time was at the initial examination when the tumor was diagnosed (T1). This happened approximately 10 day before surgery in a consulting room, in the presence of the owner. During the preoperative period, patients were evaluated at three time points, as follows: T2, immediately before premedication; T3, 15 min after premedication; T4, five min after induction and orotracheal intubation. During the transoperative period (T5), patients were evaluated every 5th min, and their physiologic parameters were kept stable. During the immediate postoperative period (first 24 h), while they were still using compression bandages, patients were evaluated at three time which were: T6, 2 h after surgery; T7, 12 h after surgery; T8, 24 h after surgery. During the late postoperative period, animals were evaluated at two time points, according to scheduled appointments: T9, 48 h after surgery, when compression bandages were removed and surgical wound was evaluated; and T10, 10 day after surgery, when stiches were removed.

Blood samples were drawn through jugular venipuncture at T2, T4, T6, and T8 to measure objective serum markers, invariably in the afternoon. Serum cortisol level was assessed through chemiluminescence after blood storage in sterile tubes with clot activator, for as long as 24 h. A reference range of 1.0–6.0 mcg/dL was used [9]. Glycemia was assessed, immediately after collection of whole blood, in a portable Trackease Smart System (Trackease stripes)Footnote10. A reference range of 70–110 mg/dL was used [9]. Samples from T2 (before administration of any drugs) and T8 (24 h after surgery) also were stored under refrigeration in sterile tubes with EDTA (ethylenediamine tetraacetic acid) for as long as 4 h for hematological assessment. Complete blood counts (CBC) were performed with Abacus Veterinary Hematology AnalyzerFootnote11. Differential leukocyte count and morphologic evaluation of cells were performed in blood smears stained with panopticFootnote12 under optic microscopy. Reference values in accordance with Jain [10] were used.

Physiological parameters evaluated included heart rate, respiratory rate, body temperature, and arterial pressure. The first three parameters were assessed in all 10 evaluation points. Reference ranges of 60–160 beats per minute, 18–36 breaths per minute, and 37.5–39.2 °C, respectively were used [11]. Non-invasive arterial pressure was assessed through oscillometric method with a Veterinary Digital Blood Pressure Device12 and a cuff with a width of 40 % limb circumference, positioned on the middle third of the right radius. Arterial pressure was evaluated on T1–T10 with patient on dorsal recumbency during surgical procedure or in left lateral recumbency on other evaluation times. Values for each patient, in each assessment time, were the result of an arithmetic average of three measurements. For systolic arterial pressure (SAP), diastolic arterial pressure (DAP) and mean arterial pressure (MAP) reference ranges of 80–120 mmHg, 60–80 mmHg and 65–96 mmHg, respectively were used [11]. When animals were in hospital cages during evaluation periods (T2, T6–T10), they were taken into a quiet room away from other animals for 5–10 min, so that they could adapt before measurements. During T5, hemoglobin oxygen saturation was also measured with a digital pulse oximeter.11

**Efficacy of Regional Mastectomy in Dogs**

Recurrence of mammary tumors in remaining mammary glands is common and subsequent surgeries may be required if only regional mastectomy is performed. For cancerous tumors, subsequent chemotherapy or radiation therapy may be used, however the effectiveness of these treatments has not been established in dogs for mammary tumors. Sarcomas are associated with shorter survival time then carcinomas. Prognosis for benign tumors is good, although recurrence can occur in other mammary glands. Prognosis of cancerous masses is more guarded, especially if the tumor has begun to spread.

**Regional Mastectomy Recovery in Dogs**

Following local/regional mastectomy your dog should have activity restricted until suture removal at 10 to 14 days. Pain killer may be prescribed and should be administered as directed. An Elizabethan collar and bandaging may be required to prevent your dog from biting, licking or scratching the surgical wound. Cage confinement may be necessary, accompanied by careful supervision. Your veterinarian will provide you with information on bandage care and removal. The wound should be monitored for signs of infection, bleeding, or rupture and immediate veterinary care obtained if these occur. If a drain is left in place it will have to be observed and maintained to keep it clean and unblocked and ensure it remains in place until your veterinarian removes it.

Following recovery, you will need to have regular veterinary follow-ups to look for signs of recurrence or spread of mammary masses. Radiographs may be performed as part of this follow-upp.

**Surgical treatment of mammary neoplasia**

* **Local excision/excisional biopsy/nodulectomy**:
  + 'Lumpectomy', basically 'shelling out' tumor from gland with a narrow or non-existent margin of normal tissue.
  + Suitable for small, firm, moveable pea size nodules (less than 0.5 cm).
* **Local mastectomy**:
  + *En bloc* removal of a single mammary gland.
* **Regional mastectomy**:
  + Removal of two or more mammary glands with their associated lymph nodes.
  + Originally based on a concept of vascular and lymphatic drainage that is potentially too simplistic given the known variation in lymphatic anatomy.
  + Glands 1, 2, 3 +/-4 drain to axillary and cranial sternal nodes.
  + Glands 3, 4, 5 +/-2 drain to the superficial inguinal nodes.
  + Unpredictable crossover of lymphatic branches between glands and also between right and left sides complicate this picture.
* **Unilateral radical mastectomy**:
  + Unilateral  'mammary strip'.
  + Removal of all mammary glands on one side plus all associated lymph nodes.
* **Bilateral radical mastectomy**:
  + Bilateral 'mammary strip'.
  + Removal of all mammary tissue plus associated lymph nodes.
  + May be performed as staged or simultaneous procedures.

**Indications**

* Other than inflammatory carcinoma, surgical resection for mammary tumors [Mammary gland: neoplasia](https://www.vetlexicon.com/canis/oncology/articles/mammary-gland-neoplasia/). Inflammatory carcinoma is highly aggressive and rapidly metastatic, carrying an extremely poor prognosis. Surgery is unlikely to significantly influence outcome, but risks additional morbidity related to poor wound healing.
* Although distant metastases are considered a contraindication to surgery, there may be cases where simple resection of a discrete ulcerated mass is warranted for palliation and quality of life reasons.
* Local mastectomy is recommended for tumors that are centrally located within the gland and which are fixed to either underlying tissues or overlying skin. Approximately 2 cm lateral margins are recommended, with deep dissection to include abdominal muscle fascia and/or muscle if involved.
* As mammary gland parenchyma tends to merge between glands 1, 2, and 3 and then again between glands 4 and 5, it will sometimes be easier to do regional mastectomy rather than try to divide parenchyma.
* Regional mastectomy is recommended where tumors are eccentrically located, palpable in more than one gland or between glands. As with local mastectomy, 2 cm lateral margins are recommended.
* Unilateral radical mastectomy is recommended if tumor is palpable in multiple glands along one chain; bilateral radical mastectomy can be performed where both sides are involved. Bilateral surgery can be done as a one-stage procedure, but many surgeons favor staging with a 4-6 week wait between procedures in order to reduce wound morbidity.
* In dogs, there does not seem to be a clear survival advantage to radical mastectomy over regional mastectomy unless tumor growth involves the full length of the mammary chain.
* For this reason, the approach favored by most surgeons is to use the simplest technique that allows removal of all neoplastic tissue, but not to routinely perform radical mastectomy for all mammary tumors.

**Alternative techniques**

**Chemotherapy**

* Pre-operative, or neo-adjuvant chemotherapy has not been evaluated for canine mammary tumors.
* Post-operative adjuvant chemotherapy is most commonly used for locally recurrent disease, tumors with high biological aggression or where metastatic disease is suspected.
* There are currently no standard regimes in veterinary medicine for chemotherapy in canine mammary tumor, and the evidence regarding efficacy is mixed.
* Conventional chemotherapy drugs reported include doxorubicin [Doxorubicin](https://www.vetlexicon.com/canis/oncology/articles/doxorubicin/), mitoxantrone, paclitaxel and gemcitabine but there are also reports investigating potential roles for anti-COX2 drugs, anti-angiogenics and desmopressin [Desmopressin](https://www.vetlexicon.com/canis/pharmacology-and-therapeutics/articles/desmopressin/).

**Radiation therapy**

* Not widely used for mammary tumors; may have a role in control of pain from bone metastases together with bisphosphonates [Radiotherapy](https://www.vetlexicon.com/canis/oncology/articles/radiotherapy/).

**Immunotherapy**

* The available evidence does not support a role for immunotherapy [Cancer therapy: overview](https://www.vetlexicon.com/treat/canis/freeform/cancer-therapy), although reports are limited to older forms of immunotherapy such as levamisole [Levamisole](https://www.vetlexicon.com/canis/pharmacology-and-therapeutics/articles/levamisole/) and BCG vaccine.

**Hormonal therapy**

* Use of hormonal therapy is controversial in canine mammary tumors.

**Decision taking**

**Diagnostic work up (pre-operative staging)**

* Consider the potential for other disease or debility as many patients are older - hematology and serum biochemistry will not show changes specific to a mammary tumor *per se* but are warranted to identify co-morbidities and paraneoplastic syndromes.
* Palpation to evaluate size, mobility and whether tumors are fixed, remembering that multiple tumors are common. Each gland with a palpable abnormality should be recorded, using the standard numbering system (glands numbered 1-5 moving cranial to caudal, but 4 or 6 are potential variations occasionally seen).
* Axillary and inguinal nodes assessed by palpation (enlargement or fixation) or needle aspiration (cytology).
* Mammary tumors should be aspirated if there is any potential for an inflammatory carcinoma.
* Thoracic and abdominal imaging should be performed for metastatic disease.
* Biopsy: histopathological diagnoses are usually made on specimens collected at surgery rather than pre-operatively (with the exception of needle aspiration [Fine-needle aspirate](https://www.vetlexicon.com/canis/oncology/articles/fine-needle-aspirate/) to rule out inflammatory carcinoma).

**Clinical staging**

* World Health Organization staging protocol is typically used (T-tumor, N-node, M-distant metastases) but is unproven with respect to prognosis [Neoplasia: TNM staging](https://www.vetlexicon.com/canis/oncology/articles/neoplasia-tnm-staging/).

**Risk factors**

* Age: the median age of occurrence ranges from 8-10 years; malignant tumors are very unusual in dogs less than 5 years of age.
* Purebred dogs tend to be over-represented but no consistent breed predispositions have been reported, eg Boxers are reported a a low risk breed by some studies but high risk by others.
* Bitches neutered before 2.5 years of age have a reduced risk of mammary tumors; the protective effect is lost after this age and seems to be greatest with neutering before the first season.
* Obesity [Obesity](https://www.vetlexicon.com/canis/nutrition/articles/obesity/), particularly in early life, was associated with mammary tumors in one study in dogs.
* Mammary tumors also occur in male dogs but are much less common and therefore information regarding potential risk factors and epidemiology is lacking.

Mammary Tumors in cats

Mammary (or breast) tumors are common in female dogs, but rare in male dogs and cats. Surgical removal is recommended for most mammary tumors. Chemotherapy may be required following surgery in some cases. The prognosis is good following surgical resection for most mammary tumors in female dogs, but the prognosis is worse for certain types of tumors in dogs and all mammary tumors in cats.

Of dogs, poodles, dachshunds, and spaniels are most affected. In cats, Siamese or other Oriental breeds and domestic short hairs are most often affected. In dogs, obesity at a young age is a risk factor.

Mammary tumors are more common in female dogs that are either not spayed or were spayed after 2 years of age. The risk of a dog developing a mammary tumor is 0.5% if spayed before their first heat (approximately 6 months of age), 8% after their first heat, and 26% after their second heat. Cats spayed before 6 months of age have a 7-times reduced risk of developing mammary cancer and spaying at any age reduces the risk of mammary tumors by 40% to 60% in cats.

More than a quarter of unspayed female dogs will develop a mammary tumor during their lifetime. The risk is much lower for spayed female dogs, male dogs, and cats of either gender. In female dogs, 50% of mammary tumors are benign and 50% are malignant. However, few of the malignant mammary tumors are fatal. In contrast, over 85% of mammary tumors in cats are malignant and most of these have an aggressive biologic behavior (i.e., mammary tumors in cats tend to be locally invasive and spread elsewhere in the body).

Signs & Symptoms

A palpable mass underneath the skin of the abdomen or near a nipple is the most common findings in dogs and cats with mammary tumors . However, other signs and symptoms include discharge from a mammary gland, ulceration of the skin over a gland, painful, swollen breasts (Figure 2), loss of appetite, weight loss, and generalized weakness.

**Diagnostics**

A good general physical exam is needed to find the location, size, and character of all the mammary masses and assess local lymph node enlargement. Other procedures are performed to stage the cancer (determine what type it is and where it is located in the body):

Bloodwork: blood count, chemistry, urinalysis, and clotting profile

Abdominal ultrasound, chest x-rays and sometimes CT scan: used to check for cancer that has spread to other parts of the body

Aspiration (aka Fine Needle Aspirate): a needle is used to sample the mammary mass to help distinguish it from other skin tumors. Lymph nodes may also be assessed to look for a spread of cancer cells. This is more reliable in dogs than cats to confirm a diagnosis.

A biopsy may be indicated to rule out a certain kind of tumor called inflammatory mammary carcinoma, as surgery is generally not recommended for this tumor type

Treatment

Further consultation with your primary care veterinarian may result in a referral to an ACVS board-certified veterinary surgeon to fully explore your options.

The type of surgery depends on the size, location, and number of mammary tumors and species of your pet. In general, surgery is more conservative for dogs with mammary tumors and involves removal of either the mass alone or the affected mammary gland. However, in cats, more aggressive surgery is recommended with removal of one or preferably both sets of mammary glands (Figure 3). Surgery to remove both sets of mammary glands from a cat is often done in two surgical procedures 2–3 weeks apart.

The local lymph node should also be removed in cats, if possible, to assess for evidence of spread of the cancer.

The role of spaying female dogs with mammary tumors is controversial. Most studies have shown no beneficial effect of spaying at the time of tumor removal in preventing the development of new mammary tumors, or influencing the aggressiveness or metastatic potential of existing mammary tumors. However spaying at the time of mammary tumor resection may be recommended by your veterinary surgeon because recent studies have shown a beneficial effect in dogs with mammary tumors, and it can prevent unrelated diseases, such as pyometra (uterine infection).

The role of chemotherapy in cats and dogs with malignant mammary tumors has not been clearly defined for all tumor types but oncologist consultation after surgery is often recommended. For most mammary tumors in cats and dogs, hormonal therapy, immunotherapy, and radiation therapy have either not been investigated or are not beneficial.

Surgery is not recommended for dogs with inflammatory mammary carcinoma because it does not improve survival rate. Unfortunately, an effective treatment has not been discovered. Radiation therapy in combination with a non-steroidal anti-inflammatory drug has been shown to provide the most effective pain relief in dogs, but the prognosis remains poor.

**Aftercare and Outcome**

Most pets are discharged 1–5 days after surgery, depending on their extent of surgery and their comfort. They are usually returned for re-check and removal of skin sutures or staples (if present). Pain can be well-controlled with owner-administered medications. Pain patches may be adhered to the skin. Antibiotics may be sent home with some patients.

**Restrictions following surgery usually are:**

Elizabethan collar for 10–14 days after surgery to prevent the natural tendency of pets to lick and chew at a wound.

Limited and restricted activity is indicated for about 2 weeks to allow recovery and incision healing.

Bandage care may also be required if one is applied.

Kitty litter made from newspaper may be recommended rather than clay litter.

Postoperative complications can include:

**Incision infection**

Incision opening or breakdown (called dehiscence), which is more common in the mammary glands near the back legs or when larger areas of tissue have been removed

Local recurrence of the tumor or spread of the cancer that was not detected at the time of surgery

If the mammary tumor is malignant, the surgical site and regional lymph nodes should be checked for local tumor recurrence and metastasis, respectively, every 3 months for the first 12 months after surgery and then every 6 months thereafter. Abdominal ultrasound and chest radiographs are also recommended every 3–6 months to assess for evidence of metastatic disease.

In dogs, there are a number of factors that influence the prognosis following surgery. These prognostic factors include tumor size, clinical stage (how far the cancer has spread in the body), tumor type and grade, and various other pathologic changes seen in the tumor tissue. Benign tumors are cured by surgery, although the development of new mammary tumors (both benign and malignant) is possible. There is a poorer prognosis with malignant mammary tumors and it also depends on what type of cancer. In dogs, the size of malignant mammary tumors is an important consideration when determining prognosis, both for local tumor recurrence and survival time. The smaller the mass is at the time of surgery (3–5cm or smaller) the less likely it will recur, or metastasize (spread) elsewhere. Dogs can live several years after complete removal of some malignant mammary tumors. So once a mass is found, having surgery to remove it earlier is better.

The prognosis for cats with mammary tumors is guarded as mammary tumors tend to be more aggressive and metastatic in cats. Many of the prognostic factors used in dogs also apply to cats, although the extent of surgery is also important in cats. When the tumor is smaller (less than 3cm) when it is removed, cats can live a couple of years; if it is larger than 3cm the prognosis for survival time after surgery is 4–12 months. Therefore, early surgical treatment is important. In cats, the amount of surrounding tissue removed with the mass can also affect how long they live after surgery. In some cases, survival time after surgery have been tripled in patients treated aggressively with surgery -those with large resections or tumor removal with wide margins lived 3 years and those treated with only tumor removal in the same tumor type lived 1 year.

Mammary tumors can be largely prevented by spaying before 6 months of age or before your pet’s first heat cycle. Other factors that may reduce the incidence of mammary tumors include feeding a well-balanced diet, avoiding obesity and avoiding the administration of hormones (particularly progesterone or mixed estrogen-progesterone drugs).