SURGICAL ONCOLOGY – WHAT DO I DO?

DR CHRISTIAAN TRIEGAARDT

FINAL YEAR SMALL ANIMAL SURGERY RESIDENT AT JSVC



- Guiding principles of surgical oncology to help you manage tumors effectively from a surgical perspective
- Recipe to follow

KEY PRINCIPL ES

- 1 Different tumors act differently
- 2 How you treat, matters!!!
- 3 Strong understanding of cancer behavior and an understanding of cancer biology are critical to effective planning and management.

- NEVER make a diagnosis based on visual appearance
- Tumors do NOT read books
- Need a systematic approach
 - A RECIPE

3 QUESTIONS

- 1. What is it?
- 2. Where is it?
- 3. How bad is it?





DIAGNOSIS

BIOPSY!!!!

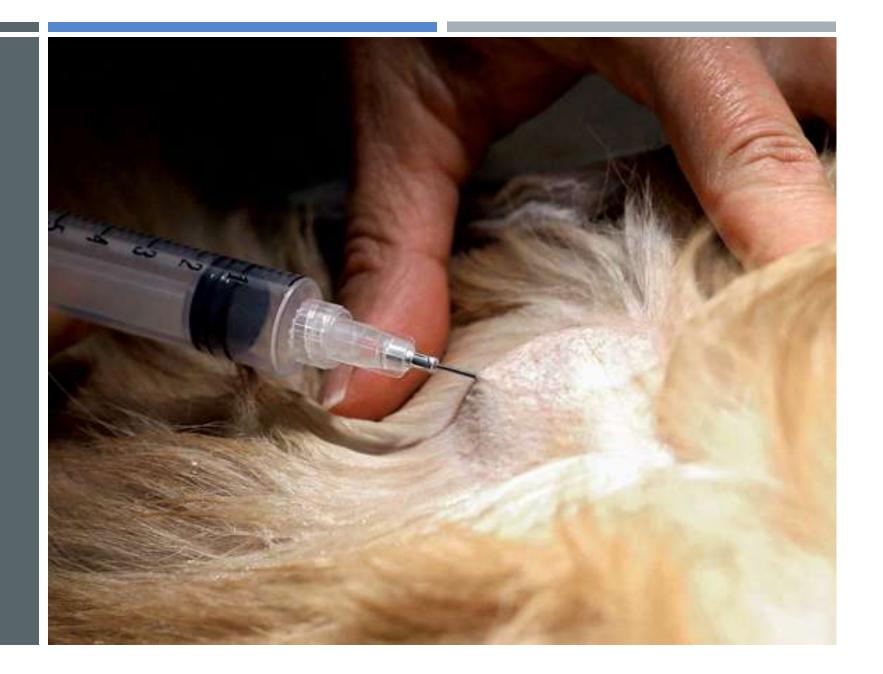
Most NB in Oncology!!!!!

WHAT BIOPSY?

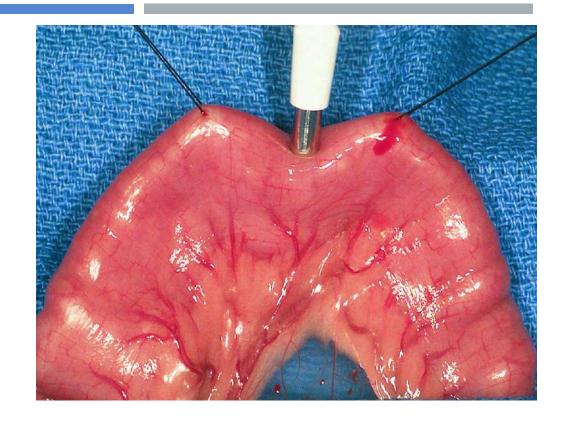
- Fine needle aspirate
- Incisional
 - Punch
 - Tru-cut
 - Wedge
 - Endoscopic pinch
- Excisional

FINE NEED LE ASPIRATE

- Easy
- quick
- Cheap
- Often sufficient info to guide
- Not invasive

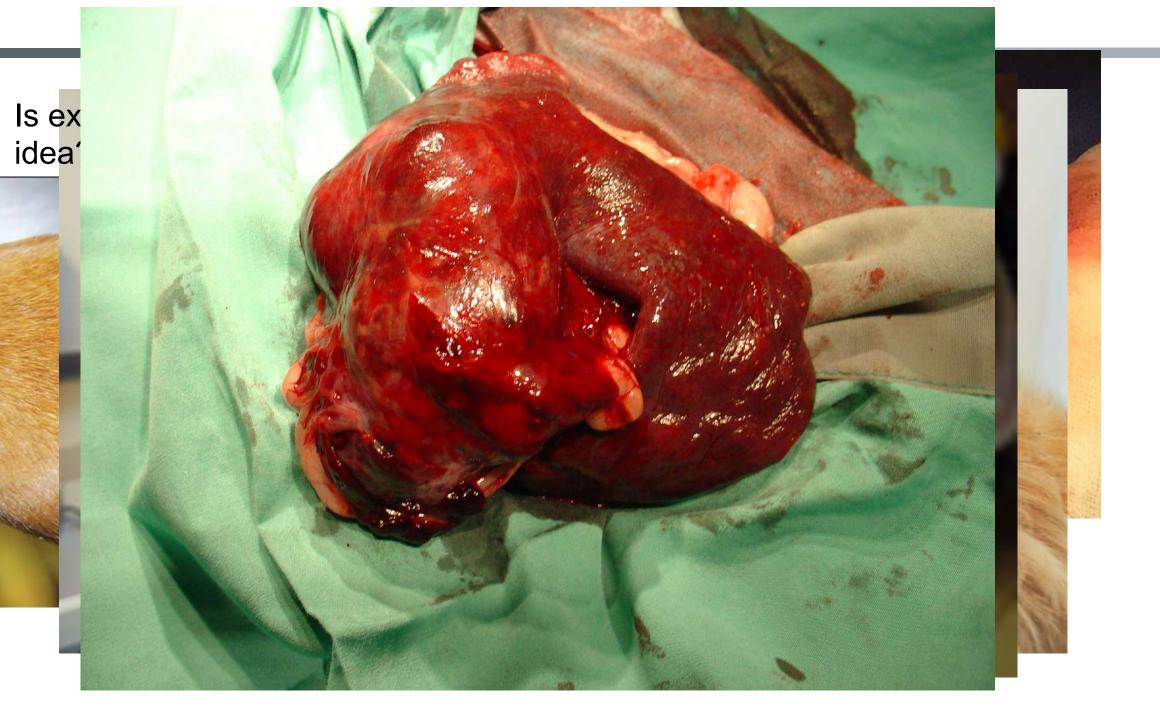


- Punch
 - Superficial lesions deeper than dermis will struggle
- Endoscopic
 - GIT, Nose, UT
- Wedge
 - Best out of all incisional



Excisional

Only in certain cases (curative intent surgery may not be compromised with this)



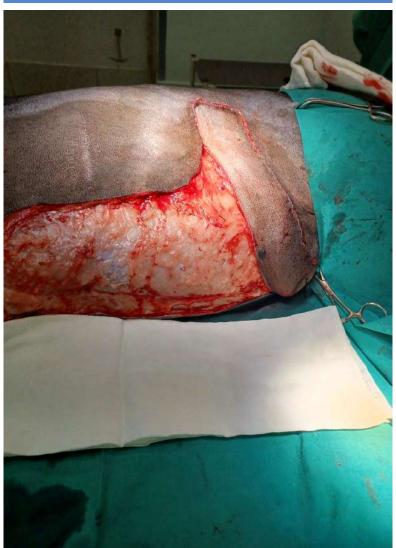
DON'T BE THAT GUY

- Very dangerous logic "Remove as much as I can and see"
 - If you don't know remove as little as possible and NOT disrupt surrounding tissue
 - Surrounding tissue has tumor cells excision will disrupt architecture/planes
 - Resection will now be bigger as scar is now dirty 3cm margins around it !!!! And deeper (might be body wall)
 - Might now need radiation to "Mop up"

NEVER BE SURPRISED BY YOUR RESULTS - EXPECT IT









CLIENT EDUCATION

- Do NOT be guided by Client You guide them
- Many clients want the growth removed don't want to look at it and be reminded that their pet might have cancer
 - This can end in tears
- Rather educate client on the correct steps involved and the seriousness
 - Most clients love the extra knowledge and will pursue more diagnostics



STAGING

- Local
- Regional
- Distant

"TNM"

" Depends on tumor type"

BENIGN

Rarely needs anything more

MALIGNANT

- Carcinomas Lymphnodes
- Sarcomas Lungs

REGIONAL

Tumor types eg – MCT, Melanoma, SCC tend to spread via lymphatics

LYMPHNODES

- Palpation normal NOT mean no mets (up to 50%)
- Aspirates negative NOT mean no mets (RLN not SLN in up to 60% of cases)
 - Ultrasound guided

SENTINAL LN MAPPING

- Radiographic / CT lymphography
- Lymphoscintigraphy
- Dyes Meth blue
- ICG

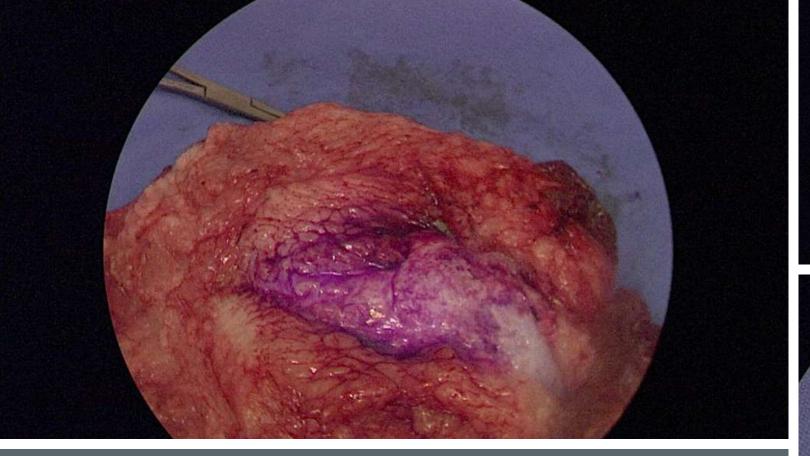
US Features of Metastatic Lymph Nodes

Features that assess lymph node for metastasis.

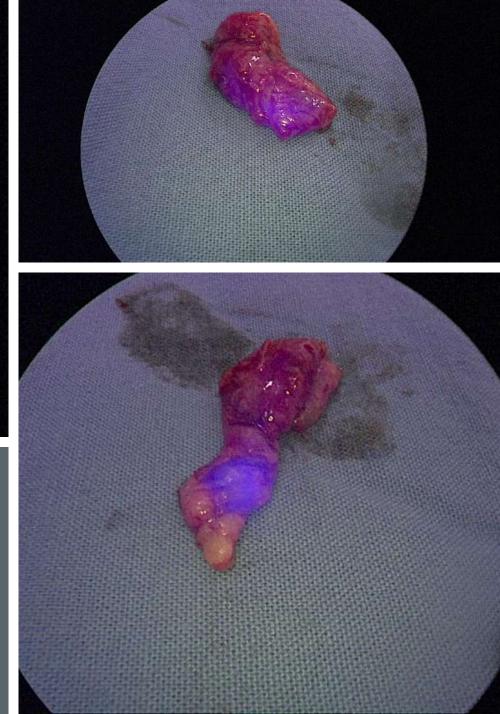
- •1 Size
- •2 Shape
- •3 Border
- •4 Echogenicity
- •5 Hilus sign
- •6 Intranodal necrosis
- 7 Calcifications
- 8 Vascularity

- Hypoechoic to surrounding structures
- Rounded
- Big

ULTRASOUND FEATURES OF METASTATIC LNN







LYMPHOGRAPHY IN HOUSE

- 1st
 - Omnipaque in 4 quadrants peritumorally under sedation. 3-4ml in total/patient
- 2nd
 - Regional radiographs @ immediate, 1 min, 3min, 5 min, 10 min
- 3rd
 - Intraoperative identification of the SLN with methylene blue injected in 4 quadrants peritumorally.
 - 0.5ml/quadrant
 - The methylene blue can get messy (mark before)

78% diagnostic

• Indirect lymphography for sentinel lymph node detection in dogs with mast cell tumors









LYMPHOGRAPHY WITH CONTRAST + METHYLENE BLUE



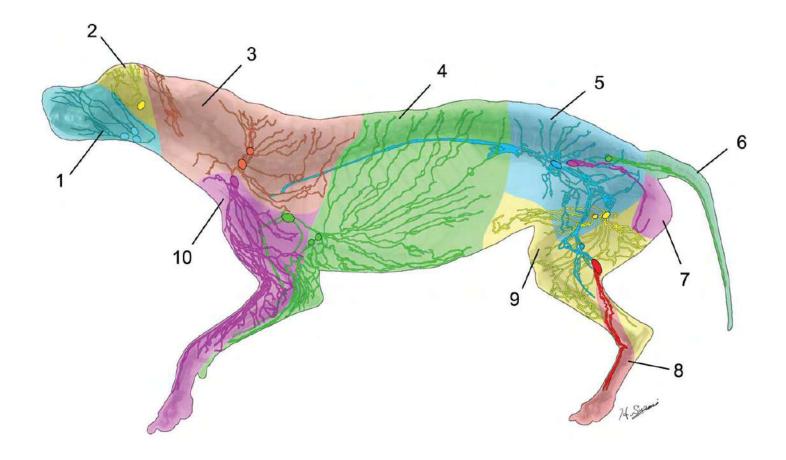






LYMPHOSOMES IN A CANINE

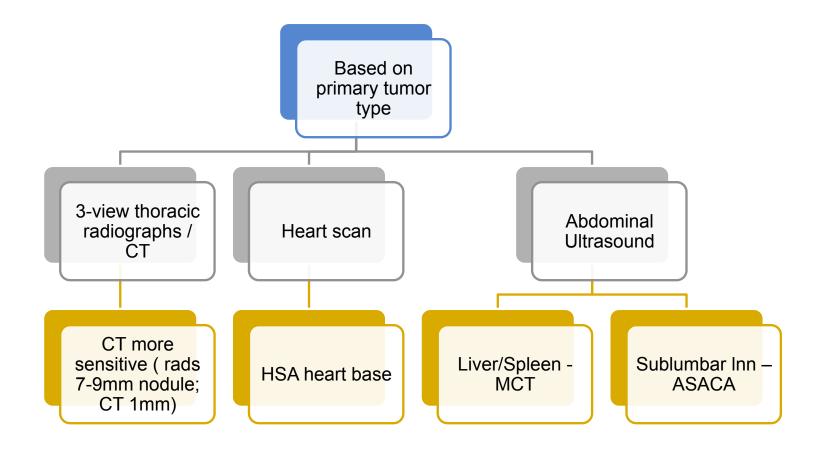
Color-coded diagram of the lymphatic territories
 (lymphosomes) with lymphatic vessels shown distally from their corresponding lymph nodes: 1, submandibular; 2, parotid; 3, dorsal superficial cervical; 4, axillary; 5, medial iliac; 6, lateral sacral; 7, hypogastric; 8, popliteal; 9, superficial inguinal; 10, ventral superficial cervical.



1, submandibular; 2, parotid; 3, dorsal superficial cervical; 4, axillary; 5, medial iliac; 6, lateral sacral; 7, hypogastric; 8, popliteal; 9, superficial inguinal; 10, ventral superficial cervical.



DISTANT



CLIENT EDUCATION – AGAIN??

- Everything up to now Rules out MACROSCOPIC DISEASE/METASTASIS
- Still have HIGH risk of microscopic disease

CHEMOTHERAPY

Extends life span

NOT

cure



GRADING

1, 11, 111

High vs Low

Aggressiveness??

"Pathologist's job"



TREATMENT PLAN

GOALS

- CURATIVE INTENT
- PALLIATIVE
- EUTHANAZIA QOL??

SURGICAL PRINCIPL ES

Surgical dose

Primary aim – REMOVE ALL CANCER and NOT closure

NEVER compromise excision because of worry of closure – Refer

Wound rarely fatal, cancer is

Best chance is 1st chance

Margins??

Stay away from the tumor - contaminate

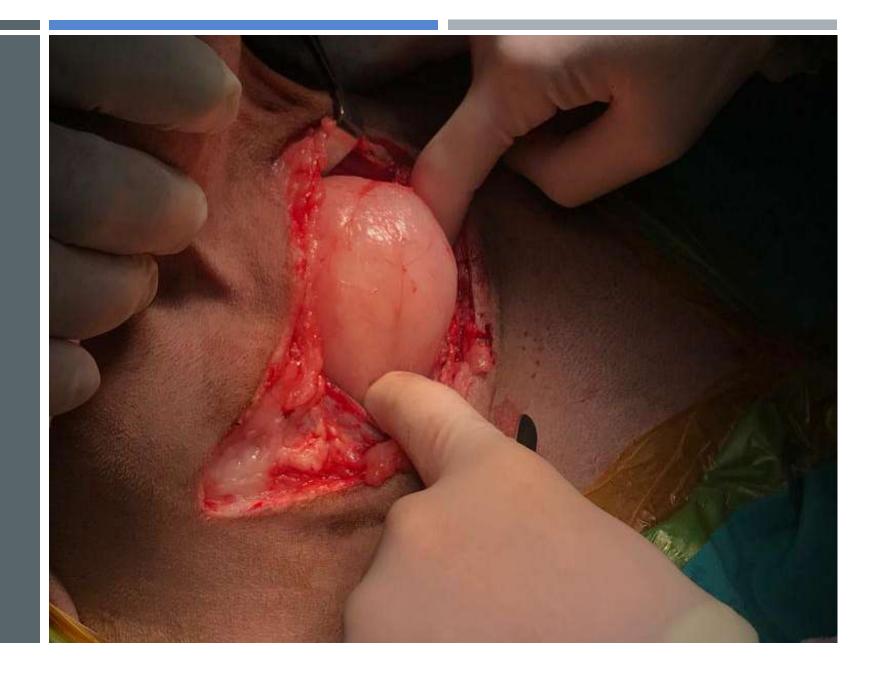
Skin Wide Satellite Tumor Marginal Intralesional (debulking) Primary Tumor Reactive Zone Muscle Belly Fascial Plane Subcutaneous Tissue

SURGICAL DOSE

- 1. INTRACAPSULAR/INTRALESIONAL
- 2. MARGINAL
- 3. WIDE
- 4. RADICAL

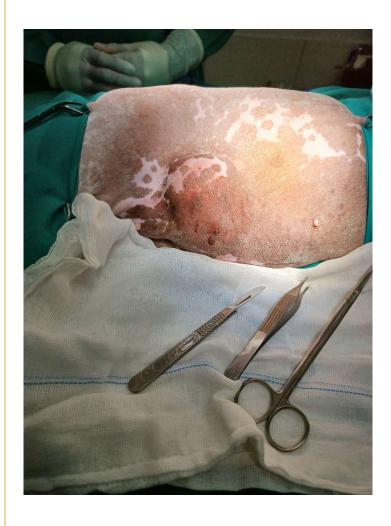
INTRACAPSUL AR

- Enter the tumor and likely to leave gross disease with an associated high risk of regrowth
 - Shelling out a lipoma
 - Cytoreduction



MARGINAL

- Gross disease is excised at its margins with no or minimal normal tissue surrounding the mass
 - location where a wide resection is not possible
 - brain tumor, large anal sac adenocarcinoma
 - benign or low-grade lesions
 - Distal limb with adjuvant radiation





WIDE

- Curative intent surgery
- Gross disease is excised with a barrier of normal tissue.
- Superficial masses: 2–3 cm of tissue laterally and a fascial plane of dense collagenous tissue deep to the mass.
- Tumor capsule NOT invaded





RADICAL

- Curative intent
- Entire compartment containing the mass
 - Amputation due to OSA
 - Thoracic wall resection



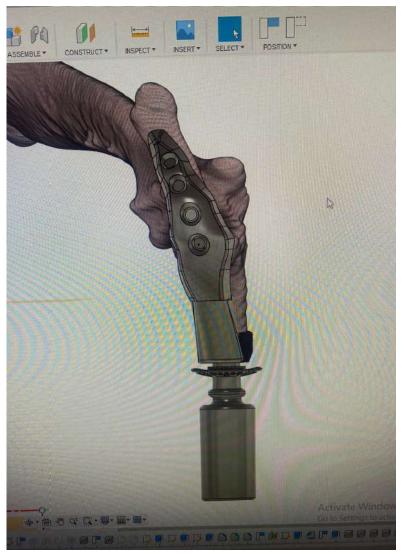
















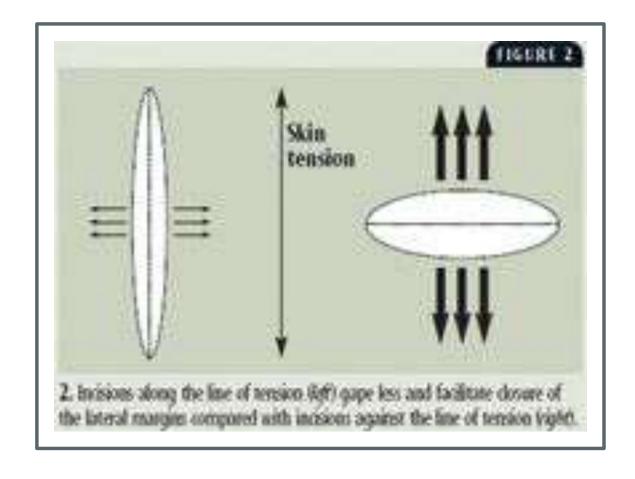
THINGS TO THINK ABOUT

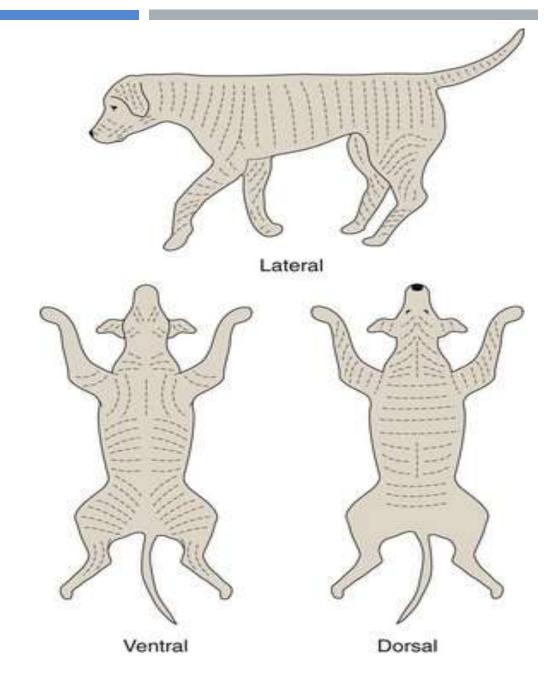
- Cells in the periphery most aggressive cells in the tumor
 - If left behind, the tumor will regrow and will contain a more aggressive population of cells.
- How will the defect be reconstructed?
 - Shaved and prepped for a skin flap?
- Do NOT "cone down"
 - Deep tissue just as NB otherwise the large skin defect is in vain
- Sterile marker
 - Draw margins in circle not oval

- Tumor cells move path of least resistance
 - Laterally easier will stop at facial plane, muscle
- Changing of gloves/clean instruments
 - When tumor margins were penetrated
 - When elevating a skin flap
- Drains
 - Stay away from Penrose drains tunneling, seeding
 - Rather use closed suction drains
 - Exit very close to wound margin



TENSION LINES

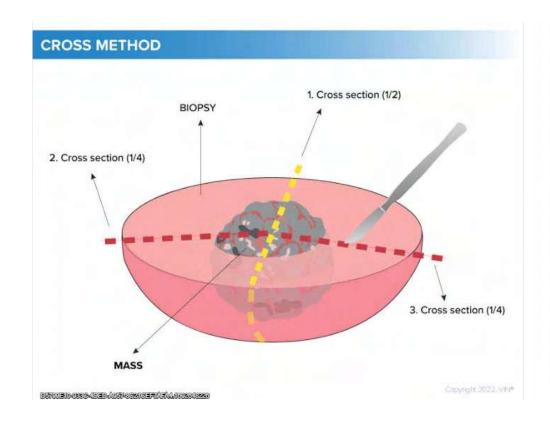




SAMPLE HANDLING

- Mark the margins
 - Sutures OR tissue ink (yellow, black preferred)
 - Ink the margin that you are concerned about and write clearly in the submission form
 - Section the tumor partial thickness fixation better
 - 10:1 formalin ratio

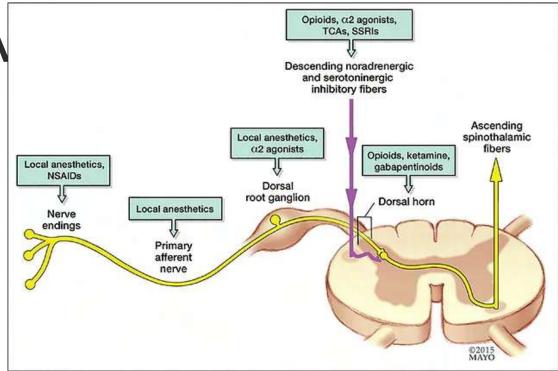
STANDARD VETERINARY MARGIN EVALUATION

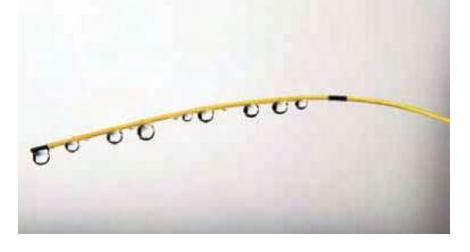


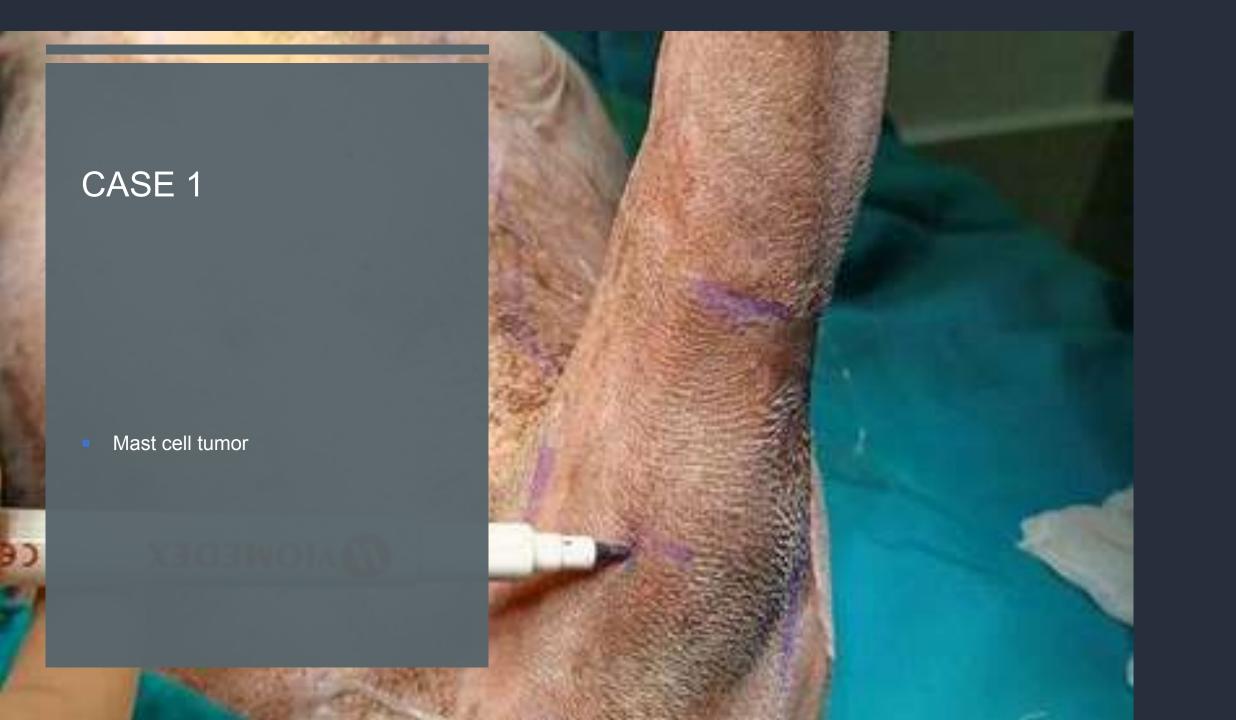
- What percentage of the tumor is the pathologist typically looking at to decide on the margin?
- One study estimated examine between 0.01% and 0.1% of the total margin (Meuten 2021).
- What is the difference between surgical margin and histologic margin?
- *surgical margin:* gross margins on the patient as planned by the surgeon. Widths might be based on the palpable tumor or on the results of CT scan or other imaging.
- histologic margin: width from tumor cells to the edge of the removed tissue, as measured by the pathologist under the microscope.

POST OP PATIENT CA

- PAIN!!!!
 - Nsaids
 - Panado
 - Opiods
 - MK infusion
 - Gabapentin
 - Phantom limb
 - Local blocks NB!!!!!
 - Soaker catheters
 - Local infusion of Bupivicaine every 6 hrs
 - Works very well









SURGICAL DOSE?

Wide









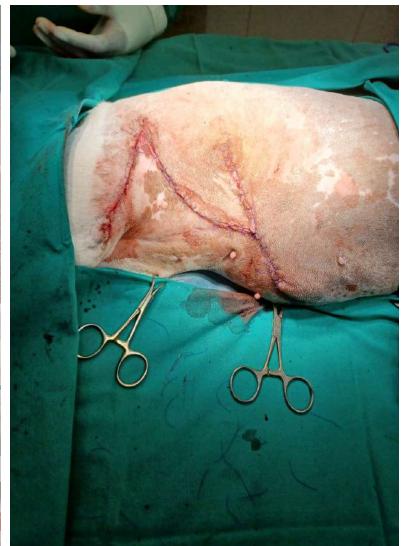
CASE 2

STS LOW GRADE









MCT

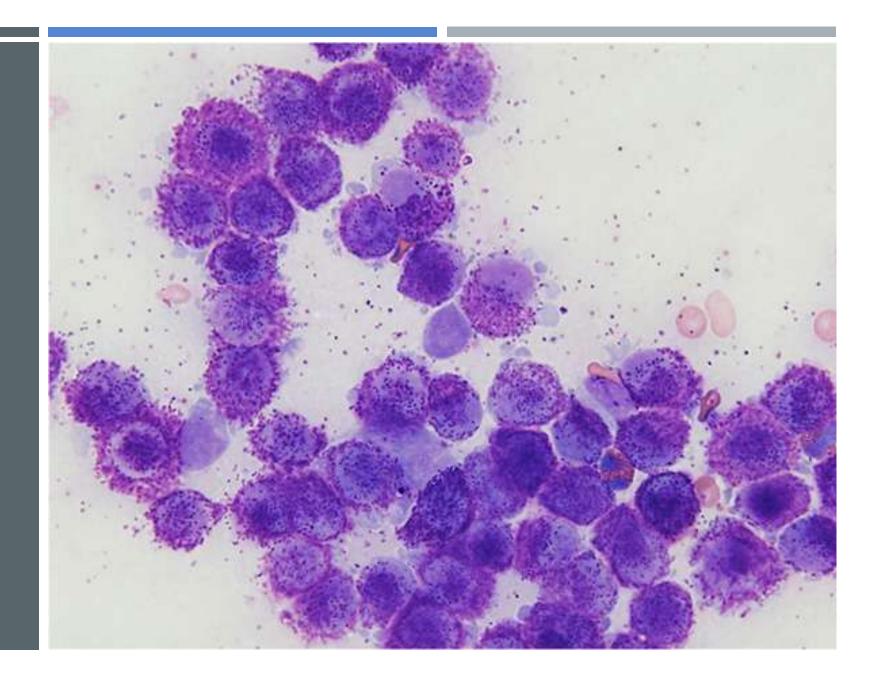






MOST COMMON **SURGICAL TUMORS** IN CATS AND DOGS AND HOW TO DEAL WITH THEM

MAST CELL TUMORS



- Great imitator
- Waxing and waning
- Vast majority not clinical for the disease
- Generally a <u>surgical based</u> disease
- Location and aggressiveness
 - Muzzle and scrotum

Mets – Grade 1 unknown (1-2%), Grade II (5-22%), grade III (55-96%)



Sites:

Lymphatics to LN, Liver and spleen, extremely rare lungs

Good news!!!

Most are cured by you sitting here tonight

2 GRADING SYSTEMS

- Putnaik Grade I, Grade II, or Grade III.
 - It was based upon looking at cytoplasmic boundaries, the nuclear size and shape, the mitotic index, and the granulation.
 - The challenge early 2000s:

Vast majority was being called a Grade II.

Why challenging:

Traditionally, Grade I or Grade II and completely excised, recommended really no follow-up for those patients.

Problem:

Underserving many patients.

And very subjective

Kuipel 2-tier high vs Low

high grade:

high >7 mitotic index, fair number of 3+ multinucleated mast cells, 3+bizarre nuclei, karyomegaly.

- average survival for a high grade was less than four months.
- General, for low-grades that were completely excised, MST over two years in these patients.
- 5-10% did not behave low grade
- Very high rate of agreement between pathologists

Know what you are cutting in to

- 1. FNA or biopsy
- 2. FNA RLN/SLN
 - 50% RLN not Sentinal
 - Normal palp Not mean no mets ,up to 50% mets
- 3. Abd U/s
 - controversial still do but low yield (maybe caudal aspect more inclined)
- 4. Chest Rads
 - Very rare to find mets
- surgical dose
 - 2cm Grade I/II/ Low
 - 3cm Grade III/High
 - Always 1 facial plane (Tricky)

Radiation

reduces the risk of local recurrence for incompletely-excised MCTs

when wide excision is not possible

incompletely-excised MCTs is most often administered as full-course treatment

may also be helpful for nonresectable, aggressive MCTs.

Chemotherapy

generally reserved for dogs with documented metastasis, or when metastasis is considered likely (e.g. Patnaik grade III; high-risk grade II; Kiupel high-grade tumors)

Prognosis

- Most cutaneous MCTs behave benignly
- Subcutaneous MCT less aggressive and smaller margins

 One study: 56% incomplete histologic excision, only 8% had local recurrence and 4% metastatic disease.
- metastasis usually occurs first to the local lymph nodes, then to the spleen and/or liver, and later to other organs/systemically.
- Higher tumor grade is associated with increased risk of metastasis; reduced rates of local control; and shorter survival times.
- Mitotic index is a strong predictor of survival time.¹ Dogs with MCTs that have a MI ≤5 have a median survival time (MST) of 80 months, compared to MST of 3 months for those with MI >5

CATS MCT'S

- Usually on the head
- Usually benign
- With incomplete margins recurrence is low
- Always just check spleen nasty if you find it



- Mesenchymal origin that arise from soft connective tissues
 - muscle, adipose, neurovascular, fascial, and fibrous tissues.
- Appear encapsulated BUT pseudocapsule
- Poorly defined margins and are locally invasive along fascial planes
 - Same as MCT Tentacles

Distant Metastasis is usually to the lungs



- Cytology can be challenging
 - STS often exfoliate poorly and can contain a large amount of necrosis.
- Well-differentiated sarcoma cells may also be difficult to distinguish cytologically from an inflammatory response or reactive fibroplasia.
 - one canine study, correct diagnosis was made in 62% of STS aspirates. In that same study, 15% were incorrectly diagnosed, and 23% of samples were nondiagnostic.
- Histologic Grading System: (grades I-III) based on : cell differentiation, mitotic count, and presence of necrosis.
- Determining grade on incisional biopsy material is NB for treatment planning BUT may not reflect the grade of the entire tumor.

- Because STS are locally invasive, wide surgical excision is typically recommended.
 - margins are 3 cm laterally one fascial plane deep
- Incompletely-excised STS are often treated with a second surgery (i.e. surgical excision of scar and adjacent tissues) or radiation therapy (RT).
 - Entire scar treated as contaminated and neoplastic.
 - Tumor grade helps determine whether a resected STS with incomplete or narrow surgical margins requires further therapy.
 - Incompletely-excised, high-grade STS requires additional treatment, although low-grade STS may not.

Radiation

- unresectable, or if surgical resection is incomplete.
- without surgery for palliation, especially pain.
- slow regression or growth stabilization.
- Macroscopic STS tend to be <u>radioresistant</u>,

Chemotherapy

- Largely undefined
- Postoperative chemotherapy (e.g. doxorubicin, ifosfamide, epirubicin, cyclophosphamide, mitoxantrone) may be considered for grade III STS, metastatic disease, or intra-abdominal STS, e.g. splenic sarcoma.

Metastasis

- Grade and mitotic count
- <15% grade I-II
- 44% grade III

Local recurrence

- Associated with grade and narrow histological margins (<1mm)
- Grade 1 7%
- Grade II 34%
- Grade III 75%
- Can take up to a year to recur continued monitoring NB

PROGNOSIS

- Generally good
- Locally aggressive and low metastatic potential
 - Local control the MOST NB!!!
- Negative prognostic indicators
 - Size, high grade
- 33% of dogs die from tumor related causes
- MST 1013 1796 days after surgery
- MST 2200 days Surgery + RT



HAEMANGIOSARCOMA





- Highly metastatic, aggressive malignant cancer of transformed vascular endothelial cells.
- Local infiltration and rapid systemic metastasis.

SPLENIC

- Dogs with splenomegaly and splenic masses
 - "double two-thirds rule": two-thirds have splenic neoplasia, and two-thirds of those have hemangiosarcoma. (One third do not have cancer!)
 - Ruptured hemoabdomen are more likely to have hemangiosarcoma
- A common clinical error
 - assume hemangiosarcoma based on the presence of a splenic mass.

Cutaneous/Subcutaneous

- <u>Cutaneous form</u>: non-haired skin and is associated with UV light exposure.
- Subcutaneous form: haired skin and is not associated with UV light exposure.
- Overrepresented breeds: German shepherds, Labrador retrievers, and other large-breed dogs.



- Anywhere from the skin to internal
 - most common internal sites: spleen, heart, liver.
- 3-view chest radiographs
 - pulmonary metastasis and pleural fluid.
- Abdominal ultrasound
- Echo
 - 25–45% of dogs with splenic hemangiosarcoma have concurrent right atrial hemangiosarcoma

Treatment for hemangiosarcoma is ideally both local and systemic.

Chemotherapy

- improves the median survival time (MST).
- Dogs with hemangiosarcoma treated with local therapy and chemotherapy live longer than dogs without treatment and with local therapy only, but one-year survival rates are still low (10%).
- Stage I, non-ruptured tumors may have an improved prognosis when chemotherapy is administered after surgery. Low-grade tumors may also have a better prognosis.

Radiation:

- The role for subcutaneous HSA is undetermined.
- Palliative RT may be beneficial for nonresectable disease.²¹
- Definitive RT for incompletely excised tumors is not routinely recommended because its benefit is unproven.

- The abdomen should be thoroughly explored and lavaged, and one should change instruments and gloves.
- Remove or biopsy any suspicious lesions.
- About 25% of dogs develop arrhythmias postoperatively. An ECG should be monitored during and after surgery, and arrhythmias usually resolve within 24–48 hours.
- Greyhound fibrinolytic syndrome
 - Tranexamic acid

Prognosis

Surgical excision: excellent for HA and good for HSA confined to the dermis.

- In one study, median survival time (MST) for dogs with dermal HSA was 780 days, and in another it was 987 days.
- less favorable for dogs with subcutaneous HSA.
 - Metastasis common.¹⁴
 - These tumors also have a high rate of local recurrence if they are narrowly or incompletely excised.

Overall, the prognosis with surgery alone is <u>poor</u> for hemangiosarcoma patients. Reported MST in dogs treated with surgery alone ranges from one to three months, and less than 10% of dogs survive one year.

SQUAMOUS CELL CARCINOMA

Cutaneous SCC

- most often thinly haired, nonpigmented, sun-damaged skin and may be preceded by actinic (solar) keratosis
- Most tumors are locally invasive and slow to metastasize
 - Digit is the exception
- Incomplete excision is associated with a high risk of local or regional recurrence
- Gross SCC lesions are typically considered resistant to conventional chemotherapy

Electrochemotherapy might hold a lot of promise in the future









CRYOTHERAPY

- (-50 to -60°C) selective destruction of neoplastic tissues
- Reported remission rates for feline SCC high (83-100%) better on eyelids and pinnae
- multiple treatments are often required and 19% of nasal planum tumors do not respond after 2-3 treatments.

NOSECTOMY

- Cut deep
- Cats do very well long term





MAMMARY TUMOR

- Epithelial neoplasms
- Hormone exposure plays a role
 - Spayed prior to their first estrous cycle 0.5% the risk
- Genetic component
- Obesity early in a dog's life is associated with increased risk
- Most common neoplasm of female dog
- ■50 % benign; 50% malignant
- ■Cats most are malignant

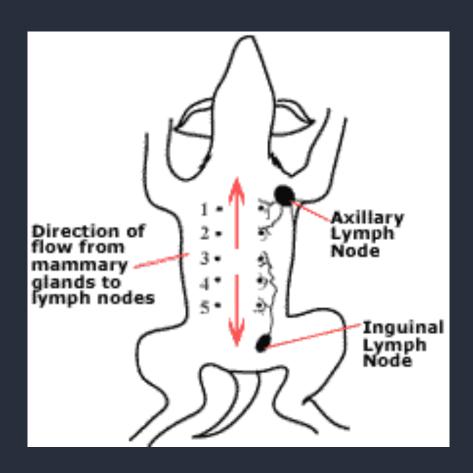


	•		1 1		
Mal	$\mathbf{I} \mathbf{\alpha} \mathbf{r}$	าวท		\mathbf{I}	nors
viai	IUI	пан		ин	1013

spectrum of behavior

 Benign mammary tumors and many canine mammary tumors with metastatic potential do not metastasize.

- Most common sites of metastasis
 - regional lymph nodes, lungs, liver, kidneys, and bone.



- Lymphatic drainage of mammary glands is complex
 - first and second (cranial) mammary glands
 drain to the ipsilateral axillary lymph node.
 - Fourth and fifth (caudal) mammary glands drain to the superficial inguinal lymph node.
 - Third mammary gland may drain to either axillary or inguinal lymph node.

Thoracic radiographs

■ Mets – 6-35 % of dogs at time of diagnosis

Abd U/S

- Intraabdominal lymphadenopathy and mets (less likely than lungs)
 - Urinary bladder and reproductive tract
 - Renal and hepatic mets 20-25%

Sentinal LN mapping

Ipsilateral and contralateral spread

Surgery

- Main Rx without distant mets
- 1-2cm lateral margin + 1 facial plane
- Small Lumpectomy (most of gland intact)
- Larger, fixed, ulcerated Mammectomy (1 gland) OR Regional mastectomy (Glands 1,2,3 OR 3,4,5)
- Multiple mammary tumors Radical chain mastectomy (unilateral/bilateral)
 - Efficacy relatively unproven and does not remove ALL mammary tissue??
- Inflammatory mammary carcinoma (IMC)
 - Many surgeons feel surgery contraindicated
 - Extends microscopically far from palpable mass
 - Mets Extremely common
 - Compromised wound healing









Other therapies

Radiation

- Usefulness in canine mammary neoplasia unknown
- May be useful in incompletely excised tumors where re-excision impractical??

Chemo

- Commonly recommended BUT benefits of specific protocols poorly defined
- More work needed
- Cats Advised survival benefit

Prognosis

- <3cm and Low grade (Well differentiated) longer survival</p>
- MST Dirty margins (70 days) vs Clean margins (872days)
- Worsens with stage of disease
- Histological classification huge influence
- IMC Most aggressive type (MST <6 months and 86% mets)

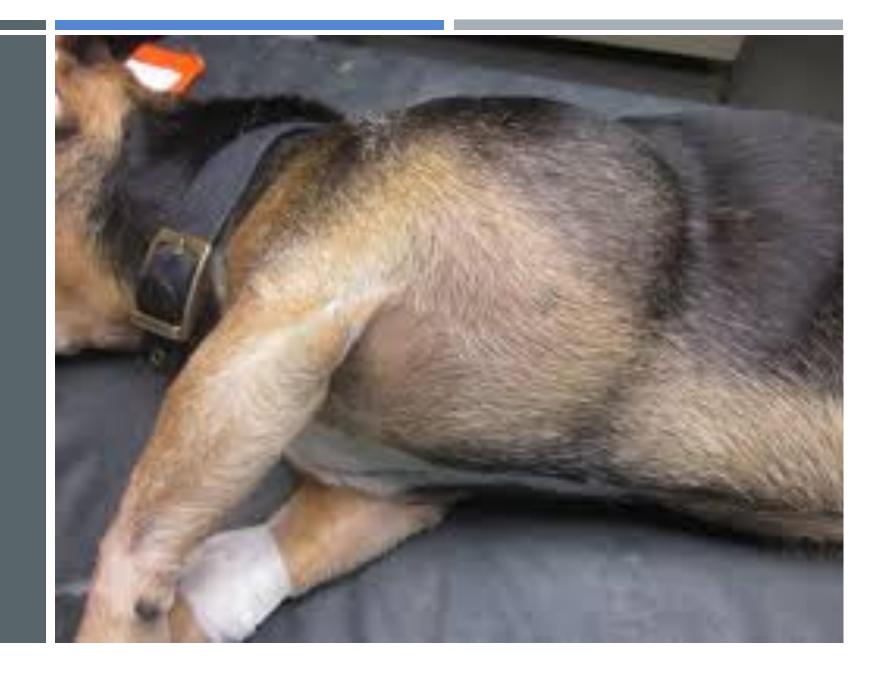
Survival outcome worse for dogs with ulcerated mammary carcinomas

- MST of 118 days and 1- and 2-year survival rates of 10.8% and 5.4%, respectively, compared to
- MST of 443 days and 1- and 2-year survival rates of 52.6% and 45.0%, respectively, for dogs with non-ulcerated mammary carcinomas.

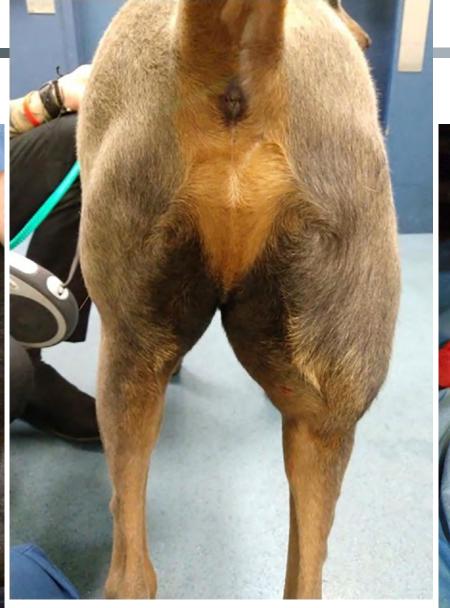
- Tumor-related mortality varies from 15% for adenocarcinoma, 65% for ductular adenocarcinoma, and 100% for inflammatory carcinoma, carcinosarcoma, and sarcoma.
- MST for various tumor types are 25-60 days for inflammatory carcinomas, 90 days for mammary osteosarcomas, 6 months for other mammary sarcomas, and 2.5 months for anaplastic carcinomas, 16 months for solid carcinomas, and 21 months for adenocarcinomas.

LIPOMA

- Benign deposits fatty tissue
- 3 types
 - Regular
 - Intermuscular
 - infiltrative



















DIAGNOSIS

- All on Cytology
- Can't diff between 3 types

TREATMENT

- Most Regular don't need any treatment
- Surgery
 - Interfering with function/locomotion
 - Intermuscular type
 - Infiltrative
 - Very aggressive approach



PROGNOSIS

- Regular and Intermuscular
 - Excellent
 - Seromas common
 - Drains
- Infiltrative
 - Guarded
 - Recur in 40% cases





- Locally aggressive tumors with a high potential to metastasize.
 - 1. first to regional (i.e. sacral, medial iliac, internal iliac) lymph nodes.^{2,3,49}
 - 2. Metastasis may occur to more distant sites (e.g. liver, lungs, spleen) later in the course of disease

Pulmonary metastasis is identified at the time of diagnosis in approximately 2-13%

- Metastasis to the sublumbar/medial iliac lymph nodes present or suspected,
 - resected via a midline celiotomy.
- Metastasis beyond the regional lymph nodes
 - surgery is not helpful except for diagnosis and/or possible temporary palliation of clinical signs

Radiation

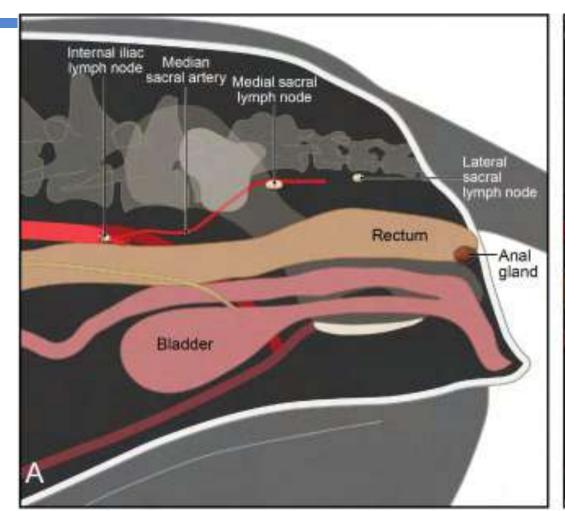
- incomplete surgical resection of the tumor or in patients in which surgery is not feasible.
- High incidence of side effects, some oncologists do not routinely recommend

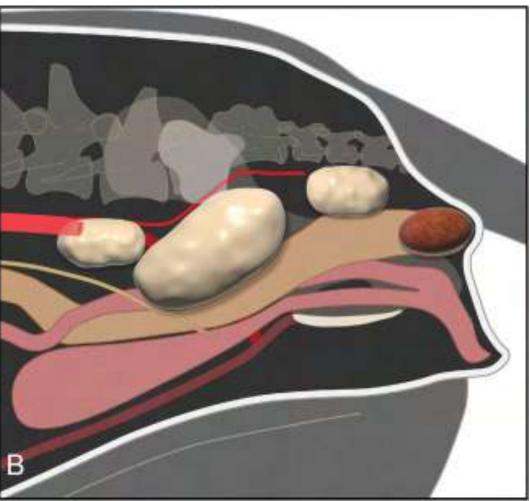
Chemotherapy

- commonly recommended, although a survival benefit for any particular protocol has not been proven.
- most effective when used in combination with local control

PROGNOSIS

- Large primary tumors and metastasis to lymph nodes or distant sites are considered negative prognostic factors
- metastasis at the time of diagnosis in 53-79% of affected dogs.
 - regional lymph nodes (72%), lungs (19%), liver (16%), spleen (14%), bone (7%), inguinal lymph nodes (5%), pancreas (2%), heart (2%), and mediastinum (2%)
- Dogs with primary tumors >2 cm were significantly more likely to have metastatic disease.
- MST 1,205 days for dogs with stage 1 disease, 722 days for stage 2, 492 days for stage 3a, 335 days for stage 3b, and 71 days for stage 4.





 Sublumbar lymphadenopathy had a significantly shorter MST (422 days) compared to dogs without lymphadenopathy prior to surgery (MST 529 days).

	_
Local tumor recurrence is reported in 5-45% of dogs after surgical excision.	
 Hypercalcemia increases the clinical signs associated with AGASACA and is a negative prognostic indicator in some studies. 	

What are the recommended histologic margins for different tumor types? How wide a margin do I need to make sure my patient's tumor will not grow back?

In most cases, our data is too limited to know

- Concern arises when malignant tumor cells extend to the edge of the margin.
- Margin of ≥ 10 mm is generally considered safe for most tumor types.
- Exceptions exist for highly invasive tumors (e.g., feline injection site sarcoma) and tumors prone to local recurrence (e.g., canine high-grade mast cell tumor).
- A gray zone exists where opinions on local control vary among oncologists.
- Microscopic images are 2-dimensional, and 3D analysis is lacking.
- Estimates of microscopic margins are currently the best available.
- The answer likely varies based on tumor type and grade.
- Further studies are required to define specific HTFD for various tumor types.

