Welcome to our new AVD-Antech Asia newsletter!

We are excited to launch this quarterly bulletin to share with you tips and latest updates about our AVD-Antech services across Asia.

In this first edition, Prof. Matti Kiupel, BS, MS, PhD, DACVP will share how to proceed with inking margins of your samples, as well as a singular histopathology case from Hong Kong.

In this 1st edition

INKING AND EVALUATING SURGICAL MARGINS

The goal of histologic examination of tumor biopsies is to provide an accurate diagnosis and prognosis of a neoplastic entity and, in the case of excisional biopsies, to evaluate cleanliness of surgical margins. The assessment of tumor excision status ('margins') is fundamental to the treatment and management of clinical oncology patients as it helps to determine whether there is local control or the likelihood of recurrence.

Assessment of surgical margins is a challenging task for the clinician, histology technician, and pathologist. It is an imprecise process, and there are nuances of margin evaluations that are difficult to understand for the untrained veterinarian. Good communication between the pathologist and surgeon will greatly improve the information provided and ensure that the samples are evaluated considering the surgical intent.

It is as difficult for the clinician to communicate to the pathologist the location of a mass and how it was excised and which surgical margins are of concern as it is for the pathologist to communicate to the submitting veterinarian the results of a margin evaluation in a written report, or even by phone. Ideally, the surgeon takes into account previous cytological or histological diagnosis, location in the body, proximity to vital structures, extent, availability of skin to close an incision and presence of a fascial plane in determining the type of surgery. The evaluation of histological margins varies with surgical approach, type of margin identification (inking, sutures), and tissue shrinkage related to post-surgical contraction, fixation, processing and trimming procedures. Additionally, neoplasms have unique characteristics, thus growth habits and natural history are important to determine the appropriateness of reported margin measurements.

The surgeon should always provide a description of the intent of surgery (i.e., incisional or intracapsular biopsy versus excisional with either marginal, wide or radical excision) and indicate any specific questions or areas of concern. As an example, there is no point in reporting margins of incisional (intracapsular) biopsies or debulking surgeries as there was never a curative intent. Margins should be reported if there is curative intent, regardless of the type of surgery.

Accurate margin assessment is further complicated by the various techniques applied in different laboratories to evaluate margins. To overcome the later problem, AVD offers a standardized approach to margin evaluation for routine submissions and a more detailed approach for determining complete excision for neoplastic entities where such knowledge impacts the therapeutic approach, e.g. mammary tumor, melanocytic neoplasms etc.

The first part of this article will provide detailed information for the clinician on how to ink and identify surgical margins, while the second part will explain how surgical margins are evaluated in the laboratory and what results the clinician can expect from the biopsy report.

To correctly identify surgical margins during the trimming process in the histology laboratory, it is necessary to paint (ink) the surgical margins. This can be done by the submitting veterinarian on unfixed samples or in the laboratory after the samples have been fixed. It is often an advantage for referring veterinarians to ink the margins on an unfixed tissue because they have performed the surgery and can best identify the margins of concern. The following paragraphs and figures illustrate how clinicians can ink samples before submission, especially if there is a specific margin that is of particular concern. By inking the tumor margins the clinician can guide evaluation of certain regions and ensure examination of these surgical margins.

The procedure is simple and does not interfere with microscopic evaluation of the tissue. **Surgical margins of a biopsy are painted with a dye that adheres to the tissue and is visible under the microscope.** Only ink, cotton swabs and wooden applicator sticks are needed to perform this procedure (Fig. 1).

Fig. 1: Ink, cotton swabs and wooden applicator sticks are all that is needed to ink margins.

Fig. 2: Commercial dyes contain multiple different colors for inking different aspects of mass orientation

There are many commercial dyes available. Such kits contain multiple different colors (black, blue, green, red, yellow, etc.) for different aspects of mass orientation (Fig. 2).

There are many commercial dyes available. Such kits contain multiple different colors (black, blue, green, red, yellow, etc.) for different aspects of mass orientation (Fig. 2).

To save money, simple waterproof drawing ink can be purchased and such bottles will last several years (Fig. 3).

Fig. 3: Commercial dyes contain multiple different colors for inking different aspects of mass orientation.

The drawing ink can even be diluted with isopropyl alcohol (1:1). **Different colors may be used to mark the cutaneous surface of a mass, which will help the histotechnician to correctly identify the orientation of the neoplasm. This is essential for communicating to the pathologist the orientation of the lesion and which margins are important.**

Application of sutures or staples can be done if the surgeon does not have a variety of colored ink. The referring veterinarian should indicate for each suture the orientation of the tissue, for example one suture in the cranial (or dorsal) margin, two sutures in the caudal (or ventral) margin and so on. Subsequent attempted excision of 'residual disease' would involve complete removal of the initial surgical field plus any additional margin, or if radiation therapy is used, the entire surgical field, including scar, would be included in the radiation field.

The mass should be placed on some absorptive material and needs to be blotted dry prior to painting the margins (Fig. 4A).

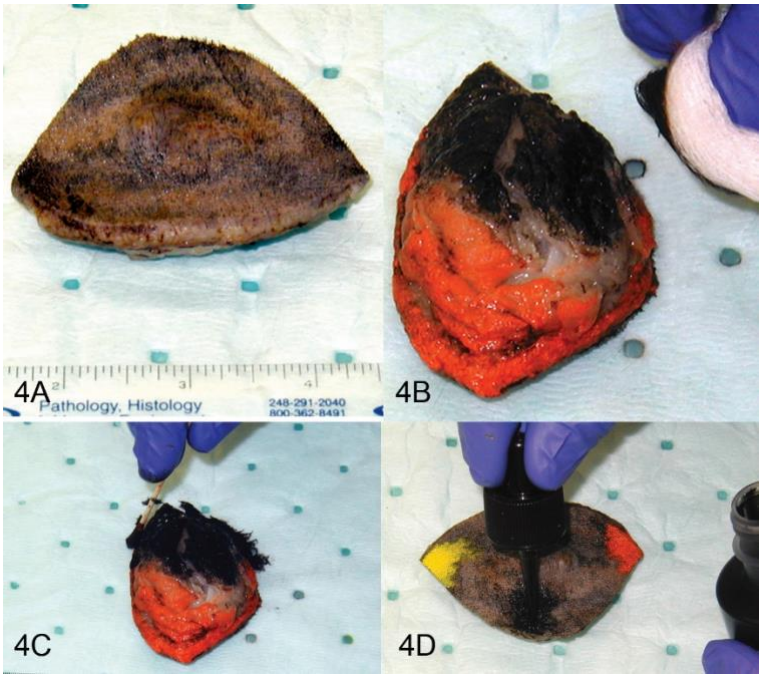


Figure 4: After the sample has been blotted dry (A), margins can be painted using a cotton swab which facilitates even color distribution over the deep tissue margins (B). A wooden applicator stick is helpful to ink lateral margins by rolling it along the tissue margin (C). Different colors may be used to mark the cutaneous surface of a mass, which will help the histotechnician to correctly identify the orientation of the neoplasm (D). Such inking marks are superior to using sutures of different colors in identifying proximal and lateral margins of a mass.

Using a cotton swab facilitates even color distribution over the deep tissue margins (Fig. 4B). **Neoplastic tissue should not be incised prior to application of ink and avoidance of incising inked margins after application is also advisable to prevent penetration of ink onto surfaces other than the surgical margins. The dye should not be poured on the surface, but a cotton swab or wooden applicator stick should be used to evenly ink only the surface and not to soak the tissue.** A wooden applicator stick is especially helpful to ink the lateral margins by rolling it along these tissue margins (Fig, 4C).

The referring veterinarians may decide to ink only margins of concern where they suspect incomplete removal (Fig. 4D).

After inking the margins, the dye should dry for 5-10 minutes prior to immersing the sample in formalin. Some dye will dissolve within the fixative, but this will not affect the microscopic evaluation of the tissue.

For large samples (thicker than 5 cm) incisions should be made into the mass to improve the penetration of the fixative, but the surgical margins should be left untouched. In general, if lesions need to be incised, a statement describing what was done should be included on the submission form so that the technologist can clearly determine which incision is a surgical margin and which was post-surgical slicing.

It is really important for the referring veterinarian to include information on the submission form a careful description of the site, location and color of applied ink or suture as well as any potential requirements or concerns they have for margin evaluation.

After the sample has been received by the laboratory, it has to be trimmed prior to embedding and cutting of slides. Trimming is the operation of sampling (cutting) the tissue for histopathology processing (Fig. 5A-F).

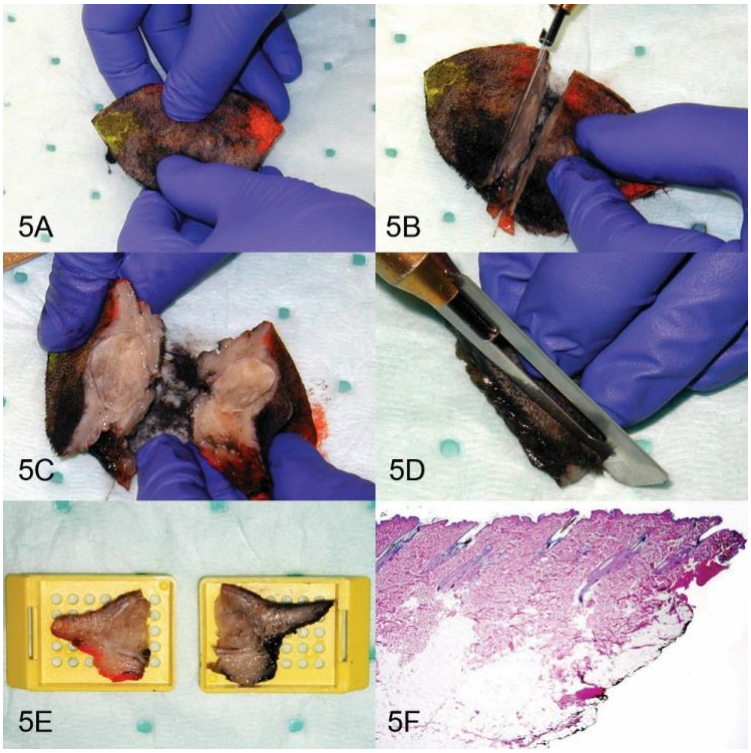


Figure 5: After receiving the tissue, our technicians will palpate the section to determine where the mass/lesion comes closest to the surgical margins (A). We will bisect the specimen vertically through the mass so the section extends through the margin closest to the identified mass and the center of the mass (B and C). Lateral margins will be evaluated by cutting tangential sections of each margins (D). Two 5 mm full thickness planes representing the two quarter sections have been placed into cassettes for embedding (E). Inked tissue section margins are easily recognized on microscopic examination (F).

It is important for the submitting veterinarian to be informed by the laboratory on how a particular specimen was trimmed. In general, the technique of trimming should reflect the type of surgery performed and vary according to several factors including tumor size, costs, and the shape of the sample.

It is the responsibility of the pathologist to share with the surgeon how margin assessment was performed. Labelled photographs or diagrams of submissions are a good way of doing this. Using drawings or photographs of tumors submitted for full margin evaluation that detail the exact position of each margin slide as it has been created by the histotechnologist will allow the pathologist to easily communicate margins to the clinician/oncologist. The pathologist can indicate in the biopsy report where neoplastic cells extend to the margin, and the clinician/oncologist can view the photographs and decide exactly where additional surgical resection or radiation may be needed. A report that indicates complete surgical removal without providing information on how a tissue has been trimmed and which margins have been examined is incomplete and essentially useless as examination of a single representative section may have resulted in “clean” margins, while a more complete examination would have easily identified extension of neoplastic cells to the margins.

The following paragraphs describe the different techniques that are commonly used to trim tissues and familiarize the referring veterinarian on how AVD has standardized its approach to allow consistent margin evaluation and simple communication between the pathologist and referring veterinarian.
For very small samples, tissues are either completely embedded or bi-sected and completely embedded. The latter method is occasionally used for very small excisional biopsies, but for the vast majority of excisional biopsies, the most commonly used method to evaluate margins of tumor samples is the cross-sectioning method, also known as the radial method or “halves and quarters” (Fig. 6A-E).

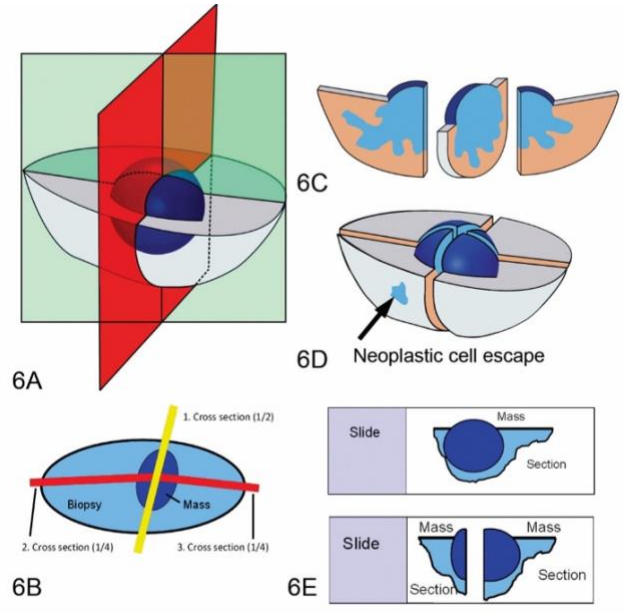


Figure 6: In our laboratory the standard trimming method used for routine tumor biopsies is the cross-sectioning method, also known as the radial method or "halves and quarters" (A). The tumor is bisected along its shortest axis (B, yellow line). Then, each half of the tissue is bisected through its longest axis, creating quarter sections that demonstrate the mass in a different plane (B, red lines). While this method is a great way for cost effective evaluation of routine biopsies, this method is not favored for complete margin evaluations since it evaluates a very limited portion of the margin area and makes the erroneous assumption of symmetrical expansile growth of the tumor (C). Neoplastic cells may extend to the margins in large portions of the submitted biopsy that were not evaluated (D). The pathologist evaluates only half and quarter sections (E).

The tumor is bisected along its shortest axis. Then, each half of the tissue is bisected through its longest axis, creating quarter sections that demonstrate the mass in a different plane. We use this method for routine evaluation of submitted biopsies, this method is not favored for complete margin evaluations since it evaluates a very limited portion of the margin area and makes the erroneous assumption of symmetrical expansile growth of the tumor. Escape of neoplastic cells through large portions of non-evaluated margins is not uncommon.

In human medicine, neoplasms are sectioned like a "bread loaf" or a "pie" to have the most detailed information for each submission. Parallel slicing at regular intervals (complete bread loafing, serial sectioning) increases the percentage of margin area examined (Fig. 7A-D).

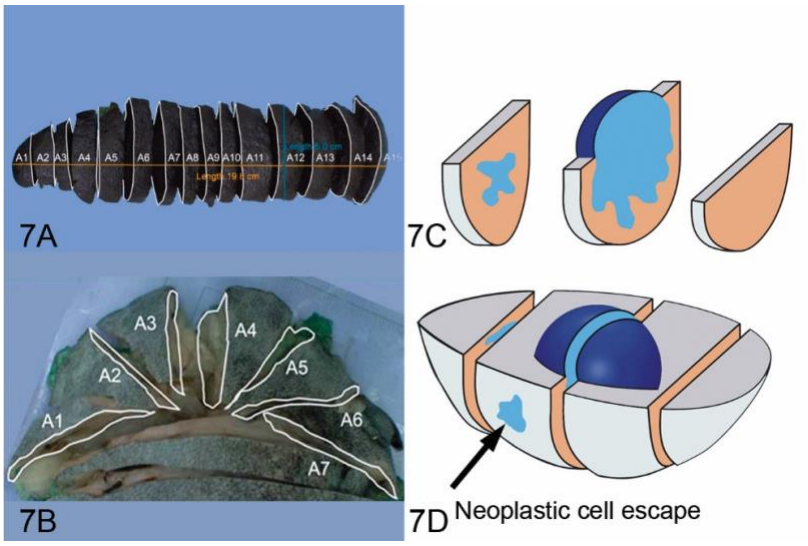


Figure 7: Other sectioning techniques such as bread-loafing (A) or pie sectioning (B) increase the number of examined margins. However, the distance between sections (C) determines the risk of not detecting dirty margins (D) and cutting more sections with smaller distance dramatically increases costs.

Since the distance between sections determines the quality of the margin evaluation, the cost of this approach limits its use in veterinary medicine. A modified technique combines radial and parallel techniques. This allows for evaluation of tissue immediately adjacent to the bulk of the tumor and evaluation of some distant margins of the sample.

In contrast, tangential sections (shaved edge sections, “orange peel”) provide a complete assessment of surgical margins (Fig. 8A and B).

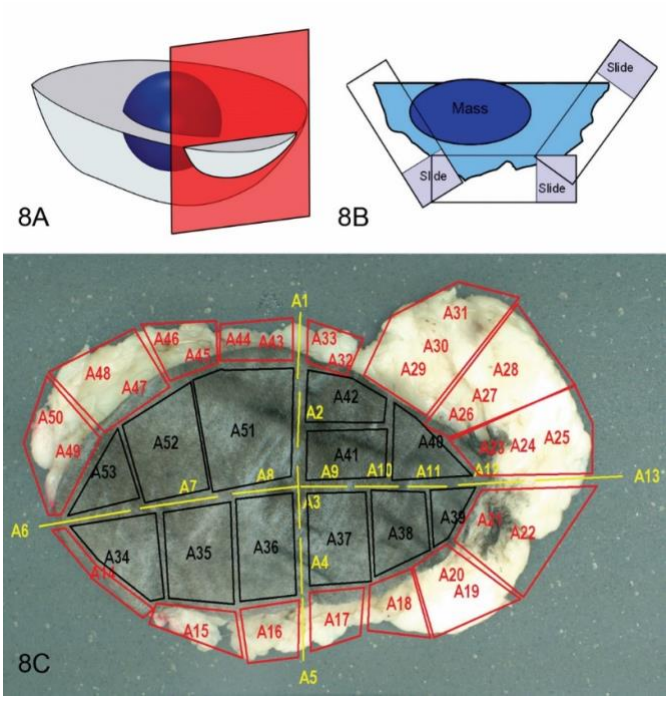


Figure 8: The tangential sectioning method (A) provides the most complete assessment of surgical margins. Any tumor present in the sections is interpreted as incomplete excision (B). By combining cross-sectioning with tangential margin evaluation (C), we deliver the most complete margin assessment. The yellow line indicate the cross sections placed through the neoplasm, while red fields mark the lateral tangential margins and black fields the deep tangential margins

Multiple 2- to 3-mm sections are shaved off the edge of the sample and laid into cassettes with the cut surface down. Any tumor present in the sections is interpreted as incomplete excision. The disadvantage is that the distance of tumor to margins cannot be assessed. However, the advantage is an accurate determination of clean margins. In some studies, up to 30% of tumors trimmed with the cross-sectioning method were identified with false negative clean margins when compared to tangential margin examination.

By combining cross-sectioning with tangential margin evaluation, we deliver the most complete margin assessment (Fig. 8C). While expensive, due to the large number of slides and time required for this method, it should be requested for all mast cell tumors, melanomas, soft tissue sarcomas, mammary tumors, and other carcinomas to more accurately determine tumor extent. By inking the tumor margins the clinician can guide evaluation of certain regions and insure examination of the surgical margins. This method is especially useful for evaluating mammary tumors, melanocytic neoplasms, mast cell tumors and any other type of carcinoma. While it can be applied for soft tissue sarcomas, the nature of these neoplasms can make evaluation of tangential margins very difficult. Soft tissue sarcomas may extend into the surrounding tissue through narrow growth resembling tentacles of an octopus. Detecting such growth in tangential sections that will be perpendicular to the neoplastic cells is challenging as the neoplastic
cells commonly blend with fascial planes. Diagnostic imaging, e.g., CT scan, has been shown to provide more accurate assessment of tissue invasion for these neoplasms (Fig. 9).

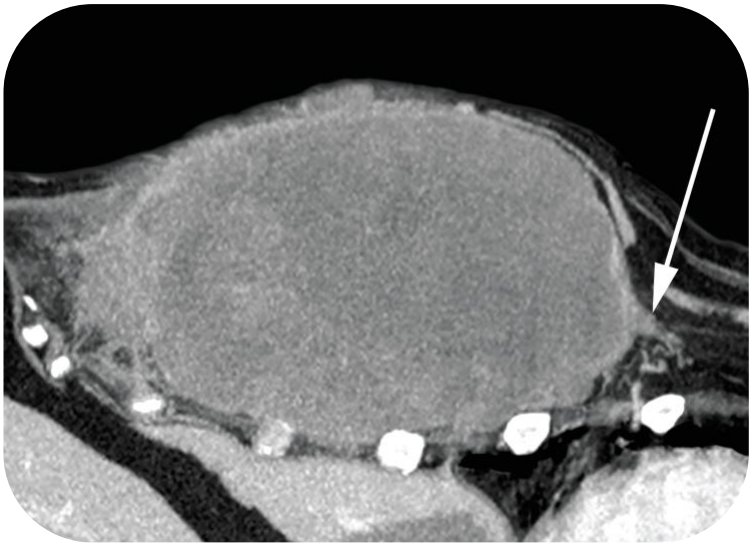


Figure 9: Tentacular spread of soft tissue sarcoma into surrounding tissue as indicated by the arrow in this CT scan.

Regardless of the method used to evaluate margins, the clinician needs to know to which margin the tumor extends in order to better direct additional resection or select advanced therapy, e.g. radiation.
We therefore provide online photographs of tumors submitted for full margin evaluation that detail the exact position of each margin slide that was created by our technician. This allows our pathologist to indicate in the biopsy report where neoplastic cells extend to the margin, and the clinician can view the photos and decide exactly where additional surgical resection may be needed.

While complete margin evaluations are typically requested for cutaneous neoplasms, online digital photographs are also very useful for assessing margins in other organs and tissues (Fig. 10).

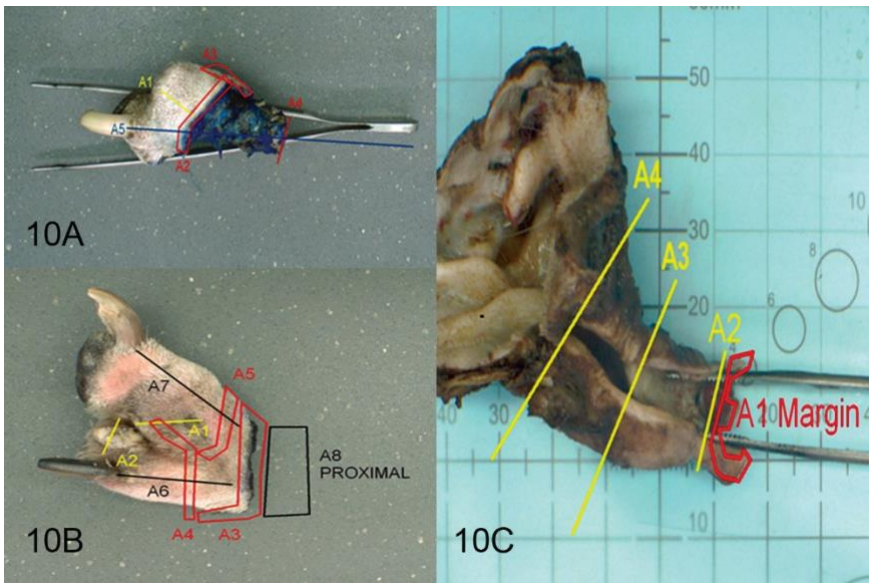


Figure 10: Sectioning of toes (A and B) and ear masses (C) with yellow lines indicating sections through primary masses, red areas indicating soft tissue margin sections, black lines indicating longitudinal sections through decalcified phalanges and black areas indicating decalcified proximal bone margins.

When assessing the margins of an amputated digit or tail one soft tissue section is taken through the mass. The proximal margins are inked and sections representing the proximal skin margins are trimmed. Then the digit or tail are decalcified and a section is taken from the proximal bony margin. A longitudinal section through the length of the digit and affected coccygeal bones is also examined to assess for bone involvement.
AVD has established standardized trimming protocols for toes, mandibular or maxillary bones, liver or lung sections, intestinal biopsies, ear ablations to just name a few. Consistent trimming of each

tissue will make communication between the pathologist to the referring veterinarian simpler and ensure a better understanding of how surgical margins were evaluated. Sending us a picture of the original lesion will further enhance communication. Please never hesitate to contact us with any questions or if uncertain how a specific tissue has been trimmed.

For more detailed information please review:

1. *Goldschmidt MH, Munday JS, Scruggs JL, Klopfleisch R, Kiupel M, Surgical Pathology of Tumors of Domestic Animals. Volume 1: Epithelial Tumors of the Skin. ed. Matti Kiupel, 1st edition, Davis-Thompson Foundation, 2018. (https://davisthompsonfoundation.org/bookstore/surgical-pathology-of-tumors-of-domestic-animals-volume-epithelial-tumors-of-the-skin/)*
2. *Roccabianca P, Schulman FY, Avallone G, Foster RA, Scruggs JL, Dittmer K, Kiupel M, Surgical Pathology of Tumors of Domestic Animals. Volume 3: Tumors of Soft Tissue. ed. Matti Kiupel, 1st edition, Davis-Thompson Foundation, 2020. (https://davisthompsonfoundation.org/bookstore/surgical-pathology-of-tumors-of-domestic-animals-vol-3-tumors-of-soft-tissue-2/)*

CASE STUDY

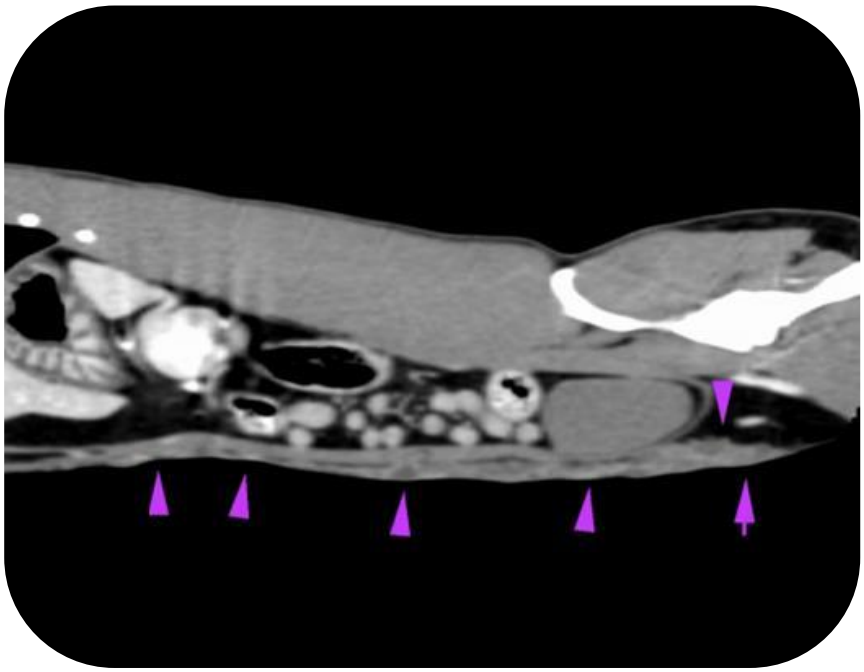
Mammary gland lobular hyperplasia secondary to mushroom supplements

THE PATIENT AND CLINICAL HISTORY:

A 3-year old, 3.3 kg, female neutered Ragdoll cat. According to the owner, the cat was very happy and did not show any clinical symptoms. However, the owner had felt while petting her multiple nodules along the abdomen that had been suddenly developing.

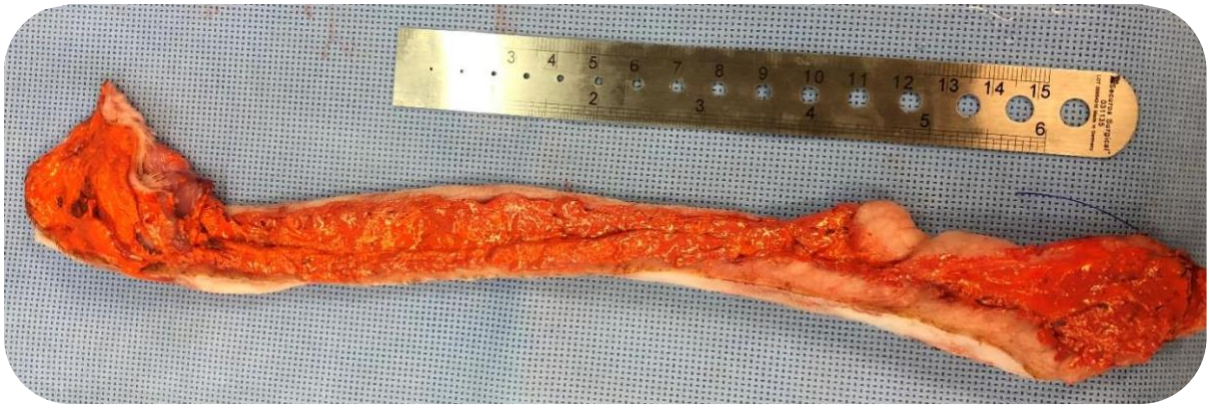
CLINICAL PRESENTATION

When presented at the veterinary clinic the cat was very alert and interested. The mucosal membranes were pink. Heart and lung auscultation was normal. The pulse was strong and regular at 200/min. The abdomen was soft and the peripheral lymph nodes palpated normal. There was no ocular discharge. The neck palpated normal. Throughout the left and the right mammary chain there were multiple nodules measuring between 2 and up to 6mm in diameter. These nodules were all hard and associated with the mammary chain. Clinical examination was most consistent with multiple mammary tumors arising in the left and right mammary chain. A CT scan of the thorax and abdomen for full staging was performed. The scan confirmed well-defined generalized bilateral mild-moderate enlargement of the mammary tissues, presenting mild irregular margination and slightly heterogeneous parenchyma. These changes were more prominent at the 5th, 4th and 3rd mammary glands and tappered cranially along the 2nd and 1st glands. Included within the mammary tissues there were multiple small ill-defined hypodense soft tissue/fluid attenuation nodular foci, some of them coalescing. The biggest nodules were located at the 5th mammary glands (right more than left, up to 3mm diameter, 4th left mammary gland (up to 3mm diameter) and 3rd/4th left mammary gland (arrows). There was no evidence of subcutaneous changes/steatites surrounding the mammary tissue.



CLINICAL APPROACH

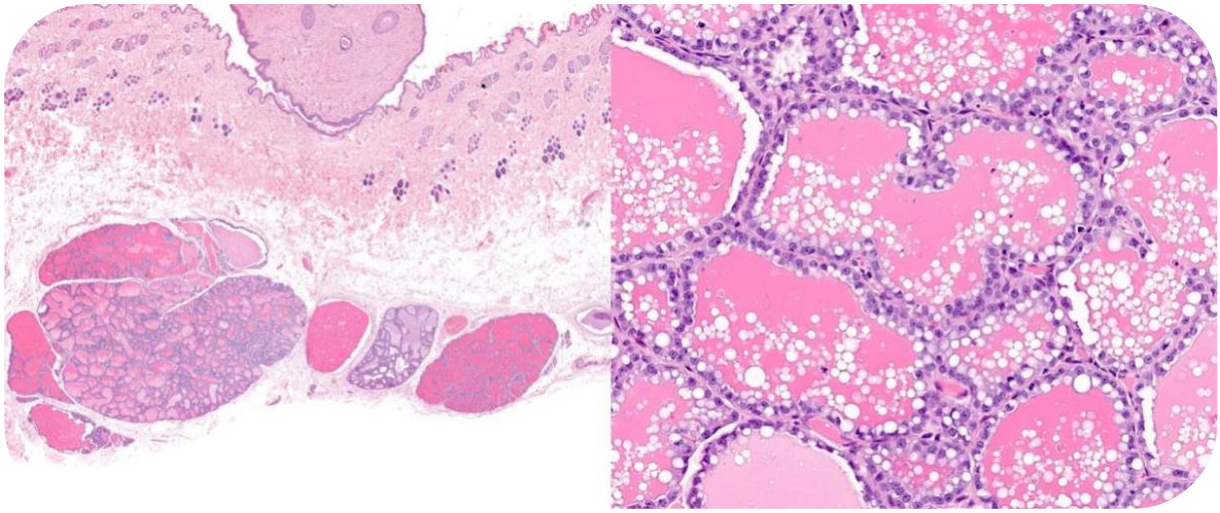
Based on the clinical examination, a presumptive diagnosis of multiple mammary tumors was made, most likely representing carcinomas. Considering the generally grave prognosis of feline mammary carcinomas, a step-wise radical mastectomy was elected starting with the right mammary chain. The cat was anesthetized for evaluation of the mammary tissue. Multiple 1-5mm nodules were palpable within the mammary chain, with the right mammary chain containing larger and more prominent nodules compared to the left. Routine mastectomy was performed from the inguinal fat pad to the axilla, including all mammary tissue and any palpable nodules right of the midline, as well as the palpable axillary node and inguinal node. Surgery and anesthesia were uneventful, and the cat recovered well from surgery. The mammary chain and lymph nodes were submitted to AVD for microscopic examination and margin evaluation.



PATHOLOGY REPORT

On gross examination, the size of the excised specimen was 21.6 cm long. A suture was noted in the specimen at the 9 o'clock position (caudal end). Multiple small mammary nodules were observed in the specimen which measured around 0. In diameter each. Four nipples were noted in the specimen. The margins were inked orange by the clinic. Three cross-sections were taken into cassettes 0 to 2. Two perpendicular sections were taken into cassettes 3 and 4. Tangential margin sections of the mammary strip were taken into cassettes 5 to 16, respectively. Two suspected lymph nodes were noted during trimming in the specimen. Sections of suspected lymph nodes were taken into cassettes 17 and 20, respectively. Three suspected mass lesions were observed in the specimen. Sections of the suspected mass lesions were taken into cassettes 18, 19 and 21, respectively. Three cross-sections which included nipples were taken into cassettes 23 to 25, respectively. An edge section which included a nipple at 3 o'clock position was taken into cassette 22. Additional tangential margin sections of the mammary strip were taken into cassettes 26 to 37, respectively.

Microscopic examination: Three cross-sections through the mammary strip (C0-C2), three sections (C18, C19 and C21) through the palpated nodules, four cross sections through the nipples (C22-C25) and two sections perpendicular to the cross sections and through the proximal and distal margins (C3 and C4) were examined microscopically. In addition, 12 tangential sections of the lateral margins (C5-C16) and 12 tangential sections of the deep margins (C26 to C37) were also examined. Furthermore, two sections through the suspected small lymph nodes were also examined (C17 and C20).
The examined mammary specimens were microscopically similar and were described collectively. There was mild multifocal mammary lobular hyperplasia with mild to moderate periglandular infiltrates of lymphocytes and plasma cells in some lobules. Commonly hyperplastic acini within hyperplastic lobules contained large amounts of eosinophilic secretory material admixed with moderate numbers of macrophages and there was mild ectasia of mammary ducts. There was no evidence of a neoplastic disease process within any of the sections examined. Hyperplastic glands extended focally to the deep margins of sections examined (C31 and C32). Two lymph nodes were identified in sections C17 and c20 that both represented with follicular hyperplasia characterized by lymphoid follicles that had prominent germinal centers and retained polarity of their mantle zones. There was mild paracortical hyperplasia and no evidence of neoplastic cells within either node.



MICROSCOPIC DIAGNOSIS

Mammary gland: Multifocal lobular hyperplasia with secretory activity and focal ectasia; Lymph node: Follicular hyperplasia

COMMENTS BY THE PATHOLOGIST

The histological findings are consistent with mammary gland lobular hyperplasia. The glands are very active (i.e. secretory) and there is focal ectasia of ducts, but neoplastic transformation was not observed. The extend of the surrounding fibrous connective tissue was minor and is unlikely to represent an early stage of the condition termed fibroadenomatous hyperplasia. The degree of lobular hyperplasia with secretory activity is unusual in a spayed cat as this change is most commonly observed in cats in late diestrus or animals in lactation. The cat should be examined for evidence of ovarian remnants or potential sources of exogenous estrogen.

CLINICAL FOLLOW-UP

Upon further questioning, the owner told the veterinarian that she had been giving the cat a homemade supplement of Lingzhi mushrooms. Lingzhi or Ling chih mushrooms have been used as a traditional medicine in East Asia for a long time and the name means "mushroom of immortality" in Chinese. In Japan it is known as Reishi mushrooms, which means "10,000 year mushroom." The scientific name is Ganoderma lucidum, a large medicinal fungus belonging to the family of bracket fungi (Polyporaceae) that is being cultivated in numerous countries for medicinal purposes. Lingzhi mushrooms have been used in Asian traditional spirit/hair-skin-nails/ready-for-reishi-mushrooms/ medicine to boost the immune system, for various anti-cancer properties, to fight fatigue and depression as well to support heart health, control blood sugar and the antioxidant status. Various pharmacological actions of Ligzhi mushrooms have been established including estrogenic activity. The fungus contains diverse phytochemicals, including triterpenes, which have a molecular structure similar to that of steroid hormones. (R, E)-5-(2,5-dihydroxyphenyl)-3-(4,8-dimethylnona-3,7-dien-1-yl) furan-2(5H)-one (GL-1) has been purified from fruiting body of Ganoderma lucidum and studies have confirmed possible binding sides of GL-1 to the estrogen receptor and estrogenic mechanisms of GL-1. The supplement was considered as the source of exogenous estrogen stimulation in this cat. All supplements were stopped at that time. At a 6-month follow up visit, the cat was doing very well and the mammary gland on the left side had no more palpable nodular changes, but there was very subtle

not bulging thickening in some areas of the glands. These sites were not painful and not movable. The surgical sites of the radical mastectomy site palpated normal.

https://www.drweil.com/health-wellness/body-mind-spirit/hair-skin-mails/ready-for-reishi-mushroom/

CONCLUSION

While it is part of a routine anamnesis to inquire about any medications a patient is currently being treated with, this case highlights the importance of also inquiring about any other supplements given to an animal. The owner had given this cat a homemade remedy of Lingzhi mushrooms that caused estrogen induced multilobular mammary gland hyperplasia leading to a diagnosis of suspected mammary carcinomas and radical mastectomy. Communication between the veterinarian and the pathologist led to further inquiries of the owner and ultimately identified the source of the mammary proliferation.

REFERENCES

Ahmad MF. Ganoderma lucidum: Persuasive biologically active constituents and their health endorsement. Biomed Pharmacother. 107: 507-519, 2018.
Goldschmidt MH, Munday JS, Scruggs JL, Klopfleisch R, Kiupel M, Surgical Pathology of Tumors of Domestic Animals. Volume 1: Epithelial Tumors of the Skin. ed. Matti Kiupel, 1st edition, Davis-Thompson Foundation, 2018.
Mills, S. W., Musil, K. M., Davies, J. L., Hendrick, S., Duncan, C., Jackson, M. L., et al. (2014). Prognostic Value of Histologic Grading for Feline Mammary Carcinoma: A Retrospective Survival Analysis. Veterinary Pathology, 1-12.
Ye WY, Wang JZ, Deng GG, Dang YW, Liu HW, Chen G. Estrogenic activities of compound GL-1, isolated from Ganoderma lucidum. Nat Prod Res. 35(24):6062-6066, 2021.
Wiese DA, Thaiwong T, Yuzbasiyan-Gurkan V, Kiupel M. Feline mammary basal-like adenocarcinomas: a potential model for human triple-negative breast cancer (TNBC) with basal-like subtype. BMC Cancer. 2013 Sep 3;13:403.
Zappulli V, Rasotto R, Caliari D, Mainenti M, Peña L, Goldschmidt MH, Kiupel M. Prognostic evaluation of feline mammary carcinomas: a review of the literature. Vet Pathol. 2015 Jan;52(1):46-60.

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Date	Topic	Speaker
18-Jan	Acute Phase Protein. What are they? When to run them? How to run them? How to interpret result?	**Dr Holly Brown** DVM, PhD, DACVP (Clinical pathology) & Dr. Jessica Winson – Hess MS, CVT, VTS (SAIM)
22-Feb	Parasitology: Hookworms, Giargia clinical updates	Dr Michelle Evason DVM, BSc, DACVIM (SAIM)
15-Mar	All you wanted to know about Canine Osteosarcomas	Prof. Matti Kiupel BS, MS, PhD, DACVP (Anatomic pathology)
19-Apr	FIP diagnosis: what are the strategies in 2023?	Dr Veronique Bachy DVM, MSc, PhD
17-May	Antimicrobial stewardship: MIC: What for? How to interpret?	Dr Michelle Evason DVM, BSc, DACVIM (SAIM)
21-Jun	Advanced Haematology and blood film essentials	Dr Holly Brown DVM, PhD, DACVP (Clinical pathology)
19-Jul	The importance of complete urinalysis	Dr Holly Brown DVM, PhD, DACVP (Clinical pathology)
16-Aug	Advances in Veterinary Oncology Diagnostics	Dr Mun Keong Kok DVM, PhD, Dipl JCVP, Dipl ACVP
20-Sep	Maximising the minimum database	Dr Holly Brown DVM, PhD, DACVP (Clinical pathology)
18-Oct	Canine Endocrine neoplasms	Prof Matti Kiupel BS, MS, PhD, DACVP (Anatomic pathology)
15-Nov	Vector Borne Disease: Anaplasma, Ehrlichia, Babesia clinical management	Dr Michelle Evason DVM, BSc, DACVIM (SAIM)
13-Dec	Canine and Feline Hepatic tumors	Prof Matti Kiupel BS, MS, PhD, DACVP (Anatomic pathology)

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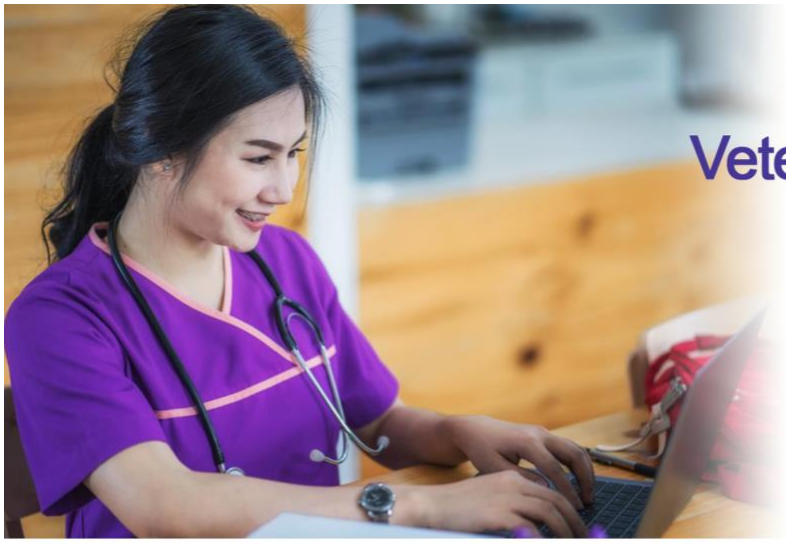

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45 minutes sessions + Q&A
Attendance Certificate provided

Speaker: Dr. Kostas Papasouliotis DVM PhD DipECVCP MRCVS
EBVS® European Specialist in Veterinary Clinical Pathology

Date	Topic
21st January	Haematology - Leukaemia: What do I need to know?
18th February	Haematology – Haemoparasitic infections: Laboratory diagnostics
18th March	Haematology – Clotting tests: which tubes do we need and why?
15th April	Haematology - Discussion of clinical cases (numbers and blood smear examination findings)
20th May	Endocrinology - Hypo-and Hyperthyroidism: Laboratory diagnostics
17th June	Endocrinology - Hypo-and Hyperadrenocorticism: Laboratory diagnostics
15th July	Endocrinology – Diabetes mellitus: Laboratory diagnostics
19th August	Biochemistry – Gastrointestinal diseases: Laboratory diagnostics
16th September	Cytology – Cerebrospinal fluid (CSF) analysis: which sample tubes do we need and why?
21th October	Cytology – Synovial fluid analysis: which sample tubes do we need and why?
18th November	Cytology – Are these cells malignant?
16th December	Cytology – Discussion of clinical cases (Skin lumps & bumps, Urine, Body cavity effusions)

To register,
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Indicate your 1. full name 2. Country 3. practicing clinic name