
UNIVERSITI PUTRA MALAYSIA

# CYTOLOGICAL DIAGNOSIS OF FELINE CUTANEOUS TUMOURS PRESENTED TO THE VETERINARY LABORATORY SERVICE UNIT, UNIVERSITI PUTRA MALAYSIA (VLSU-UPM) FROM YEAR 2017 TO 2022

ZULAIKHA BINTI ZULMANTRI

Ip
FPV 2022 61

# CYTOLOGICAL DIAGNOSIS OF FELINE CUTANEOUS TUMOURS

**PRESENTED TO THE**

**VETERINARY LABORATORY SERVICE UNIT,**

**UNIVERSITI PUTRA MALAYSIA (VLSU-UPM)**

**FROM YEAR 2017 TO 2022**

**ZULAIKHA BINTI ZULMANTRI**



A project paper submitted to the
Faculty of Veterinary Medicine, Universiti Putra Malaysia
in partial fulfilment of the requirement for the
DEGREE OF DOCTOR OF VETERINARY MEDICINE
Universiti Putra Malaysia
43400 UPM Serdang, Selangor Darul Ehsan.

December 2022

It is hereby confirmed that we have read this project paper entitled "Cytological Diagnosis of Feline Cutaneous Tumours Presented to The Veterinary Laboratory Service Unit, University Putra Malaysia (VLSU-UPM) From Year 2017 To 2022", by Zulaikha binti Zulmantri and in our opinion it is satisfactory in terms of scope, quality, and presentation as partial fulfilment of the requirement for the course VPD 4999 - Project.

_____

**DR. AZALEA HANI OTHMAN**
**DVM (UPM), MPhil (Queensland), PhD (UPM)**
**Lecturer,**
Faculty of Veterinary Medicine
University Putra Malaysia
(Supervisor)

_____

**DR. CHAN WEI YEE**
**DVM (UPM), MPhil (Queensland), MVM (UPM), PhD (Adelaide),**
**Senior Lecturer,**
Faculty of Veterinary Medicine
University Putra Malaysia
(Co-Supervisor)

---

**DR. IZZATI UDA ZAHLI**
**DVM (UPM), MVSc (Miyazaki), PhD (Miyazaki),**
**Lecturer,**
Faculty of Veterinary Medicine
University Putra Malaysia
(Co-Supervisor)

## ACKNOWLEDGEMENT

Praise be to Allah for this opportunity to conduct this project. I would like to express my greatest gratitude to my supervisor, Dr. Azalea Hani Othman for all her continuous support, patience, guidance, extensive knowledge and assistance towards the success of this study.

Plus, I would like to thank my co-supervisors Dr. Chan Wei Yee and Dr. Izzati Uda Zahli for all their guidance, support and motivation throughout the project. Their commitment and enthusiasm had helped me tremendously towards the accomplishment of this project.

This study would not have been completed without the guide and support of my friends, Michelle Yew Shyh-Xiao, Shazima Natashya, Safwa Najihah, Nur Asrina, Nur Azira, Maria Amalia, Nur Syafina, Ainna Aisyah, Nurul Natasha, Nur Farhah Sofia, Nor Azren despite of their own hectic schedule. I also would like to include all of my classmates DVM23 as participants in my journey.

Finally, I would like to thank my family, especially my parents, Zulmantri bin Abu Bakar and Rohani binti Kamarudeen, my sister Zuherni and others who had directly or indirectly assisted me in the conduct of my project. Alhamdulillah, I thank ALLAH for the opportunities and new experiences gained throughout the conduct of this final year project.

## CONTENTS

**LIST OF TABLES** **Page**

**LIST OF FIGURES** **Page**

**LIST OF APPENDIXES** **Page**

## LIST OF ABBEVIATIONS

| | |
|---|---|
| VLSU | Veterinary Laboratory Services Unit |
| UPM | Universiti Putra Malaysia |
| FNA | Fine Needle Aspiration |
| UVH | University Veterinary Hospital |

# ABSTRAK

**CYTOLOGI DIAGNOSIS TENTANG TUMOR KULIT PADA KUCING YANG DIKEMUKAKAN KEPADA UNIT PERKHIDMATAN MAKMAL VETERINAR, UNIVERSITI PUTRA MALAYSIA, (VLSU-UPM) PADA TAHUN 2017 SEHINGGA 2022**

**Oleh**

**Zulaikha binti Zulmantri**

**2022**

**Penyelia: Dr Azalea Hani Othman**

**Penyelia bersama: Dr Chan Wei Yee, Dr Nurul Izzati Uda Zahli**

Sitologi adalah prosedur diagnosis yang melibatkan penilaian mikroskopik sel daripada tisu yang abnormal. Jika dibandingkan dengan histopatologi, sitologi lebih pantas dan mempunyai kos yang lebih rendah maka, rawatan boleh dijalankan dengan cepat. Tumor kulit adalah salah satu penyakit yang kerap dilaporkan pada kucing. Walau bagaimanapun, kajian tentang prevalens tumor kulit pada kucing sangat terbatas melalui sitologi. Justeru, objektif kajian ini adalah penentuan prevalens sitologi diagnosis pada kucing yang dirujuk kepada Unit Perkhidmatan Makmal Veterinar, Universiti Putra Malaysia (VLSU-UPM) pada Januari 2017 hingga Ogos 2022. Data pesakit seperti umur, baka, jantina, lokasi, jenis tumor dan ulasan pakar

sitologi diperoleh daripada rekod Makmal Klinikal Patologi, VLSU-UPM. Daripada 266 kes, 79 kes telah didiagnosis meghidap tumor kulit. Kumpulan umur kucing yang tertinggi menghidap tumor kulit adalah kucing yang berumur lebih daripada 10 tahun. Antara baka yang paling kerap didiagnosis menghidap tumor kulit ialah baka domestik berbulu pendek (64.56%), Parsi (17.72%) dan baka domestik berbulu panjang (6.33%). Tumor kulit yang paling kerap didiagnosis ialah sel skuamus karsinoma (43.33%), tumor sel epitelium (15.56%) dan tumor kulit limfoma (14.44%). Lokasi tumor yang dilaporkan dalam kajian ini adalah telinga (21.80%), hidung (19.23%), mata (14.10%) and mulut (14.10%). Kesimpulannya, kajian ini menunjukkan bahawa tumor paling kerap didiagnosis adalah sel skuamus karsinoma, manakala lokasi paling kerap berlakunya tumor kulit ialah telinga. Kajian tidak menunjukkan sebarang perkaitan antara prevalens tumor kulit dengan umur, baka atau jantina kucing.

Kata kucing: kucing, kulit, tumor, sitologi

## ABSTRACT

**CYTOLOGICAL DIAGNOSIS OF FELINE CUTANEOUS TUMOURS PRESENTED TO THE VETERINARY LABORATORY SERVICE UNIT, UNIVERSITI PUTRA MALAYSIA (VLSU-UPM) FROM YEAR 2017 TO 2022**

**By**

**Zulaikha binti Zulmantri**

**2022**

**Supervisor: Dr Azalea Hani Othman**

**Co-supervisors: Dr Chan Wei Yee, Dr Nurul Izzati Uda Zahli**

Cytology is a diagnostic procedure that involves microscopic evaluation of cells lesions. Compared to histopathology, cytology is a rapid and low-cost diagnostic method; hence, treatment plans can be executed immediately. Cutaneous tumour is considered as one of the most frequently diagnosed diseases in cats. Nevertheless, there is a limited investigation made on the prevalence of feline cutaneous tumour diagnosed via cytology. Therefore, the objective of this study was to determine the prevalence of cytological diagnosis of cutaneous tumours in cats presented to the Veterinary Laboratory Service Unit, University Putra Malaysia (VLSU-UPM) from January 2017 to August 2022. Patients' data including signalment, history and cytologist's report were obtained from the records of Clinical Pathology Laboratory, VLSU-UPM. Out of 266 records of feline tumours, 79 cases were diagnosed with

cutaneous tumours through impression smear or fine needle aspiration. The most commonly presented breed with cutaneous tumours were Domestic short hair (64.56%), Persian (17.72%) and Domestic long hair (6.33%). The age group of cats commonly diagnosed with cutaneous tumours was senior cats which is more than 10 years old. The most frequent cutaneous neoplasia diagnosed was squamous cell carcinoma (43.33%), epithelial neoplasm (15.56%) and cutaneous lymphoma (14.44%). The common sites of lesion were ear (21.80%), nasal (19.23%), eye (14.10%) and oral region (14.10%). In conclusion, the study showed that the most frequent cutaneous tumour in cats was squamous cell carcinoma, while the most frequent site was the ear. However, there was no association between age, breed or sex of cats with cutaneous tumour.

Keywords: feline, cutaneous, tumour, cytology

## 1.0 INTRODUCTION

Skin is the body's largest organ, serving several roles such as thermoregulation, immunological defence, sensory perception, vitamin D production, and provides a barrier between the animal and its surroundings (Bourguignon *et al.*, 2013). It comprises of three main different layers, outer layer (epidermis), middle (dermis) and deeper layer (subcutis) (Moriello, 2022). The epidermis is a thin layer which has a thickness of two to three nucleated cells. It has five distinct cell layers, from inner to outer layer, which are stratum basale (basal cell layer), stratum spinosum (spinous cell layer), stratum granulosum (granular cell layer), stratum lucidum (clear cell layer) and lastly, stratum corneum (horny cell layer) (Paterson, 2008).

Basement membrane is a thin layer which separate epidermis from the dermis (Paterson, 2008). The thickness of the dermis is the most important factor in determining overall skin thickness; it varies depending on body region. The thickness of the epidermis and the thickness of the dermis are inversely correlated (Affolter and Moore, 1994).

Neoplasm is common among small animals such as cats and dogs (Morris and Dobson, 2008). Neoplasia, or also called as tumour, comprises of abnormal cells that keep dividing, despite no demand for new cells formation, and can be benign or malignant (Manuals, 2022). Benign is a mass that do not spread to other areas of the body, while malignant will likely to spread to other parts of the body as it is more aggressive and able to metastasize (Manuals, 2022).

Skin is the most common anatomical site for occurrence of tumours in cat (Shelly, 2003). It is estimated that a quarter of feline neoplasm affect the integumentary system (Filgueira *et al.,* 2022). Same study also stated that this is due to the anatomical structure of the organ itself which has different layers and structures, which increase the risk to neoplastic transformation, thus causing different types of cutaneous tumours. Plus, skin is susceptible to various type of harsh environments because it is the largest and most exposed organ in the body Ho *et al.* (2018) Furthermore, any changes on the skin can be detected easily, as it is clearly visualised and palpated (Ho *et al.*, 2018).

Cytology is a diagnostic procedure that requires microscopic evaluation of cell lesion (Radin and Wellman, 2001). In veterinary oncology, cytological evaluation helps in decision making such as determining a differential or final diagnosis, constructing a further diagnostic plan or suitable treatment, deciding the prognosis through staging, identifying the possibility of recurrence, and observing the progress after a suitable treatment (Friedrichs and Young, 2016). Cytological diagnosis remains as a valuable diagnostic tool with many advantages such as rapid, non-invasive and economic means of getting a preliminary and definitive diagnosis (Ghisleni *et al.,* 2006).

The hypotheses for this study are:

1. $H_0$: There are no distinguishable variations between cutaneous tumour in cats and age, breed or sex presented to Clinical Pathology Laboratory, VLSU-UPM

   $H_a$: There are distinguishable variations between cutaneous tumour in cats and age, breed or sex presented to Clinical Pathology Laboratory, VLSU-UPM
2. $H_0$: There is no significant difference between cytological and histopathological results of feline cutaneous tumour retrieved from VLSU-UPM

   $H_a$: There is a significant difference between cytological and histopathological results of feline cutaneous tumour retrieved from VLSU-UPM

The objectives of the study are to determine the:

1. type of feline cutaneous tumours diagnosed at the Veterinary Laboratory Services Unit, University Putra Malaysia (VLSU-UPM);
2. distribution of feline cutaneous tumours based on age, breed, sex and site of tumour in cats; and
3. corresponding of the cytological result to the histopathological result of feline cutaneous tumours presented to the VLSU-UPM

# 2.0 LITERATURE REVIEW

## 2.1 Cutaneous tumours in cats

### 2.1.1 Age

The reported age for the study of feline cutaneous tumours in United Kingdom by was 11 ± 3.32 for basal cell tumour, 12.20 ± 3.30 for squamous cell carcinoma and 10 ± 9.9 for mast cell tumour (Ho *et al.*, 2018). It was also mentioned that malignant tumours are highly diagnosed in older feline population compared to benign tumours. Cutaneous tumour such as cutaneous lymphoma, melanoma and ceruminous gland adenoma typically occur in older cats, which are more than 10 years old (Raskin, 2016), and was also similarly seen for other tumours like squamous cell carcinoma, ceruminous gland carcinoma and trichoblastoma (Manuali *et al.*, 2020). It was also found that incidence of tumours in cats increase with age and slowly declines thereafter (Graf *et al.*, 2015).

### 2.1.2 Breed

In a study conducted in Canada, among the most predisposed breed that were diagnosed with feline cutaneous tumours were Domestic Long Hair Domestic Medium Hair and Domestic Short Hair (Reid-Smith, 1999). In the same study, cutaneous tumour was diagnosed more in purebred cats compared with mixed breeds. While in Japan, the highest contributor of cat breed was mixed breed (71.8%), American Shorthair (5.6%), Chinchilla (5.3%), and Persian (3.7%) (Shida *et al.*, 2010).

### 2.1.3 Sex

In a study by Stebbins *et al.* (1989), it was shown that specific cutaneous tumours are associated with sex, in which the female: male was 1.24 for squamous cell carcinoma, while conversely, adenocarcinoma and mast cell tumour had female: male of 0.8 and 0.5 respectively. Meanwhile, other study stated that male cats are more susceptible to malignant than benign tumours, and that castrated toms showed higher cases of benign tumours than spayed female especially at a younger age, although there were no significant association was detected between sex (Ho *et al.*, 2018). Furthermore, in Switzerland, tumours in general are commonly found in neutered female cats (43.63%), followed by neutered males (36.62%), intact females (32.43%) and intact males (25.78%) (Graf *et al.*, 2015).

### 2.1.4 Common types of cutaneous tumour in cats

Four common types of cutaneous and subcutaneous tumours diagnosed via histopathology are basal cell tumours, mast cell tumours, squamous cell carcinoma and fibrosarcoma where all of these diagnoses are responsible for 70% of all feline skin tumours (Hauck & Oblak, 2020). Another study also showed the similar results, with basal cell tumour, 26% (n=89), mast cell tumour, 21%, (n=72) squamous cell carcinoma, 15% (n=52) and fibrosarcoma, 15% (n=50) being the most common tumours in cats (Miller *et al.*, 1991). Study by Manuali *et al.* (2020) stated that feline benign cutaneous tumour was commonly trichoblastoma (15.8%) and apocrine

gland adenoma (5.4%) while most common malignant cutaneous tumour were squamous cell carcinoma (28.8%), mast cell tumour (18.8%) and apocrine gland adenocarcinoma (10.8%).

### 2.1.5 Common site of cutaneous tumour

It was found that the most common site for squamous cell carcinoma were nasal planum, pinnae and eyelids (Paterson, 2008). While Siewert *et al.* (2022) mentioned that face, eye-lids and mucocutaneous junctions, are the most common sites for cutaneous lymphoma. Other study mentioned that the most common site of cutaneous tumours was on the head, trunk, extremities and neck. While for mast cell tumour, more than half of the cases located on head was predominantly in the ear (Jung *et al.*, 2019).

### 2.1.6 Differential diagnosis

Raskin (2016) stated that in the case of squamous cell carcinoma, it can be challenging to determine whether dysplastic alterations that take place at the cells is a result of chronic inflammation or an indicator of malignancy. Additionally, basal cell tumours with cytological diagnoses can be histologically defined as pertaining to the epidermis, trichofollicular epithelium, or the adnexal structures of sweat and sebum glands. Thus, basal cell tumours and adnexal or follicular tumours have significant cytological overlap as a result of their shared origin.

## 2.2. Diagnostic cytology

### 2.2.1 Cytology samples in tumour diagnosis

Cytology is the microscopic examination of suspected cells or tissue samples that is spread onto slides (Garrett, 2016). Most lesions are frequently surrounded by an interface of normal host reactive or inflammatory cells. Fast-growing lesions frequently have necrotic material at their centers. Ulcerated surfaces frequently have acellular crusts, inflammation, and pathogenic microbes. Furthermore, aspirating different areas of a lesion has distinct benefits. Diagnostically, sampling from the center of mass lesions is typically more significant, however sampling deep within ulcerated lesions is necessary (Moore, 2017). Practitioners rarely used chemical restraint such as anesthesia or sedation for sample collection therefore, samples can be collected, prepared and evaluated microscopically in a matter of minutes (Ewing, 2019).

### 2.2.2 Sampling method

Impression smears can be obtained from ulcerated or exudative superficial lesions, as well as tissue samples obtained during surgery or necropsy. Impression smears from superficial lesions frequently produce only inflammatory cells, even if the inflammation is a subsequent event; neoplastic cells may not exfoliate in exudates or impression smears of ulcerated masses (Meinkoth & Cowell, 2002). Scraping across the lesion is another sampling method which can be done by using the back of a

scalpel blade or edge of a glass slide. This method is highly recommended especially if imprinting method might yield too few cells for complete assessment (Stone and Reppas, 2010). Ultimately, the most common approach for obtaining cytologic specimens is fine-needle aspiration (FNA). It frequently results in fewer haemorrhage and less distress for the patient. Failure to obtain a monolayer of intact cells results in a specimen that is too thick to evaluate. On the other hand, forceful pressure on the sample may rupture many cells, resulting in a nondiagnostic specimen. (Friedrichs and Young, 2016).

### 2.2.3 Staining method

The most common stains used in cytology diagnosis are Romanowsky type stains such as Wright's, Giemsa, Diff-Quik®), Supravital stains (toluidine blue, New Methylene blue) and Papanicolaou stains (Wellman, 1990).

Table 1. Common stains used in the cytological diagnosis of tumours.

| Stain | Description |
|---|---|
| Romanowsky stain | Inexpensive and easily obtainable, provide excellent nuclear integrity, great cytoplasmic detail, and infectious organisms could be easily identified. |
| Supravital stain | Show high nuclear detail but limited cytoplasmic detail |
| Papanicolaou stain | Provides good nuclear detail and sufficient cytoplasmic detail, but is time consuming and unreliable for clinical practice. |

Source: Wellman (1990).

### 2.2.4 Benefits and limitations

Cutaneous neoplasm can be diagnosed via cytology, enabling prompt diagnosis and quick treatment initiation (Johnson and Myers, 2017). Garrett (2016) stated that cytology has proven to provide definite diagnosis for cutaneous lesions or masses and aid to rule out inflammatory causes, identify the existence of the specific tumour, and to proceed with the next diagnostic test.

However, cytology faces a significant constraint of diagnostic cytology, which is the capacity to obtain a satisfactory specimen (Ghisleni *et al.*, 2006). Moreover, interpreting cytology results should be done with caution, especially when determining the apparent malignancy of skin tumours because substantial cellular atypia does not always occur in malignant tumours as not all benign tumours show minimal cellular atypia. Furthermore, skin lesions induced by inflammation can cause epithelial cells to undergo hyperplasia or dysplasia, mimicking neoplastic change in cytology samples (Johnson and Myers, 2017).

### 2.2.5 Discrepancies between cytology and histopathology

Both cytology and histopathology are complementary diagnostic methods with significant differences in a few aspects such as cost, turnaround time, invasiveness and accuracy of diagnosis (Bender, 2015). Cytological procedure and diagnosis are less expensive and require less amount of time to obtain a result, as compared with histopathology, which is more costly with longer time taken to achieve a final diagnosis.

Histopathological diagnosis helps in determining the invasiveness of the lesion (Morrison & DeNicola, 1993). This is because the architecture and structure of the lesion is sustained, therefore cellular relationship can be identified. Furthermore, Chalita *et al.* (2006) mentioned that comparison study of cytology and histopathology of canine cutaneous and subcutaneous showed 97% accuracy. In addition, it was stated that for neoplasia diagnosis, cytology yields a sensitivity of 89.3%, a specificity of 97.9%, a positive predictive value of 99.4% and a negative predictive value of 68.7%.

Sample taking for cytology diagnosis can be done pre-operatively without general anesthesia or sedative allowing comprehensive examinations (Stone and Reppas, 2010). Plus, FNA for cytology sampling is less expensive than surgical biopsy for histology sampling, for both sample collection and laboratory analysis. Cytology sampling method and laboratory analysis methods are less likely to cause inevitable consequences, less sample processing is required thus cytology results are available sooner than histopathology results.

## 3.0 METHODOLOGY

### 3.1 Data retrieval

Feline cases with confirmed cutaneous tumours submitted to the Clinical Pathology Laboratory, VLSU-UPM for cytological diagnosis and Histopathology Laboratory for histopathological diagnosis from January

2017 to August 2022 were collected and compiled. Data retrieved including age, breed, sex and location of the tumour. Cases with repeated visits with the same cytological diagnosis, or tumours with different cytological diagnoses or at different anatomical sites were recorded as one case. Other cases recorded including all types of cutaneous neoplasia cases with cytological results. Cases without data on the age, breed and sex of the cats were recorded as no value.

### 3.2 Statistical analysis

The frequency of cutaneous tumour, signalment such as age, breed and sex, common type and location of cutaneous tumour were presented as bar charts. The association between the cutaneous neoplasia and age, sex was determined using the normality and Kruskal-Wallis H tests. Other information such as location and type of tumours were described and tabulated as additional information to the complement laboratory data. Any corresponding cases that were submitted for histopathological diagnosis were retrieved from the Histopathology Laboratory, VLSU-UPM. Description and diagnosis from the histopathological reports were recorded and compared with the cytological reports. The statistical analyses were done using SPSS software version 27.0 (SPSS, IBM Inc, USA) at $\alpha$=0.05

# 4.0 RESULTS

## 4.1 Frequency of feline cutaneous tumour

Based on the cytological diagnosis, out of 266 cases of feline neoplasia cases found from the January 2017 to August 2022, 79 cases (29.70%) were diagnosed with cutaneous tumour and 187 cases (70.30%) were cases other than cutaneous tumour such as lymphoma (30.08%), mesenchymal tumour (14.29%) and others (Figure 1).

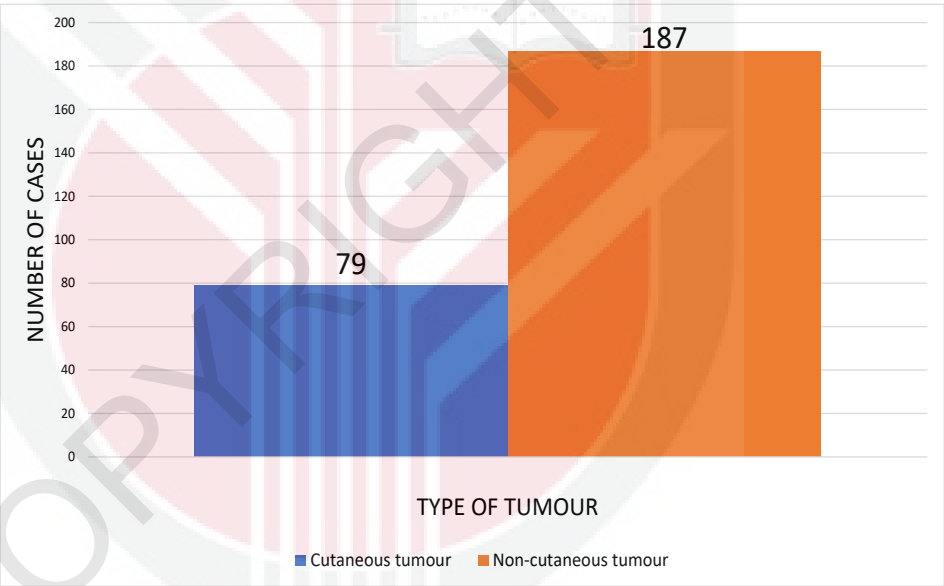



Figure 1. Frequency of cutaneous tumour in cats subjected to cytological diagnosis at the Haematology and Clinical Biochemistry Laboratory, VLSU-UPM.

## 4.2 Age

There was no significant ($p>0.05$) difference in the cases of cutaneous tumour among cats of various age groups which are kitten, young adult, mature adult and senior. Unknown age group was also included in the data.

The most affected age group was senior cats aged more than 10-years-old (Figure 2).

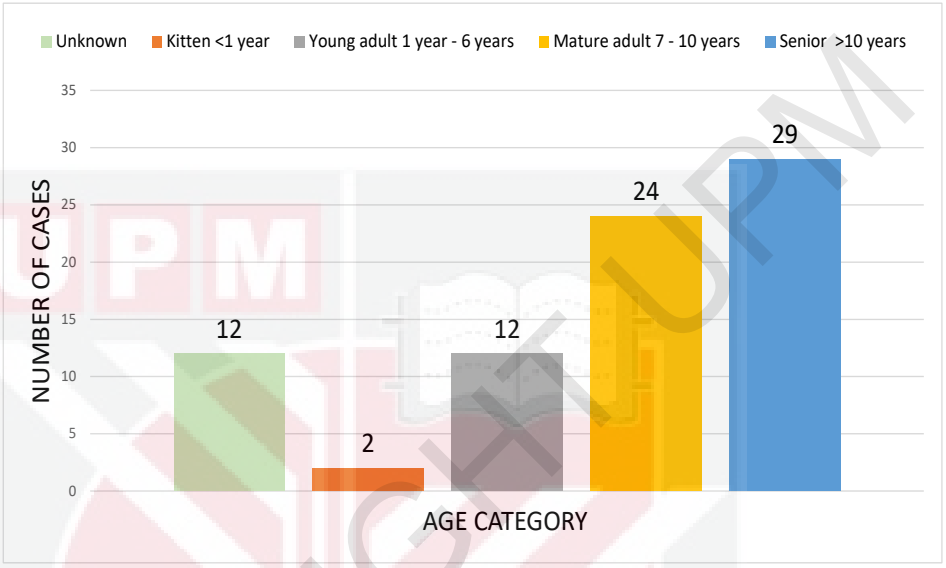



Figure 2. Age of cats presented and diagnosed with cutaneous tumour at the Haematology and Clinical Biochemistry Laboratory, VLSU-UPM.

### 4.3 Breed

There was no significant ($p>0.05$) difference for cutaneous tumour according to breed. All cases were represented by five breeds of cats. The most frequent breeds in the study were Domestic Short Hair and Persian. Domestic Short Hair were over-represented (n=52) in the study (Figure 3).

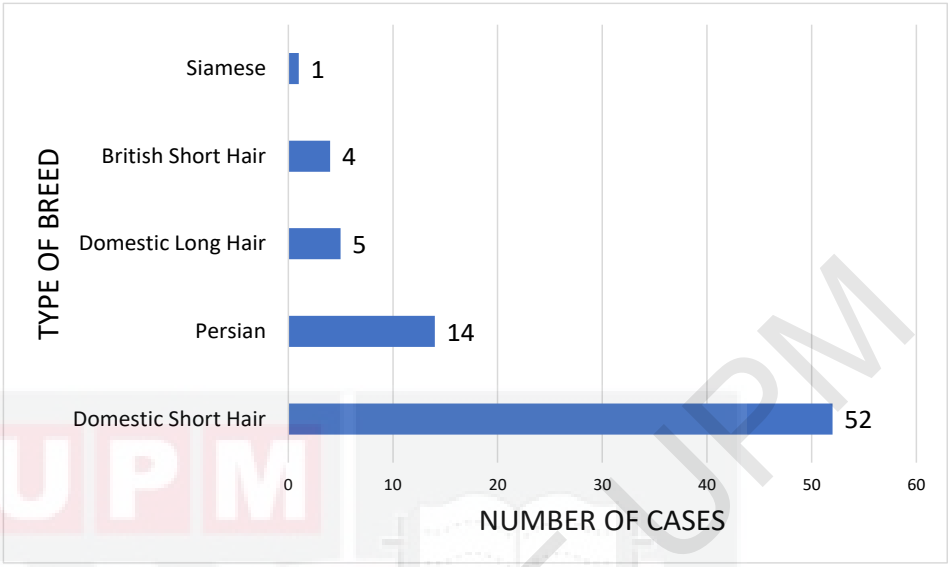



Figure 3. Frequency of breed of cats presented and diagnosed with cutaneous tumour at the Hematology and Clinical Biochemistry Laboratory, VLSU-UPM.

### 4.4 Sex

There was no significance difference ($p>0.05$) between sex of cats with cutaneous tumour. Castrated and intact males are classified as male while spayed female and intact female are categorized as female. Unknown sex was also included in the data (Figure 4).

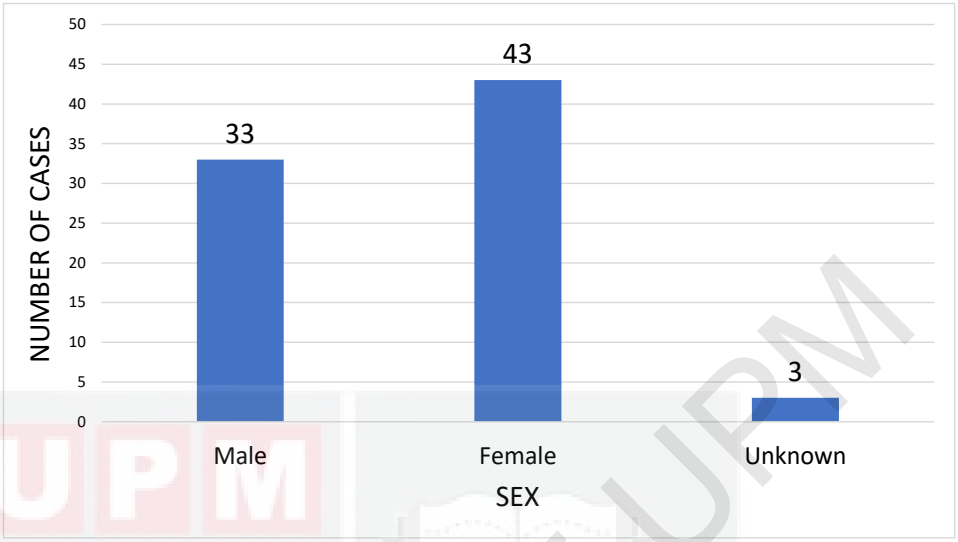



Figure 4. Sex distribution of feline cases presented and diagnosed with cutaneous tumours at the Haematology and Clinical Biochemistry Laboratory, VLSU-UPM.

### 4.5 Type of cutaneous tumour

Case suspected with cutaneous tumour were classified according to the cytology reports and the results showed that the most frequent type of feline cutaneous tumour was squamous cell carcinoma (49.37%), followed by epithelial neoplasm (17.72%) and cutaneous lymphoma (16.46%). A few cases of mast cell tumour (6.33%) and plasmacytoma (6.33%) were recorded (Figure 5).

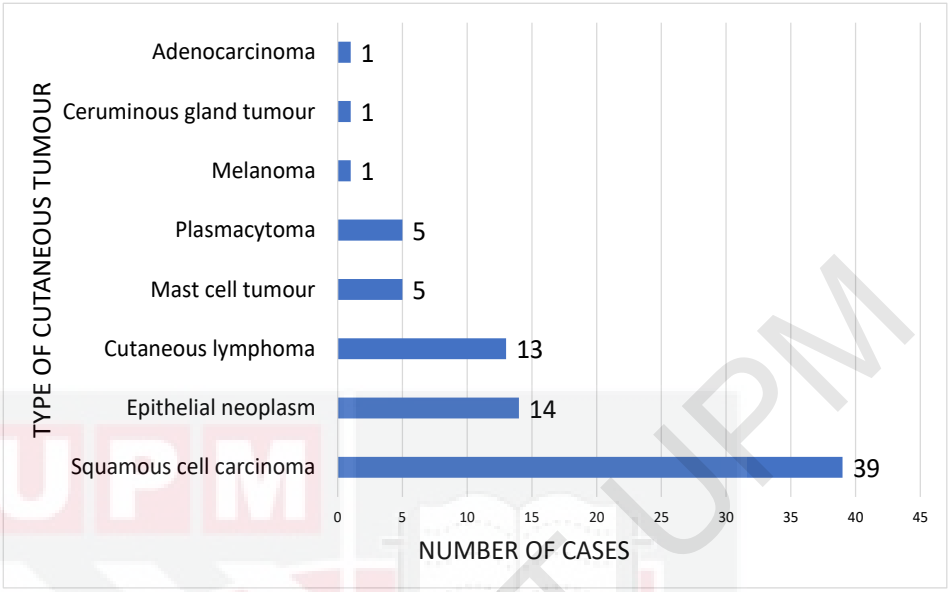



Figure 5. Distribution of cutaneous tumour in cats presented for diagnosis at the Haematology and Clinical Biochemistry Laboratory, VLSU-UPM.

### 4.6 Common site of cutaneous tumours

Based on sampling and cytology diagnosis, among 79 cases of cutaneous neoplasia that was recorded, ear (21.80%) was the common site, followed by the nasal region (19.23%), eye (14.10%) and oral (14.10%) (Figure 6).

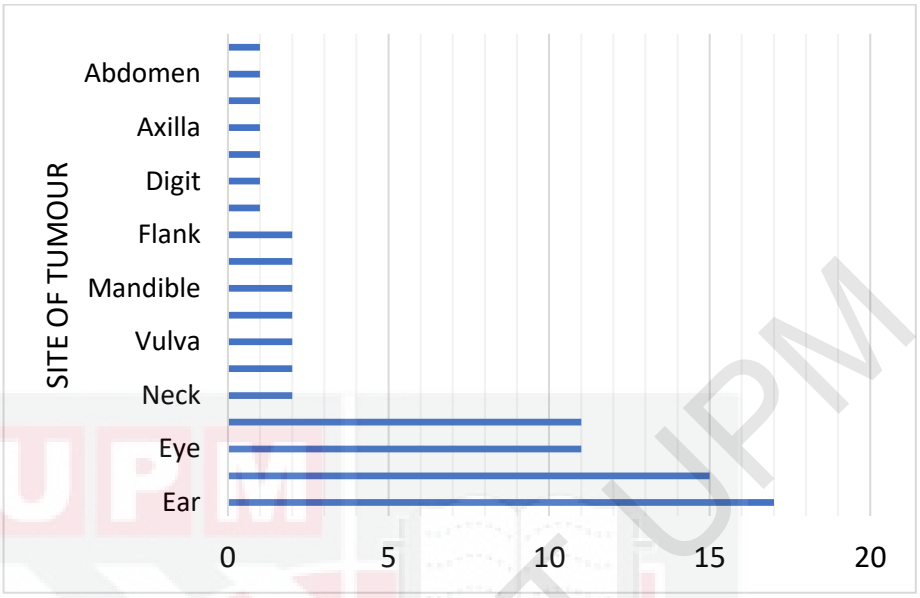



Figure 6. Site distribution of feline cutaneous tumour cases presented and diagnosed at the Haematology and Clinical Biochemistry Laboratory, VLSU-UPM.

### 4.7 Comparison between cytological and histological diagnoses

Only one reported case of suspected cutaneous tumour that was sent to both Clinical Pathology Laboratory, VLSU-UPM and Histopathology Laboratory, VLSU-UPM retrieved. Cytological diagnosis for this case was epithelial cell neoplasm with cytological findings of many tight clusters of pleomorphic poorly differentiated epithelial cells showing malignant characteristic with huge angular and binucleated nucleoli, coarse chromatin and dark blue or scanty cytoplasm.

The histological diagnosis for this case was ceruminous adenocarcinoma with histological findings of neoplasm, characterized by proliferating tubules and nests of neoplastic cells embedded in a dense stroma. The neoplastic cells are cuboidal, have moderate amount of cytoplasm with round to oval nuclei that contain stippled to vesiculated chromatin and 1-2 distinct nucleoli.

Adjacent ducts are ectatic and are lined by attenuated epithelial cells (duct ectasia). Mitotic figures are frequently observed. The stroma is mildly infiltrated by lymphocytes and plasma cells.

## 5.0 DISCUSSION

The frequency of cutaneous tumour that was diagnosed at Clinical Pathology Laboratory, VLSU-UPM from January 2017 to August 2022 was 29.70%. This is consistent with a study conducted in Japan, which stated that out of all feline neoplasm (N=1078), skin accounted for 29.70% (n=318) of them making it the most common site for tumour (Shida *et al.*, 2010). Other study also stated that cutaneous along with subcutaneous tumour are the second highest frequency of tumour in cats after lymphoid system (Vail and Withrow, 2019).

Senior cats which is described as more than 10-years-old, is the highest contributor of cutaneous tumour diagnosis among the other age group. This is consistent with study by Filgueira *et al.* (2022) which mentioned that the highest occurrence of cutaneous tumour are cats that are more than 10 years old, with the peak age at 11-15 years. In the same study, it was mentioned that older cats likely have prolonged exposure to carcinogenic agents and decrease in immune response. However, there is no statistical association between age group and cutaneous tumours.

This study also showed that the most predisposed breed is Domestic Short Hair followed by Persian and Domestic Long Hair. This result is contradicted with study by Miller *et al.* (1991) in which the most predisposed breed reported is

Domestic short hair (80.80%), Siamese (7.43%) and Persian (5.60%). However, this may not represent the true occurrence of breed for cutaneous tumour due to Domestic Short Hair being the most predominant breed that was presented to VLSU-UPM. Plus, study stated that breed predispositions for cutaneous tumour is dominated by mixed-breed cats due to little representative of purebred animals in the feline population (Ho *et al.,* 2018).

Findings showed that female has the highest cases of cutaneous tumour than male. This finding is not consistent with study by Vascellari *et al.* (2009) where male showed higher number of cases than females that was diagnosed with cutaneous tumour. However, there was no association between types of cutaneous tumour and sex. This is supported by study from Vail and Withrow (2019) where when all types of cutaneous tumour are considered together, sex (male and female) and cutaneous tumour do not have any significant association.

The most common diagnosis of cutaneous tumour is squamous cell carcinoma, followed by epithelial neoplasm and cutaneous lymphoma. Other study also showed consistent results with the current findings where the most common diagnosed cutaneous tumour, cytologically, is carcinoma, cutaneous lymphoma and squamous cell carcinoma (Filgueira *et al.,* 2022). Other study also stated that squamous cell carcinoma accounted for 15 to 48% out of all feline cutaneous tumours (Ganta, 2018). Hauck and Oblak (2020) stated that Papilloma virus and ultraviolet radiation are the co-factors of squamous cell carcinoma incidence in cats. In the present study, it is possible that due to Malaysia's equatorial climate, the cats are more exposed to ultraviolet radiation, hence increase chances of developing squamous cell carcinoma.

Present study showed the most common site affected with cutaneous tumor are ear, nose, eye, and oral region. This is consistent with study by Jung *et al.* (2018) which showed that head is the most common site, particularly in the ear. Plus, another study also mentioned that middle ear is most commonly diagnosed as squamous cell carcinoma in feline (McGrath *et al.*, 2022).

In the present study, comparison of diagnosis between cytology and histology showed different result from the same sample. The cytological diagnosis was epithelial cell neoplasm while the histological diagnosis was ceruminous gland adenocarcinoma. This result is supported by Gross *et al.* (2005) as those that are diagnosed as basal cell tumour in the cat is likely involved apocrine ductular sweat gland neoplasm. Same study also stated that basal cell tumour was originated from the lower layer of the epidermis. Therefore, basal cell tumour is categorised under epithelial cell neoplasm. Plus, results may vary due to the different sampling methods. It was mentioned by Ballegeer *et al.* (2007) that cytological diagnosis may miss the representative of the pathologic specimens that occurred at the underlying tissue, whilst histological diagnosis yields better diagnosis due to larger specimen. The whole tissue architecture can be evaluated in histopathology and have less chances to miss the representative of the pathologic process, as compared to cytological technique. Nevertheless, other study has shown that diagnoses from cytological result yield 91% of similarities with histopathological result where all type of cutaneous tumour are correctly identified (Sharkey *et al.*, 2007).

## 6.0 CONCLUSION

This study allows us to determine the occurrence of feline cutaneous tumour presented to VLSU-UPM, based on the cytological diagnosis and frequency of tumours based on age, breed and sex of the cats. The most common diagnosis of cutaneous tumour in cats were squamous cell carcinoma, epithelial neoplasm and cutaneous lymphoma. The most frequent site of cutaneous tumours diagnosed in cats were ear, nasal, eye and oral region. However, there was no association between age, breed and sex of cats with cutaneous tumour.

## 7.0 LIMITATION OF STUDY

All data collected were entirely from the forms and cytology diagnostic reports archived at the Clinical Pathology Laboratory and Histopathology Laboratory, VLSU-UPM. Among limitations in this study is lack of information and incomplete data. There were several cases with missing information including age, breed and sex of the cats and these might lead to false representation as they are included in the study. Therefore, to overcome the limitations, complete information of the patients including age, sex, breed, and type and site of samples must be obtained from the records at UVH, UPM and private clinics for cases referred to the Clinical Pathology Laboratory, VLSU-UPM.

## 8.0 RECOMMENDATIONS

It is recommended that future studies to include feline subcutaneous tumour along with the study of prevalence of canine cutaneous and subcutaneous tumours in VLSU-UPM, to compare prevalence between feline and canine cutaneous and subcutaneous tumours. The cutaneous tumour cases also should be classified as benign or malignant.

Currently, the diagnostic accuracy of cytological diagnosis in comparison with histopathologic results of cases presented to VLSU-UPM is still unknown. This aspect of the study should be included in the future to compare the accuracy of tumour diagnosis between cytological and histopathological diagnoses. This would provide information on the specificity and sensitivity of the cytology and histopathology methods in providing the accurate diagnosis of tumours.

## 9.0 REFERENCES


Affolter, V. K., and Moore, P. F. (1994). Histologie features of normal canine and feline skin. *Clinics in Dermatology*, 12(4): 491–497.

Ballegeer, E. A., Forrest, L. J., Dickinson, R. M., Schutten, M. M., Delaney, F. A., and Young, K. M. (2007). Correlation of ultrasonographic appearance of lesions and cytologic and histologic diagnoses in splenic aspirates from dogs and cats: 32 cases (2002–2005*). Journal of the American Veterinary Medical Association*, 230(5): 690–696.

Bender, H. (2015). 'Cytology vs. Biopsy: Advantages and disadvantages.' Murdoch University, Murdoch, Perth, WA, Australia, 2015

Bourguignon, E., Guimaraes, L. D., Ferreira, T. S., and Favarato, E. S. (2013). Dermatology in Dogs and Cats. In *Insights from Veterinary Medicine*. InTech.

Chalita M. C., Matera, J.M., Alves, M.T. and Longatto, F. A. (2001). Non aspiration fine needle cytology and its histologic correlation in canine skin a and soft tissue tumours. *Anal Quant Cytol Histol*. 23:395–399.

Christensen, N. I., Canfield, P. J., Martin, P. A., Krockenberger, M. B., Spielman, D. S. and Bosward, K. L. (2009). Cytopathological and histopathological diagnosis of canine splenic disorders. *Australian Veterinary Journal* 87(5): 175–181.

Ewing, P. (2019). Color cytology atlas of common feline skin tumors. Available at: https://www.mspca.org/angell_services/color-cytology-atlas-of-common-feline-skin-tumors/

Filgueira, D., Chalita, C., Sellera, P., and Reche-Júnior, A. (2022). Cytopathology of cutaneous and subcutaneous neoplasms in feline species: a retrospective study. *Acta Veterinaria Brasilica*, *16*(3): 220–226.

Friedrichs, K., and Young, K. (2016). Diagnostic Cytopathology in Clinical Oncology. Veterian Key. Retrieved from https://veteriankey.com/diagnostic-cytopathology-in-clinical-oncology/

Ganta C (2018). Cutaneous Squamous Cell Carcinoma in Cats: Associated Factors. Kansas State Veterinary Diagnostic Laboratory. Retrieved from https://www.ksvdl.org/resources/news/diagnostic_insights/march2018/squamous. html.

Ghisleni, G., Roccabianca, P., Ceruti, R., Stefanello, D., Bertazzolo, W., Bonfanti, U., and Caniatti, M. (2006). Correlation between fine-needle aspiration cytology and histopathology in the evaluation of cutaneous and subcutaneous masses from dogs and cats. *Vet Clin Pathol*, 35(1): 24-30.

Graf, R., Grüntzig, K., Hässig, M., Axhausen, K. W., Fabrikant, S., Welle, M., Meier, D., Guscetti, F., Folkers, G., Otto, V., and Pospischil, A. (2015). Swiss Feline Cancer Registry: A Retrospective Study of the Occurrence of Tumours in Cats in Switzerland from 1965 to 2008. *Journal of Comparative Pathology*, *153*(4): 266–277. https://doi.org/10.1016/j.jcpa.2015.08.007

Gross T.L., Ihrke P.J., Walder E.J., Affolter K.V., (2005). Skin diseases of the dog and cat. *Clinical and histopathologic diagnosis*, ed 2, Ames, IA, Blackwell Science.

Hauck, M. L., and Oblak, M. L. (2020). Specific Malignancies in the Small Animal Patient Tumors of the Skin and Subcutaneous Tissues. In: *Withrow and MacEwen's Small Animal Clinical Oncology*, pp. 352-362

Ho, N. T., Smith, K. C., and Dobromylskyj, M. J. (2018). Retrospective study of more than 9000 feline cutaneous tumours in the UK: 2006–2013. *Journal of Feline Medicine and Surgery*, *20*(2): 128–134.

Johnson, M. C., and Myers, A. N. (2017). Cytology of Skin Neoplasms. In Veterinary Clinics of North America - Small Animal Practice. 47(1), pp. 85–110). W.B. Saunders.

Jung, J. Y., Ko, K. R., Choi, Y. M., Jang, S. H., andKim, J. H. (2019). A retrospective study of feline cutaneous tumours in Korea from 2013 to 2018. *Korean Journal of Veterinary Research*, *59*(4), 187–193.

Garrett, L. D. (2016). Cytological Diagnosis & Treatment Options: Common Neoplastic Skin Lesions in Dogs & Cats. *Tvpjournal.Com*, January/February: 28–35.

Manuali, E., Forte, C., Vichi, G., Genovese, D. A., Mancini, D., de Leo, A. A. P., Cavicchioli, L., Pierucci, P., and Zappulli, V. (2020). Tumours in European Shorthair cats: a retrospective study of 680 cases. *Journal of Feline Medicine and Surgery*, *22*(12): 1095–1102.

MSD Vet Manual (2022). What is Cancer? https://www.msdvetmanual.com/special-pet-topics/cancer-and-tumors/what-is-cancer

McGrath, A. M., Chen, C. L., Abrams, B., Hixon, L., Grimes, J. A., Viani, E., McLoughlin, M. A., Tremolada, G., Lapsley, J., and Selmic, L. E. (2022). Clinical presentation and outcome in cats with aural squamous cell carcinoma: A review of 25 cases (2010–2021). *Journal of Feline Medicine and Surgery*, 24(10): 420–432.

Meinkoth, J. H., and Cowell, R. L. (2002). Sample collection and preparation in cytology: increasing diagnostic yield. *Vet Clin Small Anim Pract*, 32(6): 1187-1207.

Miller, M. A., Nelson, S. L., Turk, J. R., Pace, L. W., Brown, T. P., Shaw, D. P., Fischer, J. R., and Gosser, H. S. (1991). Cutaneous Neoplasia in 340 Cats. In *Vet Pathol* (Vol. 28).

Moore, A. R. (2017). Preparation of Cytology Samples: Tricks of the Trade. In *Veterinary Clinics of North America - Small Animal Practice* (Vol. 47, Issue 1, pp. 1–16). W.B. Saunders.

Morris, J., and Dobson, J. (2008). Small Animal Oncology.

Morrison, W. B., and DeNicola, D. B. (1993). Advantages and disadvantages of cytology and histopathology for the diagnosis of cancer. Seminars in Veterinary Medicine and Surgery (Small Animal), 8(4), 222–227.

Moriello, K. A. (2022). Structure of the Skin in Cats. MSD Veterinary Manual. Retrieved from https://www.msdvetmanual.com/cat-owners/skin-disorders-of-cats/structure-of-the-skin-in-cats

Paterson S. M. (2008). *Manual of Skin Diseases of the Dog and Cat, 2nd Edition*.

Radin, M. J. and M. L. Wellman, M. L. (2001). Interpretation of Canine and Feline Cytology, 2nd ed., Gloyd Group Inc., USA, pp. 1-92

Raskin, R. E. (2016). Skin and Subcutaneous Tissues. In *Canine and Feline Cytology* (pp. 34–90). Elsevier.

Reid-Smith, R. J. (1999). The Incidence of Neoplasia In The Cat And Feline Patient Populations of Private Veterinary Practices In Southern Ontario. [Doctoral dissertation, University of Guelph].

Rossetto, V. J. V., Moreno K., Grotti C.B., Reis A.C.F., Bracarense A.P.F.R.L., (2009). Frequency of neoplasms in dogs diagnosed by cytological examination: a retrospective study in a teaching hospital. Seminar on Agricultural Sciences, 30(1): 189-200.

Sharkley, L. C.; Dial, S. M.and Matz, M. E. (2007). Maximizing the diagnostic value of cytology in small animal practice. Veterinary Clinics: *Small Animal Practice*, 37(2): 351–372.

Shelly, S. M. (2003). Cutaneous lesions. Veterinary Clinics: *Small Animal Practice*, v. 33, n. 1, p. 1 46.

Shida, T., Yamada, T., Maruo, T., Ishida, T., Kawamura, H., Takeda, H., Sugiyama, H., Ishikawa, T., Ito, T., Madarame, H., Kayanuma, H., and Suganuma, T. (2010). A Retrospective Study in 1,070 Feline Tumor Cases of Japan. *Journal of Japan Veterinary Cancer Society*, 1(1): 1–7. https://doi.org/10.12951/jvcs.1.1

Siewert, J., Pellin, M. A., Husbands, B. D., Curran, K. M., Scavelli, D., and Sampene, E. (2022). Feline cutaneous lymphoma: an evaluation of disease presentation and factors affecting response to treatment. *Journal of Feline Medicine and Surgery*, *24*(4): 389–397.

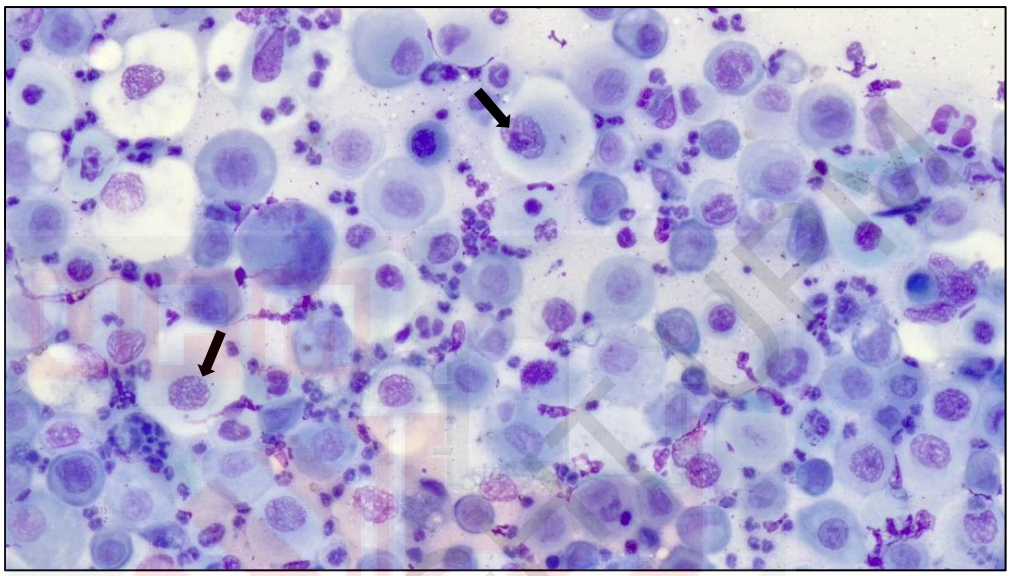
Stebbins, K. E., Morse, C. C., and Goldschmidt, M. H. (1989). Feline Oral Neoplasia: A Ten-Year Survey. In *Vet. Pathol* (Vol. 26).

Stone, B., and Reppas, G. (2010). Cytology Sample Collection and Preparation for Veterinary Practitioners. Retrieved from https://www.vetqml.com.au/Portals/0/PDF/Publications/CytologySampleCollection.pdf

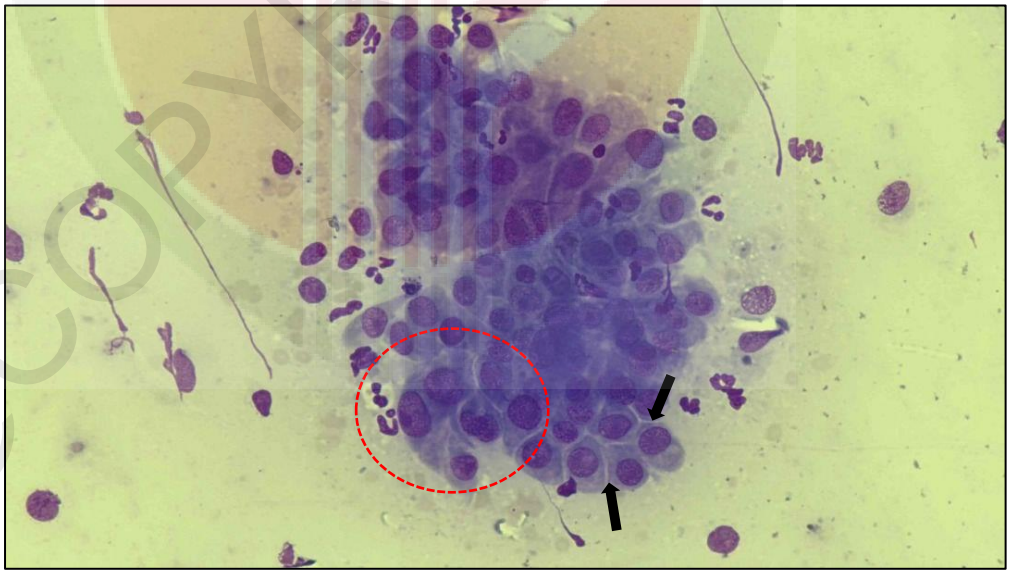
Vail, D., and Withrow, S. (2019). *Withrow and MacEwen's Small Animal Clinical Oncology*. 6th ed., Saunders.

Wellman, M. L. (1990). The cytologic diagnosis of neoplasia. *The Veterinary Clinics of North America - Small Animal Practice*, 20(4): 919-938.

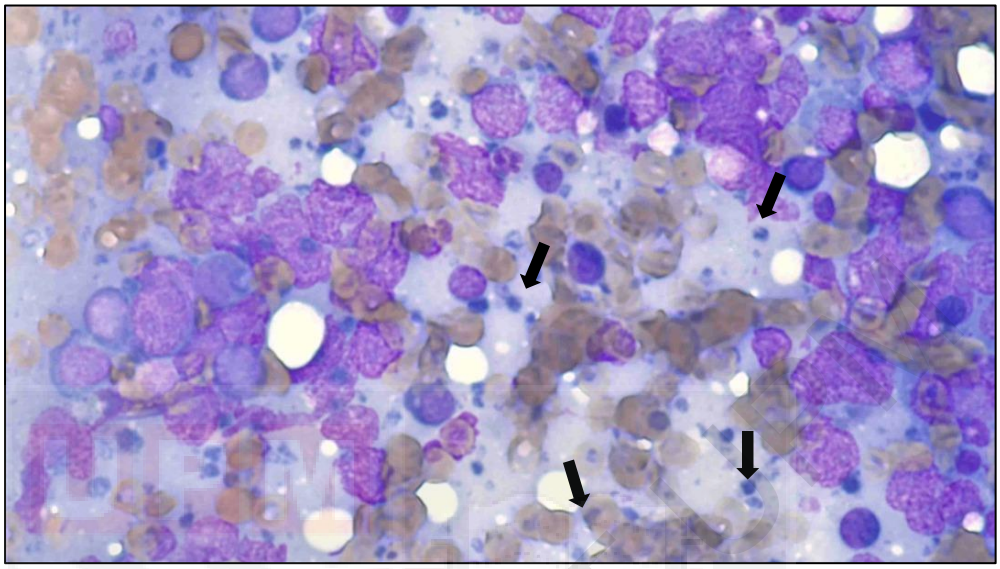
## 10.0 APPENDICES



**Appendix 1.** Squamous cell carcinoma showing signs of malignancy such as pleomorphism anisokaryosis and coarse chromatin (black arrows).



**Appendix 2.** Epithelial neoplasm showing epithelial cells sit in a cluster with clear intercellular border (black arrows) and malignant figures such as anisokaryosis (red circle).



**Appendix 3.** Cutaneous lymphoma showing lymphoglandular bodies (black arrows).