# INCIDENCE OF TUMOURS IN DOGS AND CATS OPERATED AT THE KM GLOBAL ANIMAL HOSPITAL, MALAYSIA IN 2023

**AKHILA, T. R.[1*], MANIKANDAN, K.[1], ADIBA, A.R.[2], GANESH, T.N.[1], AND MANIKAM, K.[1]**

1 Surgery Unit, KM Global Animal Hospital (KMGAH), 5 Jln Industri Batu Caves, 1/1, Taman Perindustrian Batu Caves, Selangor, Malaysia

2 Laboratory Unit, KM Global Animal Hospital (KMGAH), 5 Jln Industri Batu Caves, 1/1, Taman Perindustrian Batu Caves, Selangor, Malaysia

**Corresponding author:* akhilatr333@gmail.com

**ABSTRACT**. A retrospective study was conducted on tumours in 54 dogs and 9 cats operated and documented at the KM Global Animal Hospital (KMGAH), Malaysia, in year 2023. The objective of the study was to investigate the incidence of tumours treated via surgical excision. The study was conducted based on the clinical, surgical and biopsy reports of dog and cat patients who underwent tumour surgery from the 1st of January 2023 to 31st December 2023. Among the 1003 cases of dogs and cats that underwent surgery, 63 cases (6.2%) comprising 54 dogs and 9 cats underwent tumour excision. Among the operated cases, histopathology examination was performed on samples of 38 dogs (70.3%) and 6 cats (66.6%). Among 38 dogs, 26 different types of tumours were identified, and among 6 cats, 5 different types of tumours were identified, indicating a wide variation in the types of tumours. The incidence of tumours in operated cases was highest in mixed dog breeds (37%). In cats, the most affected breed was the Domestic Shorthair (78%). Among the operated cases, dogs (57%) and cats (56%) above 10 years old were the most affected. Among dogs, 20 (37%) were neutered while among cats, 5 (55.5%) were neutered. In both species, the females were more affected, and the mammary gland was the organ most affected. The fine-needle aspiration cytology (FNAC) performed in all 16 cases correlated with histopathology examination. The most common tumour types identified were lipoma and mast cell tumour in dogs (13.1% each), and adenocarcinoma in cats (33.3%). In conclusion, this study provided valuable information on the incidence pattern, recent trends, and potential areas for further investigation of tumours in dogs and cats. It is further concluded that retrospective and prospective studies of a longer duration will provide sufficient data for a thorough understanding of tumour incidence in dogs and cats.

*Keywords:* Dog, cat, tumour, incidence, FNAC

## INTRODUCTION

Cancer is a disease of the genome arising from DNA alterations due to mutated gene structure or function. Many agents, including viruses, chemicals, radiation damage, and altered gene expression are common features of almost all cancerous tumours (neoplasms). Cats and dogs are exposed to the same environmental risk factors as humans and the complex interactions between genetic and environmental risk factors can trigger tumorigenesis (Kaya *et. al*., 2023).

Approximately 25% of cats and dogs are expected to succumb to cancer or diseases related to cancer in their lifetime (Dobson, 2010). An extensive demographic study spanning two decades and involving a substantial sample size of 74,000 dogs from the Veterinary Medical Database in North America revealed that neoplastic disease emerged as the predominant terminal pathological condition across 73 out of 82 canine breeds (Fleming *et al*., 2011).

Diagnosis of neoplasia are determined using histopathology as a gold standard. Fine needle aspiration biopsy is a useful diagnostic tool to evaluate the palpable cutaneous and subcutaneous tumours and there was 88.7%

agreement between cytologic and histologic diagnosis (Radostin, 2010). Chemotherapy is a commonly integrated treatment option within human and animal oncology regimes. However, surgical excision remains the benchmark for treating solid tumours (Eisenhauer *et. al*., 2009).

Cancer registries serve as essential instruments for systematically gathering epidemiological data on cancer incidence, and they play a pivotal role in shaping evidence-based strategies for cancer prevention and control efforts (Pinello *et al.,* 2022a). Examining past epidemiological studies offers a valuable method and a crucial information reservoir for analysing the behaviour of neoplastic diseases over an extended time frame. However, current literature provides limited data on the incidence of tumours in dogs and cats in Malaysia, which limits understanding of the disease. Hence, this study was conducted to investigate the incidence of tumours in dogs and cats treated via surgical excision at the KM Global Animal Hospital (KMGAH), Batu Caves, Selangor, Malaysia.

## MATERIALS AND METHOD

The study was conducted based on the clinical, surgical and biopsy reports of dogs and cats that underwent tumour surgery at KMGAH between the 1st of January and 31st December 2023. The case(s) details included information on the species, breed, sex (intact or neutered), age, and anatomical location of the tumour. None of the dogs and cats included in this study had a past history of treatment for tumours. For definitive diagnosis, a fine needle aspiration cytology (FNAC) and histopathological examination based on incisional or excisional biopsy samples were carried out with the clients' consent. FNAC alone was carried out for diagnosis on some patients when the owners declined further histopathological examination. The data collected were organised into tables in Microsoft Excel (Microsoft, USA), where spreadsheet functions were applied to calculate the percentage (incidence rate) and the frequency of each tumour type.

## RESULTS AND DISCUSSION

In year 2023, out of 1003 surgical cases operated at the hospital, 63 cases (6.3%) underwent surgical intervention for tumour excision. Out of 63 cases, 54 dogs (85.7%) underwent surgical excision of tumour, with histopathological examination performed on 38 cases (70.4%). Similarly, surgical intervention for tumour was performed on 9 cats (14.3%), with a histopathological examination performed on 6 cases (66.7%). The breed, sex (neutered or non-neutered), age, tumour location, histopathology findings and the type of tumour (benign or malignant) were documented in this study and analysed by comparing patient factors with tumour factors.

### Breed wise distribution

Among the operated dogs, the incidence of tumour in different breeds were as follows: mixed breed (37%), Shih Tzu (14.8%), Rottweiler and Standard Poodle (7.4% each), Schnauzer, Siberian Husky, German Shepherd, Doberman Pinscher and Pug (3.7% each), with American Pitbull Terrier, Beagle, Chihuahua, Golden Retriever, Labrador Retriever, Pomeranian, Sheltie and Toy Poodle at 1.8% (Table 1).

It was found that mixed breeds were affected more by tumours than purebred dogs. Senthil *et al.* (2020) also observed that the majority of dogs affected with tumours were mixed breeds. Contrary to this finding, Arya *et al.* (2018) recorded that Pomeranians (35.48%)

**Table 1**: Incidence of tumours in different dog breeds

| Breeds | No. of Dogs | Percentage (%) |
|---|---|---|
| **Mixed Breed** | 20 | 37 |
| **Shih Tzu** | 8 | 14.8 |
| **Standard Poodle** | 4 | 7.4 |
| **Rottweiler** | 4 | 7.4 |
| **German Shepherd** | 2 | 3.7 |
| **Schnauzer** | 2 | 3.7 |
| **Pug** | 2 | 3.7 |
| **Siberian Husky** | 2 | 3.7 |
| **Doberman Pinscher** | 2 | 3.7 |
| **Chihuahua** | 1 | 1.8 |
| **Golden Retriever** | 1 | 1.8 |
| **Labrador Retriever** | 1 | 1.8 |
| **Pomeranian** | 1 | 1.8 |
| **American Pit Bull Terrier** | 1 | 1.8 |
| **Beagle** | 1 | 1.8 |
| **Sheltie** | 1 | 1.8 |
| **Toy Poodle** | 1 | 1.8 |
| **TOTAL** | **54** | **100** |

were more affected by neoplasms than the mixed breed dogs, which were least affected (6.45%). In this study, mammary tumours were found more in pure breeds (57%). In a study on canine mammary tumours in Malaysia by Shahabi *et al.* (2015), out of 48 dogs, 40 were purebred dogs, and the remaining 8 were mixed breeds. As reported by Devarathnam *et al.* (2021), the Spitz exhibited the highest incidence of canine mammary tumours (61.11%), followed by Labrador Retrievers (25%), while the lowest incidence was observed in Mongrels (13.89%). Similar observations were found by Sorenmo *et. al.* (2011) that miniature and toy breeds were more prone to mammary gland tumours.

In the present study, the toy breed Shih Tzu (14.8%) was next to mixed breed in tumour occurrence, and two out of six Shia Tzu breed had mammary tumours. The number of reported cases of neoplasms in a particular breed may correspond more closely to its population size in the area rather than indicating a true predisposition. This phenomenon underscores the importance of considering factors such as breed popularity and regional demographics when interpreting epidemiological data on canine neoplasms. Dobson (2013) observed that cancer can impact dogs of all breeds and mixed breeds. Certain dog breeds exhibit increased susceptibility to specific cancers, suggesting a potential genetic predisposition. Hence, further

investigation on the breed predisposition of canine cancers in Malaysia is warranted.

Among cats, the breeds affected were Domestic Shorthair (77.8%) and Maine Coon (22.2%) (Table 2). Pérez-Enriquez *et al.* (2020) also found that out of the 685 cases diagnosed with neoplasms, 37.7% involved domestic cats.

**Table 2**: Incidence of tumours in different cat breeds

| Breeds | No. of Cats | Percentage (%) |
|---|---|---|
| **Domestic Short Hair** | 7 | 77.8 |
| **Maine Coon** | 2 | 22.2 |
| **TOTAL** | **9** | **100** |

### Age wise distribution

In this study, dogs above 10 years (57%) were affected more, followed by the age group 5-9 years (37%), and 0-4 years (6%) (Table 3). Among 14 cases of canine mammary tumour, all the dogs were above 4 years of age, and among them, 9 cases (64.3%) were above 10 years of age. Similar findings were reported by Gupta *et al.* (2012) that the frequency of canine neoplasms typically rise with age, peaking around 10 years old, which coincides with the average life expectancy of dogs.

**Table 3.** Number of tumour cases in dogs and its percentage according to age group

| Age (in years) Group | No. of Cases | Percentage (%) |
|---|---|---|
| 0-4 | 3 | 6 |
| 5-9 | 20 | 37 |
| 10 and above | 31 | 57 |

Among cats, 5 animals (56%) were older than 10 years, while 2 animals each (22% each) were in the 5-10 year and 0-4 year age groups (Table 4). However, Kaya *et al*. (2023) stated that tumour incidence revealed that cats between 6 and 9 years demonstrated the highest frequency, suggesting further investigation with the local population of cats with larger data on tumours.

**Table 4.** Number of tumour cases in cats and its percentage according to age group

| Age (in years) Group | No. of Cases | Percentage (%) |
|---|---|---|
| 0-4 | 2 | 22 |
| 5-9 | 2 | 22 |
| 10 and above | 5 | 56 |

### Sex wise distribution

In this study, among dogs, 32 animals (59%) were female and 22 (41%) were male (Figure 1). All the dogs affected with mammary tumour were female. In cats, 5 animals (56%) were female, and 4 animals (44%) were male (Figure 1). All the cats affected with mammary tumour were female.

Similar findings were reported by Vachhani *et al*. (2004) and Pérez-Enriquez *et al.* (2020) in their study on dogs and cats, respectively. Pérez-Enriquez *et al.* (2020) observed that females exhibited a higher frequency of neoplasms, accounting for close to 65%. In contrast, Lather *et al*. (2017), in their 10-years study, stated that there is no correlation between sex and tumour formation, warranting further investigation on sex and tumour incidence. Lana *et al.* (2007) explained that mammary tumour was seen more in intact females and were extremely rare in males.

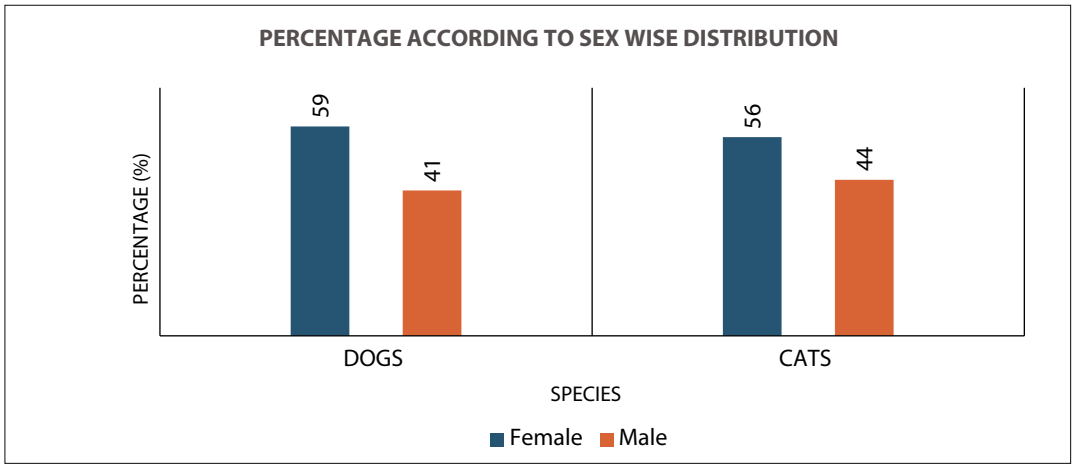


**Figure 1.** Percentage distribution of tumours according to sex wise distribution

**Neutered versus Non-neutered**

In the present study, among dogs operated for tumour, 20 animals were neutered and 34 were non-neutered (Table 5). Among non-neutered, 11 were neutered during surgery. Among 14 canine mammary tumour cases, 9 cases (64.3%) were non-neutered and 5 cases (35.7%) were neutered.

In conclusion, the tumour incidence was seen more in intact than in neutered dogs. However, Richards *et al*. (2001) observed no relationship between neutering and neoplasm occurrence. According to Beauvais *et al.* (2012), neutering bitches before the first heat cycle reduces the high risk of neoplasia and neutering before the age of 2.5 years also reduces the risk of malignant mammary tumours. Also, in a study conducted by Shahabi *et al.* (2015) at Universiti Putra Malaysia, it was recorded that from data of dogs affected with mammary tumours, 89.6% were intact females and 10.4% were spayed females.

Among cats, 6 animals (55.5%) were neutered and 3 (44.5%) were non-neutered. In 6 neutered cases, 5 were neutered before surgery, and one cat was neutered during surgery. Among cats, neutered cases showed a higher incidence of tumours, despite only a slight percentage difference. Among mammary tumour cases, out of 3 cats, 2 cats were neutered before surgery, and one cat was non-neutered. In cats, there is considerably less evidence on this subject. A study by Overly *et al.* (2005) showed that spaying cats prior to 1 year reduces the risk of neoplasm by 86% and spaying at or before 6 months reduces the incidence of neoplasm by 91%. However, there's a need for further investigation on this finding.

**Anatomical distribution of tumours**

Among dogs, there were 15 type of anatomical distribution of tumours as shown in Table 6.

**Table 5**: Number and percentage of tumour cases among Neutered *versus* Non – Neutered

| | Neutered | Percentage (%) | Non-neutered | Percentage (%) |
|---|---|---|---|---|
| **Dog** | 20 | 37.1 | 34 | 62.9 |
| **Cat** | 6 | 55.5 | 3 | 44.5 |

The mammary gland was the most affected anatomy, followed by other regions. Similar findings were observed by Vachhani *et al.* (2004). Lather *et al.* (2017) also reported that the highest number of neoplasms were associated with the mammary gland, followed by the reproductive organ, cutaneous origin, eye region, oral region, anal region, ear and prostate gland.

Among cats, tumours occurred in the mammary gland for 3 animals (33.3%), at the ear pinna for 2 animals (22.2%) and 1 animal each at the chest region, oral cavity, tail and internal organ (liver). (Table 7). Kaya *et al*. (2023) found that in cats, the most common tumours were found in the skin and subcutaneous tissues, followed by the mammary glands, and then the ears and ear canal. Hence, further investigation is required to study the tumour location in cats.

**Diagnostic workup of tumours**

Out of 54 dogs, 16 tumours were subjected for both fine needle aspiration (FNA) biopsy and histopathology, while 38 tumours were subjected to histopathology. Out of 9 cats, 6 tumours were subjected for histopathology and 3 tumours were subjected for FNA biopsy and histopathology.

**Fine Needle Aspiration Cytology (FNAC) and Histopathological Study**

Among the 63 cases, 16 cases (25.3%) underwent a FNAC procedure before surgical excision, and all samples were identified as cancerous. Out of 16 cases, 2 cases were lipoma, which showed circumscription and encapsulation of fat globules. The other 14 cases showed cellular enlargement, increased nuclear/cytoplasmic

**Table 6**: Anatomical distribution of tumours in dogs

| Location of Tumours | No. of Cases | Percentage (%) |
|---|---|---|
| **Mammary gland** | 14 | 26 |
| **Chest region** | 8 | 14.8 |
| **Neck region** | 5 | 9.5 |
| **Anal region** | 4 | 7.4 |
| **Forelimb** | 4 | 7.4 |
| **Hindlimb** | 4 | 7.4 |
| **Oral cavity** | 3 | 5.5 |
| **Abdomen region** | 2 | 3.7 |
| **Mandible** | 2 | 3.7 |
| **Ear** | 2 | 3.7 |
| **Withers** | 2 | 3.7 |
| **Head region** | 1 | 1.8 |
| **Inguinal region** | 1 | 1.8 |
| **Urinary bladder** | 1 | 1.8 |
| **Uterus** | 1 | 1.8 |
| **Total** | **54** | **100** |

**Table 7**: Anatomical distribution of tumours in cats

| Location of Tumours | No. of Cases | Percentage (%) |
|---|---|---|
| **Mammary gland** | 3 | 33.3 |
| **Ear pinna** | 2 | 11.1 |
| **Chest region** | 1 | 11.1 |
| **Tail** | 1 | 11.1 |
| **Oral cavity** | 1 | 11.1 |
| **Liver** | 1 | 11.1 |
| **Total** | **9** | **100** |

ratio and high cellularity, identified as cancerous. All the 16 results of FNAC correlated with the histopathological findings. Alleman and Bain (2000) quoted that in instances where inoperable malignant neoplasms are identified, a positive cytological diagnosis obviates the need for further confirmatory biopsy procedures. In a study by Radostin (2010), out of 193 confirmed cutaneous neoplastic cytologic specimens, 190 cases were true positives, and only 3 cases were found to be false positives in histopathological evaluation. However, Biller *et al.* (2016) suggested that cytology may lack tumour grade details and occasionally yield ambiguous outcomes, but histopathology offers definitive diagnoses and critical data on tissue structure, aiding in treatment decisions and prognostic assessments.

Among 54 cases of tumour excision in dogs, histopathology was done on 38 cases (70.3%) and from these, 26 different types of tumours were identified (Table 8). Lipoma and mast cell tumour accounted each for 13.1% of cases, followed by complex carcinoma and melanoma each 7.8% and haemangioma 5.2%, and others were sebaceous carcinoma, myxoma, mixed-type tumours, hepatoid gland epithelioma, hepatoid gland adenoma, mammary gland carcinoma, cutaneous fibrolipoma, mammary osteosarcoma, apocrine ductal carcinoma, ductal adenoma, trichoblastoma, trichoepithelioma, hemangiopericytoma, squamous papilloma, hepatoid adenoma, urothelial cell carcinoma, uterine carcinoma, basosquamous carcinoma, soft tissue sarcoma, fibroma, mixed type carcinoma and sarcoma each accounted for 2.5% (Table 8). In AAHA Oncology Guidelines for Dogs and Cats, Biller *et al.* (2016) mentioned the common tumours in dogs were anal sac carcinoma, lymphoma, mammary gland cancer, mast cell tumour, oral malignant melanoma, osteosarcoma, soft tissue sarcoma and splenic hemangiosarcoma. Among the 9 mammary gland tumours in dogs evaluated by histopathology, 4 were carcinomas, followed by other types of tumours, mammary osteosarcoma, soft tissue sarcoma, ductal adenoma, mixed-type benign tumour and fibroma. Similar findings were observed by Sahabi *et al.* (2015).

**Table 8.** Signalment, tumour location and results of histopathological study in dogs

| Sl.No | Breed | Sex/ Neutered/ Non-Neutered | Age | Histopathology Result/ Location of Tumour | Malignant/ Benign |
|---|---|---|---|---|---|
| 1 | German Shepherd | Female Neutered | 8 yr 7 months | Sebaceous carcinoma/ Chest region | Malignant |
| 2 | German Shepherd | Female Non-Neutered | 9 yr 6 months | Complex carcinoma/ Mammary gland | Malignant |
| 3 | Rottweiler | Female Neutered | 10 yr 6 months | Melanoma/Mammary gland | Malignant |
| 4 | Rottweiler | Female Non-Neutered | 12 yr 9 months | Myxoma/Chest region | Benign |
| 5 | Doberman Pinscher | Male Non-Neutered | 9 yr 6 months | Haemangioma/Chest region | Benign |
| 6 | Doberman Pinscher | Male Non-Neutered | 13 yr 6 months | Lipoma/Anal region | Benign |
| 7 | Standard Poodle | Male Non-Neutered | 9 yr 4 months | Melanoma/forelimb | Malignant |
| 8 | Standard Poodle | Female Neutered | 9 yr 1 month | Lipoma/chest region | Benign |
| 9 | Standard Poodle | Female Non-Neutered | 7 yr 4 months | Mixed type benign tumour/ Mammary gland | Benign |
| 10 | Standard Poodle | Male Non-Neutered | 10 yr | Hepatoid gland epithelioma/ Anal region | Benign |
| 11 | Shih tzu | Male Non-Neutered | 12 yr 8 months | Hepatoid gland adenoma/ Anal region | Benign |
| 12 | Shih tzu | Female Non-Neutered | 12 yr 3 months | Mammary solid carcinoma/ Mammary gland | Malignant |
| 13 | Shih tzu | Male Non-Neutered | 15 yr 7 months | Mast cell tumour/Ear pinna | Malignant |
| 14 | Shih tzu | Male Neutered | 10 yr 4 months | Cutaneous fibro lipoma/ Neck region | Benign |
| 15 | Shih tzu | Female Neutered | 9 yr 11 months | Right - mammary osteosarcoma/Mammary gland | Malignant |
| 16 | Shih tzu | Male Non-Neutered | 13 yr 2 months | Melanoma/Mandible | Malignant |
| 17 | Shetland sheep dog | Female Non-Neutered | 9 yr | Apocrine ductal carcinoma/ Ear canal | Malignant |
| 18 | Pug | Female Neutered | 8 yr 8 months | Ductal adenoma (basaloid adenoma)/Mammary gland | Benign |
| 19 | Pomeranian | Female Non-Neutered | 4 yr 6 months | Trichoblastoma/Neck | Benign |

| Sl.No | Breed | Sex/ Neutered/ Non-Neutered | Age | Histopathology Result/ Location of Tumour | Malignant/ Benign |
|---|---|---|---|---|---|
| 20 | Chihuahua | Female Non-Neutered | 13 yr | Trichoepithelioma/Forelimb | Benign |
| 21 | Schanuzer | Female Neutered | 13 yr 8 months | Hemangiopericytoma/ Forelimb | Malignant |
| 22 | Golden Retriever | Female Neutered | 10 yr 4 months | Squamous papilloma/ Oral cavity | Benign |
| 23 | Siberian husky | Male Neutered | 9 yr 3 months | Lipoma/Forelimb | Benign |
| 24 | Siberian husky | Male Non-Neutered | 11 yr 8 months | Hepatoid adenoma/ Anal region | Benign |
| 25 | Mixed breed | Male Neutered | 14 yr 4 months | Urothelial cell carcinoma/ Urinary bladder | Malignant |
| 26 | Mixed breed | Female Non-Neutered | 10 yr 9 months | Complex carcinoma/ Mammary gland | Malignant |
| 27 | Mixed breed | Male Non-Neutered | 11 yr | Low grade mast cell tumour/ Abdomen region | Malignant |
| 28 | Mixed breed | Female Non-Neutered | 12 yr 3 months | Uterine carcinosarcoma/ Uterus | Malignant |
| 29 | Mixed breed | Female Neutered | 11 yr | Mast cell tumour/Hindlimb | Malignant |
| 30 | Mixed breed | Male Non-Neutered | 10 yr 9 months | Mast cell tumour/Chest | Malignant |
| 31 | Mixed breed | Female Neutered | 10 yr 11 months | Fibroma/Mammary gland | Benign |
| 32 | Mixed breed | Female Neutered | 16 yr 1 month | Complex carcinoma/ Mammary gland | Malignant |
| 33 | Mixed breed | Male Neutered | 10 yr | Mast cell tumour/Hindlimb | Malignant |
| 34 | Mixed breed | Male Neutered | 5 yr 5 months | Lipoma/Inguinal region | Benign |
| 35 | Mixed breed | Female Neutered | 14 yr 9 months | Haemangioma/ Chest region | Benign |
| 36 | Mixed breed | Female Non-Neutered | 4 yr 11 months | Lipoma/Hindlimb | Benign |
| 37 | Mixed breed | Male Non-Neutered | 6 yr 1 month | Basosquamous carcinoma/ chest region | Malignant |
| 38 | Mixed breed | Female Neutered | 13 yr 10 months | Soft tissue sarcoma/ Mammary gland | Malignant |

*Note: yr = years

Among the 9 cases of neoplasm in cats, histopathology was done on 6 cases (66.6%), and 5 different types of tumours were identified (Table 9). Adenocarcinoma accounted for 33.3% and the other tumours, mast cell tumour, intratubular papillary carcinoma, mammary tubular carcinoma and trichoblastoma, contributed 16.6% each. Biller *et al.* (2016) mentioned the common tumours in cats were lymphoma, mammary gland cancer, squamous cell carcinoma and soft tissue sarcoma. Among the 3 mammary gland tumours, 2 cases were evaluated by histopathology and identified as intratubular papillary carcinoma and mammary tubular carcinoma. According to Burrai *et al*. (2022), mammary gland tumour of cats was morphologically classified as papillary adenomas into intraductal, ductal and simple, which again were divided into ductal ectasia, lobular hyperplasia, epitheliosis, papillomatosis and fibro adenomatous changes.

**Benign versus Malignant**

Based on histopathology findings, for dogs, the tumours were malignant in 20 dogs (52.6%) and benign in 18 dogs (47.4%). Among 9 mammary tumours, 7 (77.8%) were malignant and 2 (22.2%) were benign. In cats, 5 animals (83.3 %) had malignant tumour, and 1 animal (16.7 %) had benign tumour. All 3 mammary tumours were malignant in nature.

Pinello *et al.* (2022b) stated that the malignancy rates were found to be notably higher in females compared to males in both species, with the difference being particularly pronounced in cats. Zuccari *et al*. (2011) reported that about 88% of diagnosed canine mammary tumours were malignant. Lim and Watanabe (2016) and Norfitriah *et al*. (2023), in their separate case report publication from Universiti Putra Malaysia, documented malignant tumours in cats. Manuali *et al.* (2020) quoted that out

**Table 9.** Signalment, tumour location and results of histopathological study in cats

| Sl.No | Breed | Sex/ Neutered/ Non-Neutered | Age | Histopathology Result/ Location of Tumour | Malignant/ Benign |
|---|---|---|---|---|---|
| 1 | DSH | Female Non-Neutered | 12 yr 5 months | Mast cell tumour/Ear pinna | Malignant |
| 2 | DSH | Female Non-Neutered | 10 yr 9 months | Adenocarcinoma/Chest region | Malignant |
| 3 | DSH | Female Neutered | 11 yr 10 months | Intratubular papillary carcinoma/ Mammary gland | Malignant |
| 4 | DSH | Female Non-Neutered | 9 yr 8 months | Mammary tubular carcinoma/ Mammary gland | Malignant |
| 5 | DSH | Female Neutered | 12 yr 7 months | Adenocarcinoma/Ear pinna | Malignant |
| 6 | DSH | Female Neutered | 6yr | Trichoblastoma/Tail | Benign |

Notes: DSH = Domestic Short Hair; yr = years

of 680 feline tumour cases, about 82.9% were malignant. Ludwig *et al.* (2022) stated that in cats, a predominant proportion of tumours (53–85%) were classified as malignant, often leading to unfavourable prognoses.

**Recovery and follow up**

A follow up was made by contacting the dog owners over the telephone, and the presence of new tumours in 11 out of 54 cases was reported. Out of 11 cases, 6 cases were malignant, and 5 cases were benign tumours. Considering the age and health condition of the dogs and the clinical appearance of the relapsed tumours, 3 dogs were euthanised. One dog with melanoma died due to cardiac disease. Two dogs with an internal organ-related tumour died following surgery due to tumour-related complications.

The tumours reappeared in dogs after surgical excision in both benign (6 out of 19 cases) and malignant cases (5 out of 20 cases), based on the conversation with owners. Malignant cases included sebaceous carcinoma, mammary solid carcinoma, and mast cell tumour. The benign tumours that reappeared were myxoma, cutaneous fibro lipoma, squamous papilloma, lipoma, and fibroma. The three euthanized cases were involved with mast cell tumour, melanoma and mixed-type carcinoma. One case with melanoma died due to cardiac disease, but no new tumours were present. The dog with uterine carcinosarcoma died one month post-surgery due to deterioration in the general condition and possible metastasis, which could not be confirmed. The dog with urothelial cell carcinoma in the urinary bladder died the next day after surgery due to post-surgical complications.

On contacting the owners, none of the nine cats showed recurrence of tumour. The limitations of this study included the selected study population, which underwent surgery and represented dogs' and cats' tumour samples subjected to histopathology at a veterinary laboratory, potentially missing dogs and cats whose owners declined further diagnosis and skewing towards those owners willing to pursue surgical intervention and histopathology.

## CONCLUSION

Based on this study, it was concluded that the mixed-breed dogs and Domestic Shorthaired breed cats exhibited a higher incidence of tumours. Dogs and cats over the age of 10 years demonstrated a heightened susceptibility to tumours. Females of both species were more predisposed to developing tumours. Non-neutered dogs displayed a higher incidence of tumours compared to neutered dogs. In cats, although there was no notable disparity in percentage, neutered individuals were more afflicted by tumours. Both dogs and cats exhibited a higher susceptibility to mammary tumours. Fine needle aspiration cytology (FNAC) findings were confirmed with histopathology examination in all cases, suggesting the valuable role of this investigation. Among 38 histopathology examinations done in dog samples, 26 different types of tumours were found, indicating a wide variation in the types of tumours. In cats, out of 6 histopathological findings, 5 different tumour types were identified. Dogs tend to predominantly develop lipomas and mast cell tumours, whereas cats are prone to adenocarcinomas and mast cell tumours. Malignant tumours were more prevalent in both species. This study provided valuable information on the incidence pattern, recent trends, and potential areas for further investigation of tumours in dogs and cats. Hence, retrospective and prospective studies of a longer

duration will provide sufficient data for a through understanding of tumour incidence in dogs and cats.

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