

# Pathomorphological analysis of tumors in cats in the city of Bishkek

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**Abstract.** For the first time this particular article presents the results of a statistical study concerning the type of the spread of oncological diseases in cats in the city of Bishkek and the analysis of this processes. Therefore, the anamnesis, macroscopic data, and the state of regional lymph nodes were studied as well. The purpose of this work is to analyze the spread of oncological diseases, to identify the most common tumors depending on gender, breed, age and localization of the cats' tumor in Bishkek. 48 cats of different breeds and age groups with spontaneous neoplasms became the material for this study. According to the results of this research, the most common oncological pathologies were identified as follows: breast tumors – 41.6%, skin and skin derivatives tumors – 41.6%. Neoplasms were identified from various tissues, of which epithelial tissue tumors prevailed (56%). Ulceration of tumors and metastases were common. In general, mongrel cats (81.5%) have an increased risk of neoplasia compared to purebred cats (18.2%). The results of the study were compared with the data of other scientists and similarities in the distribution of tumors are noted.

## 1 Introduction

Oncological diseases in cats are one of the most urgent problems in veterinary medicine [1]. Moreover, the degree of spread of oncological diseases among unproductive pets has a certain significance on the epidemiological situation in society. The research results of many authors show that one of the main causes of the tumor process is anthropogenic impact on the body [2]. In many cases, the development of tumors is due to the age, breed and sex of animals [3-5]. There are data on the carcinogenic effects of atmospheric air pollution, ultraviolet radiation and ionizing radiation. Natural-climatic and technogenic features of animal habitats and their geographical location are considered as potential risk factors for the development of oncological pathology [5].

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According to statistics, cat tumors are less common than in dogs, but malignant forms prevail in cats, they are characterized by a high level of metastasis [6]. Spontaneous tumors in domestic cats are the main cause of death of elderly animals [7].

The incidence and prevalence of tumors in cats increases every year. Breast tumors in cats are the third most common type of tumor, after lymphoma and skin tumors, accounting for 17% of tumors [8, 9]. According to Morris J, the ratio of malignant to benign tumors is at least 4:1. Early detection, timely mastectomy and frequent postoperative examinations significantly affect the life expectancy of cats with breast tumors. Mortality is mainly associated with local recurrence or metastasis. It is reported that the average time between detection and death is 10-12 months [10].

For the development of anti-cancer therapeutic agents, tumors of small domestic animals are suitable and valid model systems. Pets, including cats, are an extremely underutilized resource available for study [11]. Some types of cat neoplasms are similar to human cancer in histopathological forms, biological behavior and the nature of metastasis. Tumors of potential importance for the study of human cancer include: osteosarcoma, breast carcinoma, oral melanoma, squamous cell carcinoma of the oral cavity, nasal tumors, lung carcinoma, soft tissue sarcomas and malignant non-Hodgkin lymphoma [9, 12]. The study of the biology and morphological structure of pet cancer is important, since animals are a suitable population for testing new agents, where efficacy and toxicity can be investigated.

Tumors of certain animal species have been studied in the Kyrgyz Republic [13], the prevalence and morphological diagnosis of tumors in cats is being carried out for the first time. This work is aimed at the description, statistical analysis of tumors in cats based on the study of 48 cats with neoplasms of various localization.

## **2 Materials and methods**

The scientific work was carried out at the Department of Veterinary and Sanitary Examination, Pathology and Histology of the Faculty of Veterinary Medicine of the Kyrgyz National Agrarian University (KNAU). The objects of the study were cats of various breeds and all age and gender groups, with spontaneous neoplasms. In the case of surgical treatment method, in 100% of cases, a histological examination of the surgical material was performed for morphological diagnosis. The resulting material was fixed in a 10% solution of neutral formalin in a glass container at room temperature. Paraffin blocks and histological sections were prepared from pieces of the affected organs after wiring in alcohols of increasing concentration. While performing histological studies, the methodological guidance of G.A. Merkulov (1962) was used [14]. The sections were obtained by means of a sledge microtome (thickness of 5-7 microns). Histological sections were stained with hemotoxylin and eosin. The preparations were examined by means of Biomed-4 light biological microscope. Microphotography of the studied objects was carried out by means of MicroOptixMX-100 microscope with a built-in MicroCAM 5M video camera, at low and high magnification.

## **3 Results**

As a result of statistical data processing, it was found that female cats are more prone to neoplasms (n=38 cases), which amounted to 79.1% versus 20.8% of male cats (n=10 cases). The largest number of animals suffering from oncological pathology was revealed at the age of 7 to 14 years (Table 1). At the age of 1 year, tumors were detected only in purebred cats (British shorthair cat, Sphinx, Maine Coon).

**Table 1.** Age category.

Age	Less than 1 year old	1-3	4-6	7-10	11-13	14-17
Number	3	5	5	12	15	6

Tumors of various localization were more often detected in mongrel cats (n=39), which is 81.5% and (n=3) cases in Maine Coons 6.2%, in other cat breeds Scottish fold, Mestizo, British shorthair, Exotic, Cymric, Sphinx in 1 case, which is 2%.

In the structure of oncological diseases in cats, the authors identified neoplasms of the skin, breast, tumors of the oral cavity, etc. The data are presented in (Table 2). Histological type was dominated by tumors from epithelial tissue – 27 cases (56.2%), then tumors from soft tissues – 14 cases (29%), tumors of the hematopoietic system – 4 (8.33%) and tumors of melanin-forming tissue accounted for 3 cases (6.25%).

**Table 2.** Cats' neoplasms of various localization.

The place of neoplasms localization	Number	%
Mammary gland	20	41
Skin and its derivatives	20	41
Uterus	2	4
Limbs	2	4
Oral cavity	1	2
Tibial joint	1	2
Testis	1	2
Esophagus	1	2

Neoplasms of the mammary glands are localized in domestic cats in all the pairs of mammary glands. In shape, tumor formations were rounded, oval, flat, in the form of clusters of nodes of various sizes. In consistency, they are dense, hard, soft, elastic. The size of the neoplasms varied from 0.5 to 10 cm in diameter. The color of the neoplasms varied from pale gray to black. Along with large neoplasms, individual small nodes were noted. Breast tumors were found in (n=15) cases (75%) in non-sterilized cats who used hormonal medicines such as gestrenol and (n=5) cases (25%) in sterilized cats.

Breast tumors in almost most cases were represented by malignant neoplasms (n=16) of samples (80%). Of these, 2 (10%) two cats have relapses and 2 metastases in the uterus, which is 4.1%. The tumors morphologically differed into adenocarcinoma of various differentiation (Fig. 1), infiltrating carcinoma and rarely occurring phylloid fibroadenoma (Fig. 2) and others. Benign breast tumors were diagnosed in (n=4) cases (20%) (Table 3).

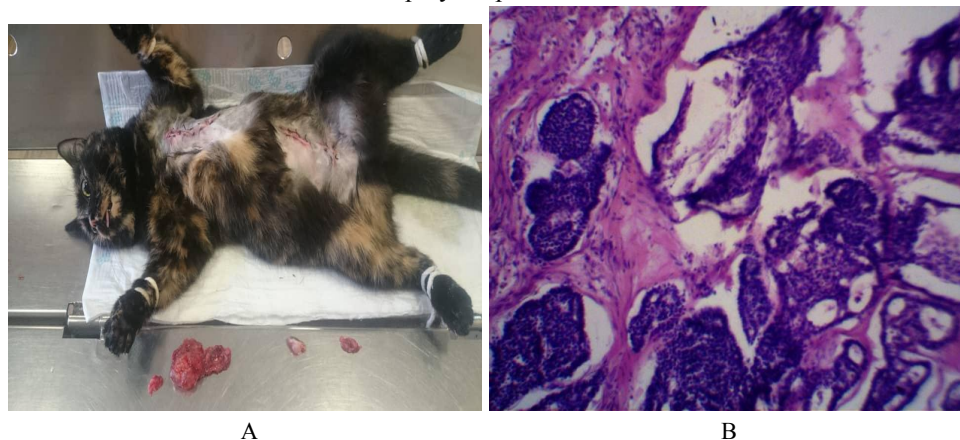
In all the cases, breast tumors were found mainly in the older generation of cats aged 12 to 17 years and were rarely observed in young cats, at the age of 1 year exclusively in pedigreed cats, such as sphinx.

**Table 3.** Histological types of breast tumors in cats.

Morphological type of tumor	Number of observations n=	%
Adenocarcinomas		
Highly differentiated	10	47.6
Moderately differentiated	5	24
Low-differentiated	1	4.7
Infiltrating carcinoma	1	4.7
Benign adenoma	1	4.7

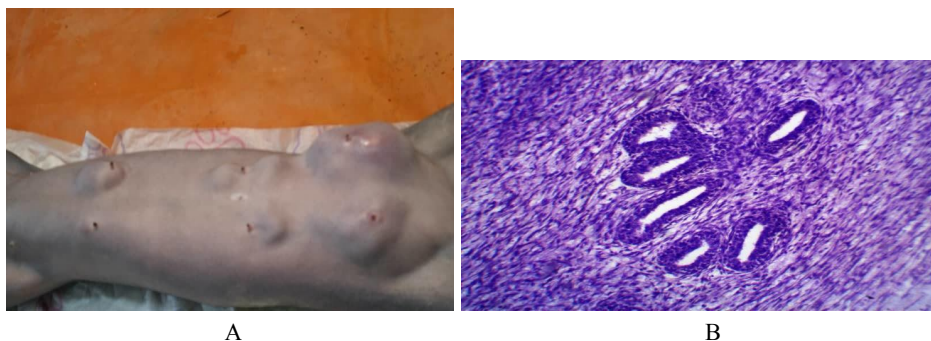
Giant cell tumor	1	4.7
Phylloid fibroadenoma	1	4.7
Lipoma	1	4.7

Cat at the age of 14, named as Umka, mongrel. The growth of the neoplasm is observed throughout the year, not sterilized, hormonal drugs were given. Multiple formations of oval, rounded shape, the size is approximately about 2x6 cm, elastic consistency. During palpation, soreness, anxiety were observed, but no effusions were observed. Histological examination revealed a low-differentiated mammary adenocarcinoma. Low-differentiated adenocarcinoma is characterized by the loss of glandular structure in almost the entire tumor. The shape of the cells is rounded, polygonal, but not cylindrical. With this pathology, cell necrosis is observed. In this sample, a tumor of various sizes and shapes is represented by an atypical glandular complex of tissue atypia, built from atypical epithelial cells. Tumor cells and their nuclei are polymorphic.



**Fig. 1.** A – is a macro-picture of a breast tumor in the cat named as Umka, at the age of 14. B – is a micro-picture of a low-differentiated mammary adenocarcinoma. Staining with hematosiline and eosin – per high powered field x 100. Compiled by the authors.

Cat named as Milka, Sphinx breed, aged 1 year, female. The cat was not sterilized, did not receive additional hormonal medicines, the growth of neoplasms began to be observed in the last 6 months. During the examination in the veterinary clinic, all pairs of mammary glands were affected by tumors of oval, rounded shape with a diameter of 1 to 8 cm, elastic consistency. Neoplasms are painless, grayish-white in color, no effusions or exudate were observed. Neoplasms were surgically removed. Histological examination revealed a phylloid fibroadenoma of the breast. Mammary gland tumors of a phylloid or leaf-like nature are a rare disease and account for 0.3-0.5% of the registered cases of breast tumors. This is an extremely rare histological heterogeneous fibroepithelial tumor that develops from connective tissue. Fibroepithelial tumors of the mammary glands are characterized as neoplasms of a two-component structure with the predominant development of the connective tissue component. It is predominant in sarcomas, and in the group of phylloid tumors it is combined with the parallel development of epithelial tissue. Histologically, phylloid tumors are divided into benign, borderline and malignant. In this sample, the tumor stroma is represented by loose fibrous tissue, the glandular tubes are compressed by the stroma, the connective tissue component predominates in the structure of the phylloid breast tumor. The stroma is more pronounced, with significant phenomena of nuclear polymorphism and proliferation of stromal cells, tumor growth has the form of leaflets.



**Fig. 2.** A – is a macro-picture of a breast tumor in the cat of the Sphinx breed, at the age of 1 year. B – is a micro-picture of of phylloid (leaf-shaped) fibroadenoma of the mammary gland. Staining with hematosiline and eosin – per high powered field x 100. Compiled by the authors.

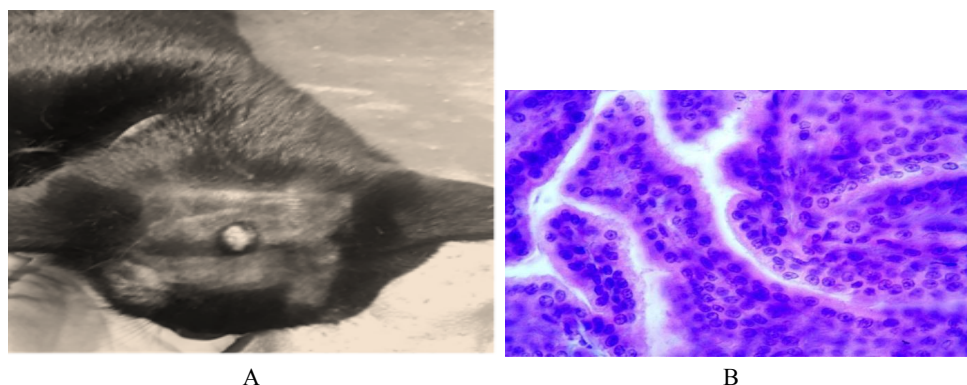
It has been established that skin neoplasms in cats can be localized in various places of the skin of the trunk. The shape, size, size, color and consistency of tumors can be different. At the age of 4 to 10 years, cats often have an education on the skin. Among cutaneous neoplasias in cats, benign neoplasms were most often diagnosed (n=12) cases, which is 60%, and (n=8) samples, malignant neoplasms occur in a percentage of 40% (Table 4), (Fig. 3, 4).

**Table 4. Histological types of skin neoplasms in cats**

Morphological type of tumor		Number of observations n=	%
Benign skin tumors	Atheroma	5	30
	Mesenchyme	1	5
	Lymphangioma	1	5
	Hemangioma	1	5
	Papilloma	2	10
	Ectodermal cyst	2	10
Malignant skin tumors	Lymphosarcoma	1	5
	Fibrosarcoma	1	5
	Pigmented melanoma	2	10
	Basal cell carcinoma	2	10
	Cancer from the appendages of skin	1	5
	Syringocarcinoma of papillary structure	1	5

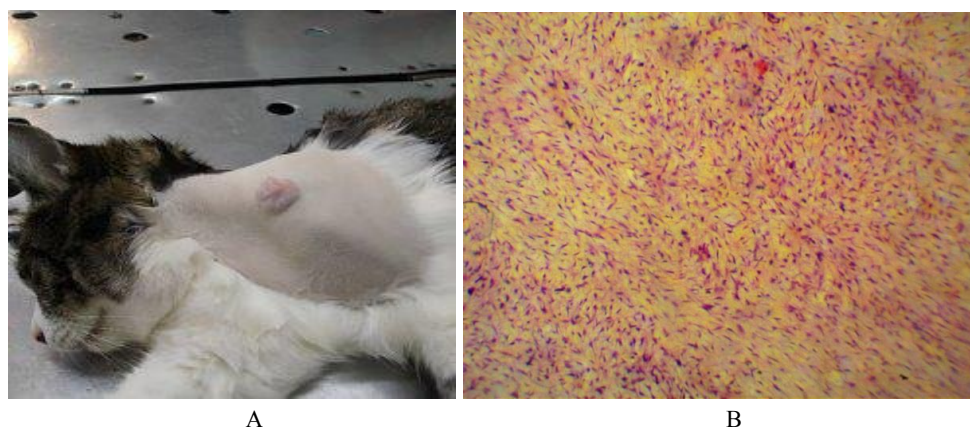
A cat named as Margot, 10 years old, mongrel, black suit. The primary skin neoplasm in the head area grew for 6 months. The tumor has a rounded shape, the size is 1.5 x 1.5 cm, elastic consistency. The color is white-grayish. The tumor was surgically removed. During histological examination of this pathological material, a carcinoma of the sweat gland of papillary structure was diagnosed.

Under microscopy, tumor cells can be seen in this preparation, which have formed papillary outgrowths as a result of proliferation. Tumor cells have cubic or cylindrical shapes. The cytoplasm of tumor cells is intensely basophilic, and the nuclei are hyperchromic. In addition to tumor cells in the cavity of the sweat gland, there is a secret that is intensely colored with eosinophilic, in some areas there is a deposition of calcium salts. The tumor stroma is poorly developed (Fig. 4).



**Fig. 3.** A – macroscopic manifestation of syringocarcinoma of the cat’s scalp. B – is a histological structure of papillary carcinoma. The nuclei of some tumor cells are hyperchromic. Papillary outgrowths of tumor cells are visible. Staining with hematosiline and eosin – per high powered field x 400. Compiled by the authors.

The cat is 4 years old, mongrel. Neoplasm on the skin in the scapula area. The formation of a rounded shape, the size is 1.5 x 1.5 cm, elastic consistency, white-gray color. Surgical removal. After the surgery, the animal’s condition was fair. Histological diagnosis of fibrosarcoma of the skin. In this preparation, it is possible to see spindle-shaped polymorphic, stellate tumor cells. These cells in some places have a one-sided direction, in other places a versatile direction. The nuclei of tumor cells are hyperchromic and there is an infiltrative aggressive growth of tumor cells with the destruction of neighboring tissues. There are no lymphocytes in the tumor focus (Fig. 4).



**Fig. 4.** A – macroscopic manifestation of a cat skin tumor. The cat is 4 years old, mongrel. Formation on the skin in the scapula area. The animal’s behavior is normal. The formation of a rounded shape, the size is 1.5 x 1.5 cm, elastic consistency, white-gray color. B – is a histological picture of the skin fibrosarcoma. The figure shows polymorphic fusiform, stellate tumor cells with hyperchromic nuclei. Staining with hematosiline and eosin – per high powered field x 100. Compiled by the authors.

Tumors of the uterus (4.1%) and testis (2%) are found among the neoplasms of the reproductive system. Characteristic clinical signs and the results of histological examination make it possible to form an accurate diagnosis, in the first case a benign fibromyoma was diagnosed, in the second case a highly differentiated adenocarcinoma of the uterine body with concomitant pyometer disease.

## 4 Discussion

The authors of this study studied tumors in cats in the Kyrgyz Republic for the first time. This article discusses the results of statistical data on 48 cases of neoplasms in cats. Therefore, malignant tumors accounted for 31 cases (64.5%) and benign ones – for 17 (35.4%). According to various authors [7, 15], in a retrospective study of tumors in cats, 80-82% of the total number were malignant, and topographic localization mainly included skin, connective tissue and mammary gland. According to the results of their analysis, skin and soft tissue neoplasms were most often observed in cats 56%, followed by breast tumors (11%). In this particular study, tumors of the breast 41.6% and skin 41.6% prevailed, then they were followed by genitals tumors (6%), etc. Oncological diseases in cats were found in all the age and gender groups. The peak incidence was observed at the age of 7 to 14 years, these data are confirmed by the information of other authors.

According to the authors, tumors in mongrel cats amounted to 81.5%, in purebred cats (18.2%). According to the academic literature, there are a number of pedigree predispositions to certain types of tumors, but mongrel cats have an increased risk of developing a malignant tumor [16].

Tumor diseases were diagnosed mainly in female cats 38 cases (79%), in male cats 10 cases (20.8%). Breast tumors in 80% of cases are represented by malignant formations: adenocarcinoma, infiltrating carcinoma. Skin tumors in cats occur at the age of 4 to 10 years, with 60% of benign tumors and 40% of malignant formations.

## 5 Conclusion

According to these studies, out of 48 cases of neoplasms in cats, malignant tumors accounted for 31 cases (64.5%) and benign ones – for 17 (35.4%). In cats, neoplasms of the mammary gland 41.6% and skin and its derivatives 41.6% occur in equal amounts. Tumors of the reproductive system in cats were 6%. Neoplasia of the oral cavity, esophagus, limbs, joints in cats are somewhat less common, they demonstrate a fairly low percentage – 2% each. Tumors from epithelial tissue are common 56.2%, tumors from soft tissues are 29%.

Oncological diseases are observed in cats aged 7 to 14 years, less often in young animals and in our studies only in purebred cats and isolated cases have been recorded in old animals of 17 years. These particular studies revealed that the dishormonal state of the reproductive system, the violation of feeding and keeping cats are predisposing factors for the occurrence of cat tumors.

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