A Retrospective Study in 1,070 Feline Tumor Cases of Japan.

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Abstract

The purpose of this study was to document the incidence of feline tumors in the Japanese cat population. 1,078 feline tumors obtained from 1,070 cats. All of these were cytologically or histologically diagnosed at Azabu University Veterinary Teaching Hospital in Japan from April 1985 to March 2008. The baseline hospital population during the same period included 6,748 cats. The 1,070 tumor-bearing cats were analyzed for age, sex, breed, type of tumors, site-specific tumor incidence and malignant tumor incidence rate. The average age was significantly higher in the tumor group (9.9±3.8 years) than in the baseline hospital population (5.6±4.9 years). As to gender difference, the incidence of tumors was significantly higher in female cats. The incidence rate of malignant tumors in cats was significantly higher with an odds ratio of 4.55 as compared to 6,302 tumor-bearing dogs at the same university teaching hospital. The odds ratio for malignancy was significantly higher in cats for specific tumors such as lymphomas (8.39), the head and neck (5.18), mammary gland (4.55), female genitalia (3.64), and skin/subcutis (1.64) tumors. On the other hand, as compared to dogs, the incidence of the following tumors was significantly lower in cats; mast cell tumor, urologic tumors, male genital tumors, bone and joint tumors and endocrine tumors. This study provided a substantial amount of information useful for client education as well as diagnosis and treatment of feline tumors.

Key word: Cat, Epidemiological research , Retrospective study , Tumors.

Introduction

Cancer is a major cause of companion animal death [2,4]. This statement is supported by a study that determined the cause of death in a series of more than 2,000 necropsy cases [13]. Of more than 74 million household dogs and 90 million cats in the United States, at least 4 million dogs and 4 million cats may develop cancer each year [8]. In the Japanese dog population, 40.1% of dogs that lived to 8 years or older were affected with tumors [12].

Epidemiological research for spontaneous cancers in animals contributes to not only veterinary medicine but also comparative oncology for human and companion animals. Until 1950’s, very little was known about the site, type, distribution, frequency of malignant types, and biological behavior of feline tumors [3]. This unfortunate lack of information had been improved in 1970’s by reports of feline tumors from the United Kingdom and the United States [1,5,6,7,10,11]. It is now apparent that tumors occur quite frequently in cats and that there are many differences between canine and feline tumors [7]. On the other hand, in Japan, epidemiological studies concerning feline tumors are extremely few [14].

The purpose of this study, therefore, is to document age, sex, breed, type of tumors, site-specific tumor incidence, and frequency of malignant types in tumor-bearing cats, and to make comparison with dogs.

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Materials and Methods

This retrospective study was based on spontaneous feline tumor cases that were either cytologically or histologically diagnosed at Azabu University Veterinary Teaching Hospital in Japan from April 1985 to March 2008. Tumor-bearing cats were analyzed for age, sex, breed, type of tumors, site-specific tumor incidence, and frequency of malignant diseases. The classification for anatomic site was based on TNM Classification/WHO in domestic animals. The data were compared between the tumor-bearing cat population and the baseline hospital population of cats including all the cat patients seen during the same period.

T test was used to analyze age distribution. Chi square ($\chi^2$) was used to analyze sex, breed, and the frequency of malignant tumors, and Yates calibration and Fisher’s exact test were used as needed. Breed distribution, the frequency of malignant tumors and site-specific tumor incidence were multiple comparisons, and Bonferroni correction was applied in the statistical adjustment. $P$ values less than 0.05 were considered significant for all of the statistical analyses. Relative risks (odds ratio) by breed, sex and the most frequent tumor site were estimated.

Results

The population studied

A total of 1,078 feline tumors obtained from 1,070 cats were studied. The baseline hospital population during the same period included 6,748 cats.

Comparison between tumor-bearing cat population and baseline hospital cat population

Mean age of the baseline hospital cat population was 5.6±4.9 years old, with 53.3% (3,599) of the cats under 5 years of age. The mean age of tumor-bearing cats (9.9±3.8 years old) was significantly higher ($p<0.001$) than that of the baseline hospital population mentioned above. In the baseline hospital population, however, at 8 years or older, 35.6% (777 cases) were tumor-bearing cats. Age distribution of the baseline hospital population and tumor-bearing cats is summarized in Figure 1.

The male to female ratio of cats in the baseline hospital population was 1 : 0.93 ($p=0.025$), and was 1 : 1.42 ($p<0.001$) in tumor-bearing cats. This sex distribution was significantly different between the two groups ($p<0.001$). The chances for female cats to develop any tumors were greater than in male with an odds ratio of 1.54.

The cat breeds in the baseline hospital population included mixed breed (71.8%), American Shorthair (5.6%), Chin-
chilla (5.3%), Persian (3.7%), Himalayan (2.6%) and Siamese (2.4%), while those in tumor-bearing cats were mixed breed (75.2%), American Shorthair (7.5%), Chinchilla (5.4%), Persian (4.0%), Siamese (2.6%) and Himalayan (2.4%), with no significant difference between two groups.

Analysis of tumor-bearing cats

The 1,078 tumors were classified into 140 (13.1%) benign and 938 (87.7%) malignant tumors. The malignant diseases were much more frequent than benign tumors (p<0.001).

The skin/subcutis was the most common site for tumors (318; 29.7%), followed by the mammary gland (182; 17.0%), lymphoid/hematopoietic system (176; 16.5%), head and neck (121; 11.3%), mast cell tumor (80; 7.5%), respiratory tract (59; 5.5%). The site distribution of both malignant and benign tumors is summarized in Figure 2.

The sites and histopathologic types of tumors are shown in Tables 1 and 2. The common sites for benign tumors were the skin/subcutis and head and neck. The three most common histopathologic types of benign tumors in the order of frequency were basal cell tumor, lipoma, and adenoma. The common sites for malignant tumors were the skin/subcutis, mammary gland, and head and neck. Furthermore, malignant tumors were seen at significantly higher frequency in some anatomic locations such as the urinary tract (100%, p=0.013), respiratory tract (98.3%, p<0.001), mammary gland (95.6%, p<0.001), alimentary system (92.0%, p=0.0011), and head and neck (88.4%, p<0.001). The three most common malignant histopathologic types except the round cell tumors were adenocarcinoma, squamous cell carcinoma, and soft tissue sarcoma.

In addition, all the neoplasms in the lymphoid/hematopoietic system and mast cell tumors were classified as malignant. The lymphoid/hematopoietic system neoplasms included 39 cases of myeloproliferative diseases and 137 cases of lymphomas. The lymphomas were further classified into alimentary (32; 23.4%), anterior mediastinal (29; 21.2%), extranodal (28; 20.4%, nasal lymphoma included), cutaneous (21; 15.3%), multicentric (13; 9.5%), renal (11; 8.0%) and others. Mast cell tumors classified as an individual category in the WHO classification, included cutaneous (71; 88.8%), splenic (8; 10.0%) and retroperitoneal (1; 1.2%) types.

As compared to the entire tumor-bearing population, the mean age of cats with lymphoid/hematopoietic system tumors was significantly lower (8.4±4.0 years old vs 9.9±3.8 years old, p<0.001). On the other hand, mean ages of cats with tumors in female genital system, mammary grand, head and neck, 11.0±1.0 (p<0.001), 11.3±3.3 (p<0.001), 11.2±3.9 (p=0.007), respectively, were significantly higher than that of the entire tumor-bearing population.
There was no significant difference in sex distribution between the baseline hospital population and tumor-bearing cats when the cases with mammary grand and female genital system tumors were excluded. Since all the cases with mammary grand and genital system tumors were female, with no case in the male genital system, there was a strong sex predilection with tumors in these systems.

With reference to the breed distribution of the baseline hospital population, American Shorthair cats had a significantly high incidence of respiratory tumors with an odds ratio of 3.05 \( (p=0.043) \). Persian and Siamese had significantly high incidences of mammary grand tumor with odds ratios of 2.66 and 2.80 \( (p=0.004 \text{ and } p=0.031) \), respectively.

### Discussion

In this study, the incidence rate of feline tumors \( (1,070/6,748, 15.9\%) \) was extremely high as compared to the data.
reported by Uchino, et al. in which a Japanese cat population in local primary care hospitals were studied (147/5,274, 2.8%) [14]. A possible explanation for this difference is that the present study included a unique population of the cats with more serious diseases referred to this university hospital.

The average age was significantly higher in the tumor-bearing group than in the baseline hospital population. The average age of cats with lymphoid/hematopoietic tumors, however, was significantly younger, with a general agreement with the previous studies conducted in the United States [1,3].

As to the sex predilection, the incidence of tumors was significantly higher in female cats, with a male-to-female ratio of 1 : 1.42. According to the canine tumor studies conducted by Priester and colleagues [10] and Shida and colleagues [12], the incidence of female mammary gland tumors were relatively high, and mammary gland tumors accounted for 17.0% of the total tumors in this study. Therefore, it is considered that a high incidence of the female mammary tumors in cats produced this significant gender difference. It has been reported that lymphoid/hematopoietic tumors are more common in male cats [5]. In the present study, however, no significant sex predilection was observed with lymphoid/hematopoietic tumors and others except for mammary gland and genital tumors.

Many studies have documented significant differences in the incidence of tumors among different animal breeds [1, 5, 10, 11, 12]. Particularly significant differences in the incidence of tumors have been reported in such canine breeds as Golden Retrievers [11, 12]. This study did not confirm any significant breed predisposition among feline breeds in the tumor group with reference to the baseline hospital population. In terms of the site distribution, however, the odds ratio for respiratory tract tumors was significantly higher for American Shorthair (3.05), and that for mammary gland tumors was significantly higher for Persians (2.66) and Siamese (2.80).

In this study, the ratio of malignant tumors to all feline tumors was 87.7% (938/1,078) with a significantly high number of malignant diseases (p<0.001). This malignancy ratio in canine tumors at the same university hospital was 59.6% (3,754/6,302) [12]. Thus, the frequency of malignant tumors in cats was significantly higher as compared to dogs with an odds ratio of 4.55 in the similar university hospital populations.

Common tumors in cats were skin/subcutis, mammary gland, and lymphoid/hematopoietic tumors, accounting for 63.2% of all tumors. Previous studies in the dog have reported that mammary gland tumors account for 40.6% [12] or 23.6% [1] of all canine tumors, but in this study with the cat, mammary gland tumors accounted for 17.0% of all feline tumors. As reported by many studies[1], the incidence of lymphoid/hematopoietic tumors was higher in cats than in dogs. In comparison with canine tumors [12], cats were 8.39 times more likely than dogs to develop lymphomas (odds ratio: p<0.001). On the other hand, as compared to dogs, the incidence of following tumors was significantly lower in cats: those included mast cell tumor, urologic tumors such as bladder tumor, male genital tumors such as testicular tumor, bone and joint tumors, and endocrinological tumors such as thyroid tumors [12]. Although it is very common for older cats to have hyperthyroidism associated with benign thyroid tumors, the present study did not include such referral cases in significant numbers, because usual hyperthyroid cases are treated in primary care hospitals [14]. There was no male genital tumor among the 1,070 cases, and this was clearly different from dogs.

Newkirk and colleagues [9] reported six cases of UV-induced hemangiosarcomas (14%) among 43 eyelid skin and subcutaneous tumors in the cat. In the present study, of the 318 skin and subcutaneous tumors, there were only 3 hemangiosarcomas (0.9%), and this was markedly lower when compared to the U. S. study results. This might have been due to breed differences, but there might have been differences in UV exposure between the U. S. and Japan.

Besides skin mast cell and lymphoid/hematopoietic tumors, the incidence rate of malignancies was significantly higher for the following sites in cats: urinary system, respiratory tract system, mammary gland, alimentary system, and head and neck region mostly consisted of oral tumors. In comparison with canine tumors [12], the odds ratio for malignancy was significantly higher for the head and neck region (5.18 fold), mammary gland (4.55 fold), female genitalia (3.64 fold), and skin/subcutis (1.64 fold). The odds ratio for malignancy was significantly lower for bones and joints (0.16 fold).

The above results may be useful and helpful for client information, the early diagnosis and treatment of feline tumors, and also contribute the comparative oncology for human and companion animals.
References


猫の腫瘍症例1,070例の回顧的分析
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■ 和文要約

猫の腫瘍1,070例を回顧的に分析した。腫瘍例は有意に高齢で雌に多かった。猫の悪性腫瘍確率は、麻布大学附属動物病院で分析した犬の腫瘍例の4.55倍であった。猫は犬の8.39倍リンパ腫に罹患しやすかった。雄生殖器系腫瘍・骨関節系腫瘍・内分泌系腫瘍を、犬に比較して少なかった。悪性比率が高い部位は、泌尿器系・呼吸器系・乳腺・消化器系・頭頸部であった。犬と比较して、有意に悪性比率が高い部位は、頭頸部（5.18倍）、乳腺（4.55倍）、雌生殖器（3.64倍）、皮膚皮下繊維（1.64倍）であった。有意に悪性比率の低い部位は、骨関節系（0.16倍）であった。以上の結果は、猫の腫瘍の診療に有用な指標となると考えられた。

Key word: Cat, Epidemiological research, Retrospective study, Tumors.