RESEARCH ARTICLE

# A Retrospective Study on Incidence of Neoplasms in Canine Population around Anand, Gujarat

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## Abstract

The incidences of canine neoplasms were calculated retrospectively from 23,236 cases presented at Teaching Veterinary Clinical Complex, Anand (Gujarat, India) during January, 2017 to December, 2021. In all 562 cases had canine neoplasms, which included mammary tumors 322 (57.29%), oral tumors 59 (10.49%), bone tumors 36 (6.41%), CTVT 68 (12.09%) and other tumors 77 (13.70%). Further in prospective study of 11,178 canine cases from January, 2022 to December, 2023, a total of 152 cases were diagnosed and treated for neoplasms. Out of which 71 cases were of mammary gland tumors, 36 cases of oral tumors, 22 cases of CTVT, and rest others. In retrospective and prospective studies, the highest incidence of canine mammary tumors was observed in the age group of 8 to 12 years, whereas no case was reported below 4 years of age. The incidences of canine neoplasms were significantly higher in female than in male dogs mainly due to high level of neoplasms in the mammary gland and CTVT in females. The breed most vulnerable to the neoplasms was Labrador retriever, whereas the least tumors were found in Rottweiler. The age, breed, and sex were identified as the major risk factors for tumorogenesis in canines.

**Key words:** Bone tumor, Canine neoplasm, Incidence, Mammary tumor, Oral tumor.

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## Introduction

Tumors are one of the leading causes of death in dogs. The incidence of neoplasms in dogs was reported to be 1,007 per 100,000 of the population at risk. In dogs, malignant neoplasms occur only one half as often as benign (Moulton, 1978). The venereal granulomas are more frequent in female than male dogs (Sousa *et al.,* 2000). Dobson *et al.* (2002) estimated the incidence of canine neoplasia from a population of insured dogs in UK, and found most tumor growths in the skin and soft tissues, with a normalized incidence rate of 437 per 100,000 canines annually. Tiwari (2002) recorded maximum incidence of canine transmissible venereal tumor (23.30%), followed by squamous cell carcinoma (14.38 %), mixed mammary tumor (10.59%) and adenocarcinoma (9.32%). In a study conducted by Spangler and Kass (2006), melanocytic neoplasms comprised 19% of the oral neoplasms and 92% of these were classified as malignant in the biopsy report, but malignant behaviour was observed in only 59% of the cases.

In recent years, the incidence of neoplastic lesions in companion animals, especially dogs, has been steadily increasing (Baioni *et al*., 2009; Evans, 2010; Gach *et al*., 2022). In humans, sarcomas are relatively uncommon, whereas epithelial tumors like breast, lung, and colon cancer are widespread. In dogs, on the other hand, lymphomas and sarcomas are more common than epithelial tumors. The population-based Piedmont Canine Cancer Registry data on 1175 tumors of 7 years confirmed by histopathological diagnosis revealed the prevalence rate of malignant tumor and benign tumor as 8.04 and 8.97%, respectively, the higher incidences being discovered in purebred dogs, mainly in Yorkshire terrier and Boxer (Baioni *et al*., 2017).

Identifying cancer early, when therapy may be more successful, is the aim of cancer screening. Dog cancer screening has traditionally depended on yearly physical exams and standard laboratory testing, both of which are not very effective in identifying preclinical illness. Rafalko *et al.* (2023) analyzed data from 3,452 cancer-diagnosed dogs. Most

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dogs with cancer were diagnosed around 8.8 years old. Male dogs tended to have neoplasms at a younger age compared to female dogs. Neutered dogs were typically diagnosed at a later age than intact dogs. Heavier dogs were generally diagnosed at an older age than younger dogs. Surprisingly, purebred dogs were diagnosed with cancer at a younger age than mixed-breed dogs. The current retrospective (5 yrs; 2017-2021) and prospective (2 yrs; 2022 & 2023) study was aimed to record the incidence of neoplasms in canine population presented at the Veterinary College Clinics, Anand, Gujarat, India.

## Materials and Methods

This study involved retrospective analysis of 23,236 case records of canines presented over a period of 5 years (January, 2017 to December, 2021) and a prospective study of 11,178 cases presented over last 2 years (January, 2022 to December, 2023) at Veterinary Clinical Complex of Veterinary College, Kamdhenu University, Anand, Gujarat (India) to find out the cancer incidences. In the retrospective and prospective analysis 562 and 152 dogs, respectively, affected with neoplasms were recorded. These data were utilized to record the year-wise, age-wise, sex-wise, and breed-wise occurrences of canine tumors. The findings were expressed as frequency (number & percent) of overall and of various types of neoplasms, mainly mammary gland tumors, oral tumors, bone tumors, CTVT and other miscellaneous tumors. As the data were obtained from a veterinary hospital, for an area without any known specific bias, they may be considered a reliable estimate of reference incidence rates.

## Results and Discussion

The overall tumor incidence noted based on 5 years' retrospective data was 2.41% (562/23236) and for 2 years' prospective data it was 1.36% (152/11178) with an overall pooled incidence of 2.07% (714/34414) in the hospital population of VCC, Anand (Table 1).

Among all the retrospective canine neoplasms the mammary gland tumors were the highest with 57.29% (322/562) prevalence, followed by CTVT 12.09 % (68/562), oral tumors 10.49% (59/562), bone tumors 6.41% (36/562) and other tumors 13.70% (77/562). The total number of cases reported was the lowest during the year 2021 because of COVID 19 Pandemic. The highest percentage of canine neoplasms were 6.20% during the same year despite of low number of cases indicating that, dog owners consider canine neoplasm as most important for curative treatment. The prospective data analysis of last 2 years (Jan 2022 to Dec 2023) revealed the prevalence of mammary gland tumors, oral tumors, bone tumors and CTVT as 46.71% (71/152), 23.68% (36/152), 14.47% (22/152) and 15.13% (23/152), respectively, with an overall pooled incidence of these tumors based on 714 cases as 55.04% (393/714), 13.30% (95/714), 8.12% (58/714) and 3.22% (23/714), respectively (Table 1). In 1985, Kusch diagnosed malignant neoplasms in 2142 (16.59 %) of 12,908 dogs with more than one primary malignant tumor in 199 dogs with the main sites as mammary gland (21.7%) followed by haematopoietic system (16.67%), thyroid gland (8.77%) and testes (6.8%). Henry *et al.* (2005) found that squamous cell carcinoma, malignant melanoma, osteosarcoma, hemangiopericytoma, benign soft tissue tumors and malignant soft tissue tumors accounted for 51.0, 15.6, 6.3, and 4.7, 7.8 and 14 %, respectively. Khimta *et al.* (2010) recorded 403 cases of neoplasms in which incidence of canine transmissible venereal tumor (CTVT) was recorded highest (42.93%) followed by mammary gland tumors (33.50%) and skin and other tumors (23.57%).

From the data of 714 canine neoplasms collected at VCC, maximum of neoplasms (86.13%) in canines were recorded in females, whereas only 13.86% neoplasms were recorded in male dogs. All cases of canine mammary tumors were recorded only in female dogs (Table 2). The similar finding was also observed by the Arshi (2016), Devarathnam *et al.* (2021) and Rokad *et al.* (2023). The observations were

**Table. 1:** Year-wise retrospective (Jan 2017 to Dec 2021) and prospective (Jan 2022 to Dec 2023) incidence (%) of canine neoplasms recorded at VCC, Anand

| Year | Total cases | Mammary gland tumors | Oral tumors | Bone tumors | CTVT | Other tumors | Total |
|---|---|---|---|---|---|---|---|
| Jan-Dec. 2017 | 5493 | 1.15 (63) | 0.15 (08) | 0.07 (04) | 0.15 (08) | 0.22 (12) | 1.73 (95) |
| Jan-Dec. 2018 | 5434 | 1.26 (69) | 0.20 (11) | 0.12 (07) | 0.22 (12) | 0.28 (15) | 2.09 (114) |
| Jan-Dec. 2019 | 5375 | 1.04 (56) | 0.22 (12) | 0.14 (08) | 0.29 (16) | 0.35 (19) | 2.06 (111) |
| Jan-Dec. 2020 | 5129 | 1.38 (71) | 0.27 (14) | 0.21 (11) | 0.37 (19) | 0.29 (15) | 2.53 (130) |
| Jan-Dec. 2021 | 1805 | 3.49 (63) | 0.77 (14) | 0.33 (06) | 0.72 (13) | 0.88 (16) | 6.20 (112) |
| ***Sub-Total A*** | ***23236*** | ***1.38 (322)*** | ***0.25 (59)*** | ***0.15 (36)*** | ***0.29 (68)*** | ***0.33 (77)*** | ***2.41 (562)*** |
| Jan-Dec.2022 | 5075 | 0.63 (32) | 0.29 (15) | 0.19 (10) | 0.15 (08) | - | 1.26 (65) |
| Jan-Dec. 2023 | 6103 | 0.63 (39) | 0.34 (21) | 0.19 (12) | 0.25 (15) | - | 1.41 (87) |
| ***Sub-Total B*** | ***11178*** | ***0.63 (71)*** | ***0.32 (36)*** | ***0.20 (22)*** | ***0.21 (23)*** | | ***1.36 (152)*** |
| **Grand Total** | **34414** | **1.14 (393)** | **0.27 (95)** | **0.16 (58)** | **0.26 (91)** | **0.33 (77)** | **2.07 (714)** |

supported by Dhayugde (2006), Gupta *et al.* (2012), Lather *et al.* (2017) and Patel *et al.* (2019), who reported rare occurrence of mammary tumors in male dog. Arya *et al.* (2018) also found higher incidences of neoplastic conditions in females than in male dogs. Sousa *et al.* (2000) recorded 42 cases of venereal granuloma in one year of which 61.9 % (n=26) were female and 38.09 % (n=16) were male. Sorenmo *et al.* (2000) opined that female sexual hormones were supposed to cause some breast cells to lose their ability to control their growth, bringing them at risk of mutation and malignant transformation of breast tissue, which predispose to development of mammary tumors. In the current study, the occurrence of oral tumors, bone tumors and CTVT in females was 74.73%, 77.58% and 74.72%, respectively. In a study conducted by Tiwari (2002), canine transmissible venereal tumor (23.30 %) had the maximum incidence, followed by squamous cell carcinoma (14.38 %), mixed mammary tumor (10.59 %) and adenocarcinoma (9.32 %). In another study conducted by Spangler and Kass (2006) melanocytic neoplasms comprised 19 % of the oral neoplasms and 92 % of these were classified as malignant in the biopsy report, but malignant behaviour was observed in only 59 % of the cases.

**Table. 2:** Sex-wise incidence (%) of canine neoplasms recorded during the period from January 2017 to December 2023 at VCC, Anand

| Group | Female | Male | Total |
|---|---|---|---|
| Mammary tumors | 100 (393) | 00 | 393 |
| Oral tumors | 74.73 (71) | 25.26 (24) | 95 |
| Bone tumors | 77.58 (45) | 22.42 (13) | 58 |
| CTVT | 74.72 (68) | 25.27 (23) | 91 |
| Other neoplasms | 49.35 (38) | 50.65 (39) | 77 |
| **Total** | 86.13 (615) | 13.86 (99) | 714 |

Out of 714 dogs presented with neoplasms, the occurrence of tumors was highest in age group of 8 to 12 years (50.14%, 358/714), followed by 4 to 8 years of age group (32.07%, 229/714), above 12 years of age group (17.08%, 122/714) and only 0.70% (5/714) cases were recorded in below 4 years of age group (Table 3). Arya *et al.* (2018) found the highest risk of development of several neoplasms in the age group of 9-12 years, followed by 6-9 years, 12-15 years, 3-6 years and 0-3 years, respectively. Salas *et al.* (2015), Silva *et al.* (2019) and Sarkar *et al.* (2022) reported the highest

**Table. 3:** Age-wise incidence (%) of canine neoplasms recorded during the period from January 2017 to December 2023 at VCC, Anand

| Groups | No. of cases | Age groups (Years) | | | |
|---|---|---|---|---|---|
| | | 0-4 | 4-8 | 8-12 | > 12 |
| Mammary tumors | 393 | 00 | 28.49 (112) | 55.47 (218) | 16.03 (63) |
| Oral tumor | 95 | 00 | 31.57 (30) | 54.73 (52) | 13.68 (13) |
| Bone tumor | 58 | 00 | 8.62 (5) | 41.37 (24) | 50.00 (29) |
| CTVT | 91 | 00 | 71.43 (65) | 24.17 (22) | 4.39 (04) |
| Other | 77 | 6.49 (5) | 22.07 (17) | 54.55 (42) | 16.88 (13) |
| **Total** | **714** | **0.70 (5)** | **32.07 (229)** | **50.14 (358)** | **17.08 (122)** |

**Table. 4:** Breed-wise incidence (%) of canine neoplasms recorded during the period from January 2017 to December 2023 at VCC, Anand

| Groups | Mammary gland tumors | Oral tumors | Bone tumors | CTVT | Other neoplasms |
|---|---|---|---|---|---|
| Labrador retriever | 45.29 (178) | 26.31 (25) | 8.62 (05) | 12.08 (11) | 7.79 (6) |
| German Shepherd | 18.06 (71) | 25.26 (24) | 6.89 (04) | 15.38 (14) | 6.49 (5) |
| Doberman Pinscher | 10.17 (40) | - | 15.51 (09) | - | 7.79 (6) |
| Rottweiler | 6.10 (24) | 15.78 (15) | 18.96 (11) | - | 10.39 (8) |
| Great dane | - | - | 32.75 (19) | - | 5.20 (4) |
| Golden retriever | - | 6.31 (06) | 10.34 (06) | - | 6.49 (5) |
| Pomeranian | 7.12 (28) | - | - | 13.18 (12) | 10.39 (8) |
| Sptiz | - | - | - | 8.70 (08) | 10.39 (8) |
| Beagle | - | - | - | - | 2.60 (2) |
| Shih Tzu | - | 3.15 (03) | - | - | 2.60 (2) |
| Dachshund | - | - | - | 6.59 (06) | 7.79 (6) |
| English cocker spaniel | 3.56 (14) | 5.26 (05) | - | 13.18 (12) | 9.09 (7) |
| Indie (Mongrel) | 9.66 (38) | 17.89 (17) | 6.89 (04) | 30.76 (28) | 12.99 (10) |
| **Total (n=562)** | **393** | **95** | **58** | **91** | **77** |

incidence of tumors in age group of 8 to 12 years and less common before 4 years and above 12 years of age. According to Witsch *et al.* (2010) aging results in a greater probability of genetic mutations and accumulation of tumourogenous factors that lead to increase probability of development of tumor in advanced age.

Out of 393 cases of canine mammary tumors, 178 cases (45.29%) were observed in Labrador retriever followed by German Shepherd, Doberman Pinscher, Indie Mongrel, Pomeranian, Rottweiler and English Cocker Spaniel (Table 4). Kusch (1985) found higher disposition for malignant neoplasms in Boxer, German shepherd, Airedale terrier and Poodle with the average age of affected dogs as nine years. haemangioendotheliomas were recoded more frequent in male dogs than in bitches, while pancreatic tumors were more frequent in bitches. Dhami *et al.* (2010), Patel *et al.* (2019) and Rokad *et al.* (2023) reported that canine mammary tumors commonly occurred in German Shepherds. Bala (2005) and Devarathnam *et al.* (2021) reported majority cases of canine mammary tumors in Spitz breed followed by Labrador Retrievers. Arya *et al.* (2018) recorded the highest incidences of neoplasms in Pomeranian (35.48%), followed by German shepherd (25.80%), and Labrador retriever (19.35%).

The prevalence of oral tumors was highest in Labrador Retriever 26.31% (25) followed by German Shephard, Indie Mongrel, Rottweiler, Golden Retriever, English Cocker Spaniel, and Shih Tzu. The numbers of bone tumors were highest in Great Dane (32.75%) followed by Rottweiler (18.96%), Doberman Pinscher (15.51%), Golden Retriever (10.34%), and Labrador Retriever (8.62%), German Shephard and Indian Mongrels (6.89% in each) (Table 4). The prevalence of CTVT was the highest in Indie Mongrels (30.76%) followed by German Shepherd and Spitz (15.38%), Pomeranian and English Cocker Spaniel (13.18% in each), Labrador Retriever (12.08%), Spitz (8.70%) and Dachshund (6.59%). The uncontrolled breeding among the Indian dogs could be the reason of higher prevalence of CTVT cases in canines. Based on these findings it can be predicted that pet owners have a preference for a particular breed based on its popularity in that region. Therefore, the number of breeds in different geographical areas varies, reflecting the breed variation in the incidence of different disorders, including mammary tumors. Khimta *et al.* (2010) recorded 403 cases of neoplasms among different breeds of dogs;, pitz, Mongrel and German shepherd were found more susceptible, while more cases were recorded in females (70.72%) than that in males (29.28%). Breed variation in the incidence of neoplasia was also recorded by Dhami *et al.* (2010), Patel *et al.* (2019) and Rokad *et al.* (2023).

## Conclusions

Based on incidences of canine neoplasms at veterinary clinical complex, it is concluded that, the maximum manifestation of oncological pathology in dogs, regardless of breed, was observed between the age of 8 and 12 years. The incidences of canine neoplasms were significantly higher in female (86.13%) than in male dogs, mainly due to high level of neoplasms in the mammary gland (55.04 %, 393/714) and genitalia - CTVT (9.52 %, 68/714). The breeds most vulnerable to the neoplasms were Labrador retriever followed by German Shepherd, Rottweiler, Great Dane and Pomeranian. The age, breed, and sex were identified as the major risk factors for tumorogenesis in canines.

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