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## Epidemiological studies of canine mammary gland tumors

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#### Abstract

The present study was carried out to determine the epidemiological characteristics of canine mammary gland tumours diagnosed during the period 2017-2019 at Veterinary Clinical complex, College of Veterinary Science, Proddatur. Out of 700 canine cases presented, 36 cases, diagnosed as canine mammary tumors. Age wise incidence was highest in the age group of 7-9 years (41.67%) followed by 10-12 years (33.33%) and lowest in 4-6 years (19.44%). Breed wise incidence was highest in Spitz breed (61.11%), followed by Labrador (25.00%) and lowest in Mongrel (13.89%). Out of 36 cases reported for canine mammary tumors, all were females (100%). In majority of the cases (75%) only one gland was grossly involved, in 19.45% cases, two glands were involved and three glands were involved in 2.8% of cases. Involvement of inguinal mammary gland was seen in 44.44% cases, involvement of caudal abdominal mammary gland was seen in 41.67% cases and involvement of cranial abdominal mammary gland was seen in 11.11% cases. Both inguinal and caudal abdominal glands were affected in 27.8 % cases. Both inguinal and cranial abdominal glands were affected in 13.9 % cases. No involvement of cranial or caudal thoracic mammary glands was observed in the present study. Fine needle aspiration cytology revealed malignancy in all 36 cases. Ipsilateral superficial inguinal lymphnodes were involved in 20 cases. Among 36 cases, 5 cases (13.59%) were at stage I, 10 cases (27.78%) were at stage II, 2 cases (5.56%) were at stage III, 15 cases (41.67%) were at stage IV and 4 (11.11%) cases at stage V as per TNM classification. Among the various histological types identified in 36 cases, 63.88 % were adenocarcinomas, 19.44% were fibrosarcomas, 2.77% were Chondro Adenosarcomas, 5.4% were fibro adenocarcinomas, 2.7% were liposarcoma and lipoadenocarcinoma each.

**Keywords:** Canine mammary tumours, incidence, epidemiology, malignancy

#### Introduction

Canine mammary cancer is a heterogeneous group of diseases linked to morphology and biological behavior. Being the most common neoplastic condition in intact bitches, canine mammary gland tumours pose a great challenge to veterinary surgeons due to its complexity in molecular pathogenesis and varied response to treatment. Epidemiological studies of canine mammary gland tumors are useful in establishing risk factors associated with neoplasia and prognosticating criteria which are helpful in optimization of therapeutic protocols. Therefore the present study was undertaken to study the epidemiological aspects of canine mammary gland tumors.

#### Materials and Methods

The present study was undertaken on clinical cases of canine mammary tumors, which were brought to Department of Veterinary Surgery and Radiology, College of Veterinary Science, Proddatur during the period of 2017-2019. The data regarding the incidence of mammary tumors in dogs were collected and variables like age, breed, sex, reproductive status, gland affected, lymphnode involved, staging and histological types of tumors were recorded and analyzed.

#### Results

A total of 700 canine cases were presented to the department of Veterinary Surgery and Radiology, College of Veterinary Science, Proddatur during the period from 2017 to 2019. Out of these 36 cases were diagnosed as canine mammary tumors.

#### 1. Age

In the present study, highest incidence was observed in the age group of 7-9 years (41.67%)

Followed by 10-12 years (33.33%) and 4-6 years (19.44%). The lowest incidence (5.56%) was observed in age group of 13-15 years. No incidence was observed in age group of 1-3 years. The details of age wise incidence of canine mammary tumors in the present study are tabulated in Table. 1 and depicted in Fig. 1.

## 2. Breed

Among all the reported cases of canine mammary tumors, incidence was observed in only three breeds attended to hospital like Spitz, Labrador and Mongrel. Majority of the cases were in Spitz breed (61.11%), followed by Labrador (25.00%) and lowest incidence was observed in Mongrel (13.89%). The details of breed wise incidence of canine mammary tumors in the present study are tabulated in Table 2 and depicted in Fig. 2.

## 3. Sex

Out of 36 cases diagnosed for canine mammary tumors, all were females and intact (100%). Incidence of mammary tumors in males was not observed in the present study.

## 4. Gross observations

### 4.1 Evaluation of size

Among the cases reported for canine mammary tumors, wide variation was observed in the size. The smallest tumor was 2 cm in size and the largest tumor measured about 13 cm in size. The details of different sizes of canine mammary tumors in the present study are tabulated in Table 3 and depicted in Fig. 3.

### 4.2. Consistency and external appearance

On palpation, all the tumors in the present study were found hard in consistency. All the tumors were nodular and non-pedunculated. In the present study, out of 36 cases, 27.78% cases were ulcerated, 13.89% cases were ulcerated and infested with maggots and 58.33 % cases did not show any other abnormality except the nodular non-pedunculated growth. All the tumors in the present study were observed fixed to the skin.

## 5. Glands involved

### 5.1 Number of glands involved

The number of mammary glands affected in all 36 cases varied from 1 to 3 glands. In majority of the cases (75%) only one gland was grossly involved. In 19.45 cases, two glands were involved. Three glands were involved in 2.8% of cases.

### 5.2 Location of tumors

Among the five pairs of mammary glands, tumor involvement was seen only in three pair of glands i.e., Inguinal, caudal abdominal and cranial abdominal glands in the present study. Involvement of inguinal mammary gland was seen in 44.44% cases, involvement of caudal abdominal mammary gland was seen in 41.67% cases and involvement of cranial mammary abdominal gland was seen in 11.11% cases. Both inguinal and caudal abdominal glands were affected in 27.8% cases. Both inguinal and cranial abdominal glands were affected in 13.9 % cases. No involvement of cranial or caudal thoracic mammary glands was observed in the present study. The details of glands affected with canine mammary tumors in the

present study are tabulated in Table 4 and depicted in Fig. 4.

## 5. Staging of malignant canine mammary tumors

All the malignant tumors in the present study were staged as per WHO (TNM) classification of canine mammary tumors as shown in Table 5 and 6. Among 36 cases, 5 cases (13.59%) were at stage I, 10 cases (27.78%) were at stage II, 2 cases (5.56%) were at stage III, 15 cases (41.67%) were at stage IV and 4 (11.11%) cases at stage V. The smallest tumor was 2 cm in size and the largest tumor measured about 13 cm in size. Lymphnode involvement was observed in 20 cases, where malignant cells were found in affected lymphnode aspiration cytology. Ipsilateral superficial inguinal lymphnodes were involved in all the cases. Distant metastasis in lungs was observed in four cases. Metastatic lesions in lungs were observed in dogs with tumor size more than 10 cm. No distant metastasis was observed in dogs with tumor size less than 5 cm.

## 6. Histological characteristics of tumors

The biopsy samples were taken from all the 36 cases of malignant mammary tumors to identify the type of tumor. Out of 36 canine mammary tumors, Among the various histological types identified (Table 7) in 36 cases, 63.88 % were adenocarcinomas, 19.44% were fibrosarcomas, 2.77% were Chondro Adenosarcomas, 5.4% were fibro adenocarcinomas, 2.7% were liposarcoma and lipoadenocarcinoma each.

**Table 1:** Incidence of mammary tumors in different age group of canines

Age group	No. of cases	Percentage
4-6 years	7	19.44%
7-9 years	15	41.67%
10-12 years	12	33.33%
13-15 years	2	5.56%

**Table 2:** Incidence of mammary tumors in different breeds of canines

Breed	No. of animals	Percentage
Spitz	22	61.11%
Labrador	9	25.00%
Mongrel	5	13.89%

**Table 3:** Size of the canine mammary tumors observed in the present study

Size	No. of cases	Percentage
< 3 cm	5	13.89%
3-5 cm	10	27.78%
5-10 cm	15	41.67%
> 10 cm	6	16.67%

**Table 4:** Details showing the location of canine mammary tumors

Location	No. of animals	Percentage
Inguinal	16	44.44%
Caudal Abdominal	15	41.67%
Cranial Abdominal	4	11.11%
Caudal thoracic	Nil	Nil
Cranial thoracic	Nil	Nil

**Table 5:** WHO (TNM) staging of tumors

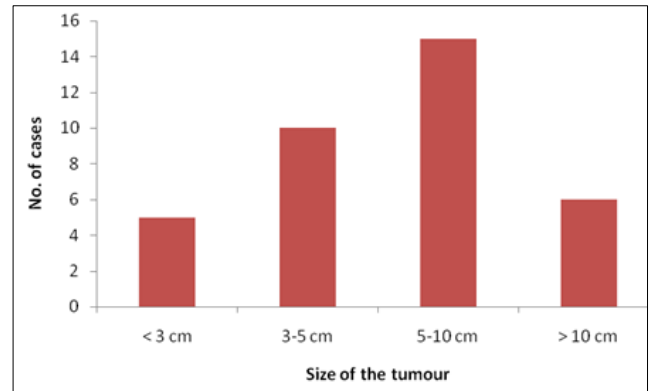
S. No.	TNM classification	No. of tumors in stages					Total
		Stage I	Stage II	Stage III	Stage IV	Stage V	
1.	T1N0M0	05	-	-	-	-	05
2.	T2N0M0	-	10	-	-	-	10
3.	T3N0M0	-	-	02	-	-	02
4.	T3N1M0	-	-	-	15	-	15
5.	T3N1M1	-	-	-	-	04	04

**Table 6:** Percentage of cases under different stages according to TNM classification

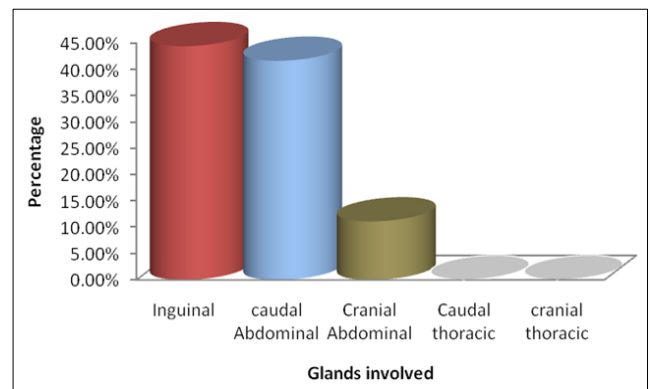
Clinical stage	Number	Frequency
Stage I	5	13.89%
Stage II	10	27.78%
Stage III	2	5.56%
Stage IV	15	41.67%
Stage V	4	11.11%

**Table 7:** Histopathological types of canine mammary tumors

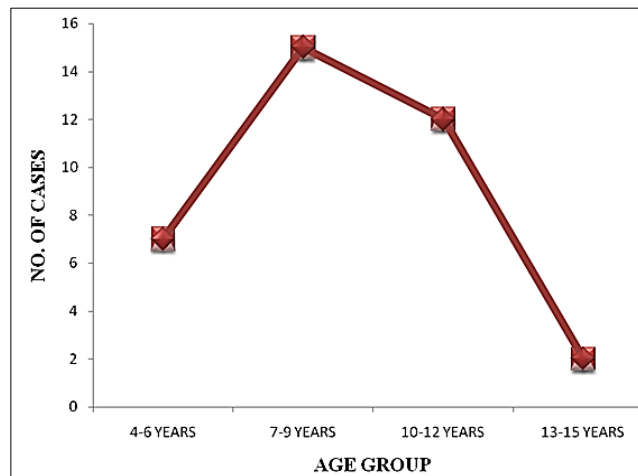
Type of tumor	No. of cases	Percentage
<b>I. Carcinomas</b>		
Adenocarcinoma	23	63.88%
<b>II. Mixed mammary gland tumors</b>		
Fibrosarcoma	7	19.44%
Chondro Adenosarcoma	1	2.77%
Fibroadenosarcoma	1	2.77%
Fibroadenocarcinoma	2	5.4%
Liposarcoma	1	2.77%
Lip adenocarcinoma	1	2.77%



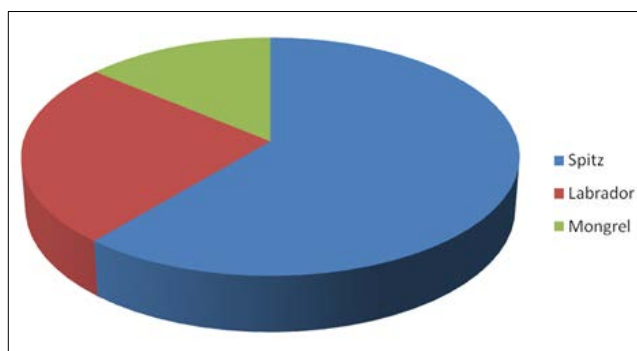
**Fig 3:** Graph depicting the size of canine mammary tumours in the present study



**Fig 4:** Graph depicting the location of canine mammary tumours in the present study



**Fig 1:** Graph depicting the age wise incidence of canine mammary tumours



**Fig 2:** Graph depicting breed wise incidence of canine mammary tumours

**Discussion**

Retrospective epidemiological studies of canine mammary tumors are useful in establishing risk factors associated with neoplasia and prognosticating criteria which are helpful in optimization of therapeutic protocols. The frequency of canine mammary tumors may vary according to the location where the study is conducted (Salas *et al.* 2015) [1]. This can be due to popularity of breed in that particular area, exposure to carcinogens, diet related to that area and climatic conditions. In the present study, highest incidence was observed in the age group of 7-9 years, followed by 10-12 years and 4-6 years. An increasing trend of malignancy with the advancing age was observed in the present study which might be attributed to concept on the carcinogenesis stating the fact that the growing age results in the accumulation of tumorigenous factors leading to malignant tumors as reported by Rejthar, (2002) [2]. The results of age related incidence of canine mammary tumors in the present study are in consistent with other earlier studies (Gill, 1997; Sharma, 2003; Bala, 2005; Shivani, 2007 Gupta 2008 and Sassi *et al.* 2010) [3-7]. The lowest incidence was observed in age group of 13-15 years in the present study which is in agreement with study of Gupta *et al.* (2012) [8]. Zatloukal *et al.* (2005) [9] reported that

incidence of mammary gland tumors increased after the 5 years of age with a peak at the age of 10-12 years followed by subsequent decrease.

In the present study, all the mammary tumors occurred in females only and no incidence was reported in males. Females are predisposed to canine mammary tumors because of the tropism of natural estrogens in relation to the mammary gland that are capable of stimulating cell proliferation and generating carcinogenesis through potential cells (Telang *et al.* 1997) <sup>[10]</sup>.

Incidence of tumors was observed in only three breeds i.e., Spitz, Labrador and Mongrel in the present study. A considerably higher breed predisposition to mammary tumors has been reported in pure bred dogs compared to Mongrels (Dorn *et al.* 1968, Zatloukal *et al.* 2005) <sup>[9, 11]</sup>. Variable breed-wise incidence of CMT has been described by earlier workers (Shivani 2007 and Gupta 2008) <sup>[6, 7]</sup>. Highest incidence was observed in Spitz according to present study which is in agreement with Veena (2009) <sup>[12]</sup> and Dileep Kumar *et al.* (2014) <sup>[13]</sup>.

In the present study, involvement of inguinal mammary gland was seen in 44.44% cases, involvement of caudal mammary gland was seen in 41.67% cases and involvement of cranial mammary gland was seen in 11.11% cases. These results are in consistent with the earlier reports on location of mammary gland involved by Veena, (2009) <sup>[12]</sup>, Sowbharneya *et al.* (2016) and Raval *et al.* (2018) <sup>[15]</sup>. Approximately two third of CMT cases occurred in the fourth and fifth pair of mammary glands as reported by Cohen *et al.* (1974) <sup>[16]</sup> and Ettinger and Feldman (1995) <sup>[17]</sup>. Maximum involvement of the caudal glands might be due to the fact that they have maximum glandular tissue and they maintain their secretory activity longer than other pairs (Fidler *et al.* 1967) <sup>[18]</sup>. Involvement of single gland in majority of the cases in the present study is in concurrence with the earlier reports of Sharma (2003) <sup>[4]</sup>, Bala (2005) <sup>[5]</sup> and Jain (2006) <sup>[19]</sup>. Multiple gland involvement was observed in the present study although with lower incidence. Similarly, high incidence of multiple mammary involvements has also been reported by Fowler *et al.* (1974) <sup>[20]</sup>, Mitchell *et al.* (1974) <sup>[21]</sup>, Mulligan (1975) <sup>[22]</sup> and Gupta *et al.* (2012) <sup>[8]</sup>.

Among the cases reported for canine mammary tumors, wide variation was observed in the size in the present study. The smallest tumor was 2 cm in size and the largest tumor measured about 13 cm in size. Veena (2009) <sup>[12]</sup> reported that the size of tumors varied between 2-12 cm. In the present study, all the tumors were nodular and non-pedunculated. Out of 36 cases, 27.78% cases were ulcerated, 13.89% cases were ulcerated and infested with maggots and 58.33% cases did not show any other abnormality except the nodular non-pedunculated growth. Hellmen *et al.* (1993) correlated ulceration of the skin with tumor malignancy and considered it as an independent factor strongly associated with a poor prognosis. In the present study all ulcerated tumors were associated with malignancy. In the present study out of 36 canine mammary tumors subjected for histopathological examination, 63.88 % were adenocarcinomas, 19.44% were fibrosarcomas, 2.77% were Chondro Adenosarcomas, 5.4% were fibroa denocarcinomas and 2.77% were liposarcomas and lipoadenocarcinomas each. Adenocarcinoma was the most common lesion observed in the present study followed by mixed mammary gland tumors. These results were in consistent with the reports of Veena (2009) <sup>[12]</sup>. An equal incidence of adenocarcinomas and mixed mammary tumors in canine malignant mammary tumors was reported by Reddy *et*

*al.* (2009).

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