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Occurrence and histopathological classification of canine mammary tumours in Wayanad, Kerala

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Abstract
Canine mammary tumours are the most commonly occurring tumours in dogs. The present study was aimed at determining the epidemiological characteristics of canine mammary tumours that were reported in and around Wayanad, Kerala over a period of one year (August 2017 to June 2018). The study included 40 excisional biopsy samples of intact female dogs presented to Teaching Veterinary Hospital, Pookode, Kerala. Age wise analysis revealed that highest risk of developing mammary tumours was seen in the age group of 7-9 years with the mean age of 7.04±1.90 years. Data on breed wise occurrence showed highest number of cases in Labradors followed by German shepherds. The majority of the tumours were having malignant features histologically (92.5 per cent) and three tumours were identified to be benign. Incidence was more with intact female dogs and the caudal and inguinal mammary glands were more affected. Highest number of tumours were epithelial type (simple carcinomas) followed by mixed tumours. Among malignant tumours, solid carcinomas were the most frequent type followed by ductal carcinomas and in benign tumours, adenomas were the most common type of tumour.

Keywords: Canine mammary tumours, age, breed, histopathology

1. Introduction
Tumours are the leading cause of death in companion animals. Mammary neoplasms constituted the most common malignant neoplasms with an annual estimated incidence of 198/100,000 (Dorn *et al*., 1968) [2]. Mammary tumours are the second most common neoplasms frequently encountered in canines preceding skin tumours. These could be mixed type of tumours which could be either benign or malignant. Incidence of mammary gland tumour in canines is as high as 50 per cent of all neoplasms compared with breast cancer (27%) in human beings (Dhami *et al*., 2010) [3]. The common practise of neutering the dogs prior to their first oestrous is likely to decrease the occurrence of these tumours, but canine mammary tumours are still remaining as a common health challenge in veterinary practice. Mammary tumours account for 25-50% of all tumours in intact female dogs and most of them are malignant.

Mammary tumours are thought to be age dependent, as dogs less than two years of age were rarely affected, but there was a sharp increase in the incidence after six years of age with peak incidence at 8-12 years (Srivastava *et al*., 2009). Mammary tumours were the most common tumour affecting female dogs, attributed to hormonal disturbances in female dogs (Moulten *et al*., 1970) [10]. Accurate histopathological diagnosis plays a crucial role in predicting the biological behaviour, assessing the prognosis and deciding the further course of treatment in canines as described by Granja and Dutra (2004) [6]. Scarce information is available regarding the occurrence and type of canine mammary tumours in Wayanad, Kerala. Therefore, the present study was aimed to study the incidence and histological classification of canine mammary tumours in Wayanad, Kerala.

2. Materials and Methods
The study was carried out in forty dogs presented to Teaching Veterinary Hospitals under Kerala Veterinary and Animal Sciences University, with the history of mammary tumour growths during the period from August 2017 to June 2019. Tumour suspected samples were collected in 10% neutral buffered formalin (10% NBF) for histopathology. The data pertaining to breed, age, sex, tumour location, appearance of tumour mass and consistency of the samples was recorded at the time of sample collection.

Tumour tissue samples fixed in 10 percent neutral buffered formalin were processed by routine paraffin embedding method (Spencer and Bancroft, 2013). Serial sections were cut at 4-micron

Thickness using rotary microtome and sections were stained with routine haematoxylin and eosin procedure (Suvarna *et al*., 2008). The benign and malignant mammary tumours were classified into different subtypes based on the histological features as described by Goldschmidt *et al*. (2011) [7].

3. Results and Discussion

3.1. Age wise incidence

In the present study, the highest occurrence of mammary tumour was observed in seven to nine years age group (55 percent) followed by four to six years age group (35 percent) and ten to twelve years age group (5 percent) each. This is in line with the findings of Dileepkumar *et al*. (2014) [4] who reported highest incidence of CMTs in the same age group and Sreevatsava *et al*. (2009) who reported that occurrence of mammary tumours progressively increased from four to ten years age group and they correlated with ovarian hormone influences in tumour development with advancing age.

Most of the tumours (80 percent) were observed in dogs aged six years and peak at twelve years. The mean age of the dog affected with the mammary tumours was 7.04±1.90 years. In the present study, no case was reported below two years of age and an increase in the occurrence of mammary tumours was observed after six years of age. This is in agreement with Moulten *et al*. (1970) [10] who reported that occurrence of mammary tumours increased after six years of age, so called the onset of "cancer age" and incidence decreased below two years of age in dogs.

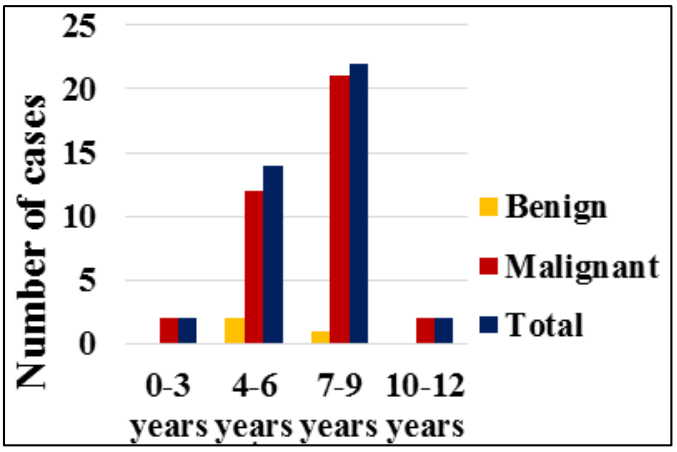

Fig 1: Age group

3.2. Gender wise incidence

In the present study all the mammary tumours were reported in female dogs. This is in line with the findings of Moulten *et al*. (1970) [10] who observed that mammary tumours were specific to females and rare in male dogs which was attributed to the hormonal changes.

3.3. Breed wise incidence

In the present study, occurrence of canine mammary tumours were observed more in Labrador (16/40, 40 per cent) followed by German shepherd (10/40, 25 per cent), Dachshund (5/40, 12.5 per cent), Beagle (3/25, 7.5 per cent), Rottweiler (3/25, 7.5 per cent) and one case each was observed in Pug, Pomeranian and Non-descript. This is in agreement with the observation of Mathew *et al*. (2019) [11] who reported the high occurrence of CMTs in Labrador (30 percent) followed by German shepherd (25 percent) and Dachshund (10 percent). Dhami *et al*. (2010) [3], Reddy *et al*. (2009) [12] and Priya *et al*. (2006) reported highest incidence in German shepherd breed. Gill (1997) [5] and Jain (2006) [8] reported highest occurrence in Spitz breed followed by Dobermann. Various authors observed different breed wise occurrence in development of CMTs. Thus, it could be concluded that pure breeds are at high risk of developing mammary tumours. Variation in breed wise occurrence might be due to variation in sample size and popularity of particular breed in the area of study.

3.4. Tumour location

In the present study, majority of the tumours were observed in inguinal mammary glands (50 per cent) followed by caudal glands (42.5 per cent) (Fig 1) and cranial glands (10 per cent). This is in agreement with the findings of Silva *et al*. (2019) [14] who observed that inguinal and caudal mammary glands are most affected. The reason for this was proposed as that the posterior glands are having greater volume of glandular tissue to react to any carcinogenic stimulus Cranial pairs showed less affection.

Fig 2: Mammary tumour mass in left caudal abdominal gland involving teat.

3.5. Tumour type and histological classification

Out of forty cases, 37 were malignant (92.5 per cent) and 3 were benign (7.5 per cent). The benign tumours were diagnosed as complex adenoma, fibroadenoma and papillary adenoma. Malignant tumours observed were solid carcinoma, ductal carcinoma, and tubulopapillary carcinoma, carcinoma arising from benign mixed tumours, adenosquamous carcinoma, malignant Myoepithelioma, complex carcinoma and mixed carcinoma. Among these malignant tumours, simple carcinomas accounted for highest number (65 per cent) followed by carcinoma arising from benign mixed tumours (15 per cent), carcinosarcomas (12.5 per cent) and special carcinomas (7.5 per cent). This is in line with the findings of Karayannopoulou *et al*. (2005) [9], who observed that simple carcinomas were the most commonly occurring tumours with 64.7 per cent followed by carcinoma arising from benign mixed tumour (21.2 per cent), complex carcinoma (9.4 per cent). Three cases were benign which were diagnosed as complex adenoma, fibroadenoma and papillary adenoma. Similar findings were observed by Strattmann *et al*. (2008) [13] who found that adenomas were the most frequent benign tumours and common malignant ones were simple carcinomas. Among the simple carcinomas, solid carcinomas were the most frequent type of tumour followed by ductal carcinomas.

Histologically solid carcinomas were characterized by sheets

of neoplastic cells with minimal stroma (Fig 2). The cells were highly pleomorphic with hyper chromatic nuclei, stippled chromatin, prominent nucleoli and scanty basophilic cytoplasm (Misdorp *et al*. 1972). Ductal carcinomas were characterized by proliferation of cells forming single to multiple layers of epithelial cells with intact basement membrane (Fig 3) as described by Mathew *et al*. (2019) [11]. Malignant mixed tumours or carcinosarcomas were composed of carcinomatous epithelial cells along with malignant cartilaginous tissue characterized by binucleated.

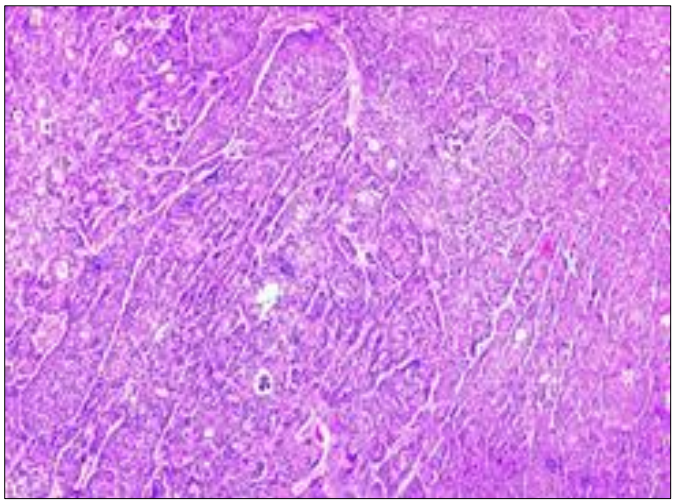

Fig 3: Solid carcinoma. Sheets of neoplastic cells giving hepatic cord like appearance without lumen (H&E. 100X)

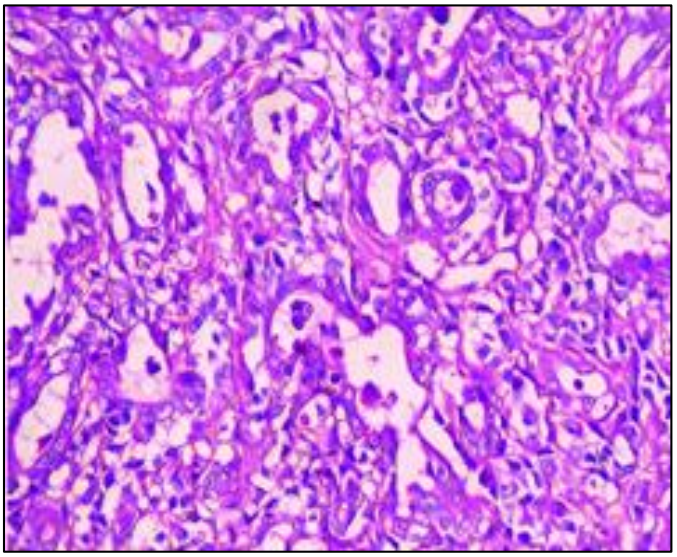

Fig 4: Ductal carcinoma. Ducts endowed with proliferation of population of pleomorphic cells in multilayers (H&E.400X)

Chondrocytes with mitotic areas (Fig 4). Al-Mansoor *et al*. (2018) [1] reported that mixed tumours were malignant if the connective tissue component carried malignant features. Cribriform carcinoma showed bridges of neoplastic cells arranged in sieve like pattern by forming small lumen (Fig 5) within the duct as described by Goldsmith *et al*. (2011) [7]. The cells were polygonal to oval with scanty eosinophilic cytoplasm and moderate anisocytosis and anisokaryosis. Cystic papillary carcinoma was composed of papillary neoplastic cells with supporting fine fibro vascular stroma extending into the dilated cystic lumen (Fig 6) similar to that described by Muniappan *et al*. (2019)

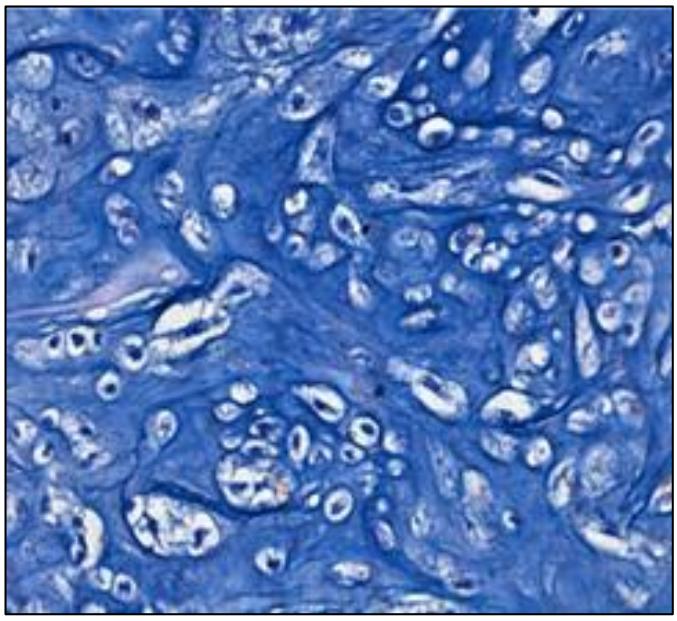

Fig 5: Malignant mixed carcinoma. Highly pleomorphic binucleated chondrocytes admixed with fibrillar matrix (H&Ex1000)

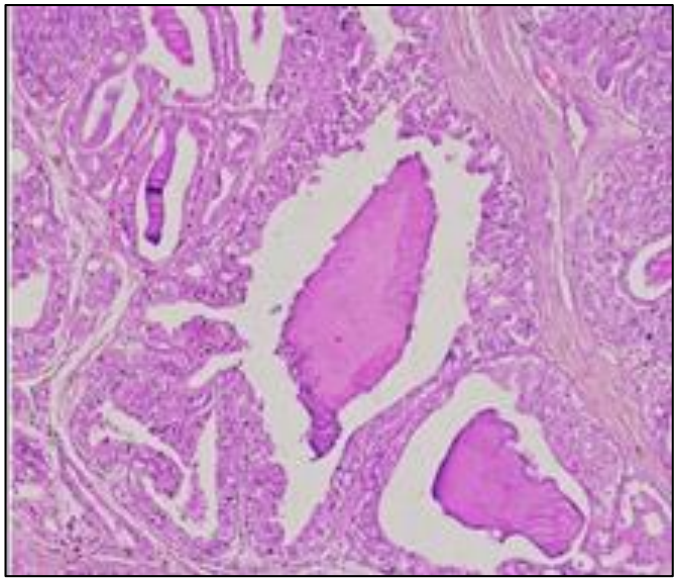

Fig 6: Cystic papillary carcinoma. Neoplastic epithelial cells arranged in papillary fashion extending into the evstic lumen (H&E. 100X)

4. Conclusion

Canine Mammary tumours are one of the major health problems in intact female dogs. Most of the affected dogs were of adult to elderly ones with the mean age of diagnosis at 7.04±1.90 years. Pure breeds showed high incidence of developing mammary tumours. Majority of the mammary gland tumours studied are histologically malignant and considerably high histological diversity was observed. The clinical features, prognosis and response to therapy may vary with the histological variants of the tumours. Present study emphasizes the necessity of improving awareness about the high rate of occurrence of canine mammary gland tumours in Kerala so as to formulate better diagnostic and therapeutic regimes for the prevention and control of the disease.

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