



Pathology and occurrence of canine mammary tumours in Kerala[#]

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Abstract

Epidemiological and pathological features of 25 canine mammary tumours were investigated. All the tumours were found in female dogs and diagnosed as malignant. The occurrence was higher in intact female dogs (92%) compared to spayed ones (8%). Pure breed dogs were more affected (72%) than non-descript (28%) and among pure breeds, Labrador was found to be affected the most (44%). Caudal abdominal glands were most frequently affected (40%) followed by the inguinal gland (24%). The tumours were presented in varied sizes, shapes and consistencies. Some tumours had ulcerations, pus formation and necrosis. Mixed carcinoma was the most frequent histotype closely followed by complex carcinoma. Most tumours were classified as Grade II tumours followed by Grade I and Grade III.

Keywords: Canine mammary tumours, occurrence, histopathology

Cancer is a widespread disease that causes significant social and economic hardships globally and remains a leading cause of mortality despite extensive research efforts. In 2022, nearly 20 million new cancer cases were diagnosed in humans resulting in approximately 9.7 million deaths. The most frequently diagnosed cancer was lung cancer, followed by breast cancer (Bray *et al.*, 2024). The annual incidence rate of mammary tumours in dogs is approximately 198 cases per 100,000 (Meuten *et al.*, 2016), which is higher than in humans, where the rate is 85 occurrences per 100,000 women (Bray *et al.*, 2018). Canine mammary tumours (CMTs) have been suggested as an excellent animal model for studying human breast cancer due to similar characteristics such as spontaneous occurrence, hormonal aetiology and histologic patterns. Thus, CMTs can contribute to studying the molecular pathogenesis of human breast cancers (Queiroga *et al.*, 2011). Hence, this study reports the occurrence of mammary tumours in dogs and their association with age, sex, breed, tumour location, gross pathology and histopathological characteristics.

Materials and methods

The study was carried out on 25 dogs presented at Kerala Veterinary and Animal Sciences University and various other hospitals in Kerala with a history of spontaneous mammary tumours. Information regarding breed, age,

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sex, tumour location, evidence of metastasis, spaying status and the gross appearance of tumour mass were collected. Tissue samples were collected from at least three distinct sites within each tumour and fixed in 10 per cent neutral buffered formalin. The biopsy specimens were then processed at the Department of Veterinary Pathology, College of Veterinary and Animal Sciences, Pookode as per standard protocol. Four-micrometre thick sections were stained with hematoxylin and eosin (H&E) following the protocol outlined by Suvana *et al.* (2018). Histopathological classification of the tumours was performed as described by Goldschmidt *et al.* (2011) and histological malignancy grading was done as described by Meuten, (2017).

Results and discussion

All 25 collected mammary gland masses obtained in the present study were diagnosed as malignant tumours. This outcome is consistent with the findings of Tavasoly *et al.* (2013), who similarly reported 100 per cent malignancy in their investigation. According to Petrov *et al.* (2014), delays in reporting by the owners could be a cause of this high prevalence of malignant tumours. On the other hand, Salas *et al.* (2015) found a lower per cent (47.5%) of malignant tumours in their study. Differences in sample

size and research duration may contribute to the variation in the incidence of tumours.

The age-wise occurrence of CMTs is given in Fig. 1. Majority of the tumours were observed in dogs aged between 7 and 9 years (56%), followed by those in the 10 to 12 years age group (24%). These results align with the observations of Dileepkumar *et al.* (2014), who also recorded the highest incidence of CMTs in the same age group. An increase in incidence was noticed after six years in the present study as reported by Moulton *et al.* (1970), who identified this as an age for cancer development.

All the cases of CMTs were recorded in female dogs, which aligns with the findings of Tamilvani *et al.* (2024). The high incidence of CMT in female dogs is believed to be influenced by canine endocrinological and functional differences in either sex. Also, intact female dogs were affected more (92%) compared to spayed bitches (8%). This is in agreement with the findings of Hemanth *et al.* (2015) who also reported a higher incidence of mammary tumours in intact bitches compared to spayed bitches. This might be attributed to the impact of steroid

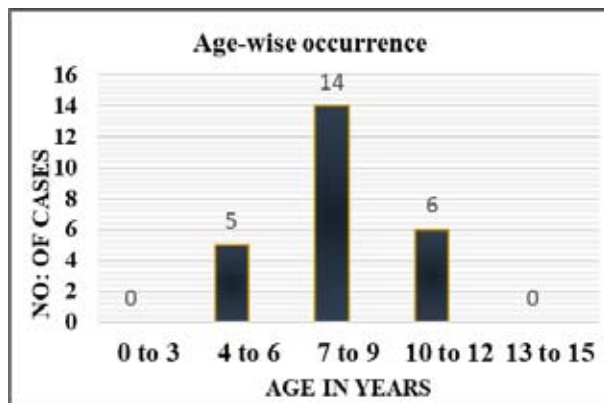


Fig. 1. Age-wise occurrence of CMTs

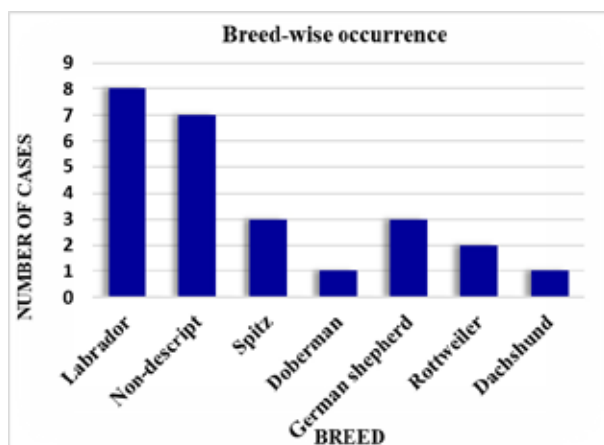


Fig. 2. Breed-wise occurrence of CMTs

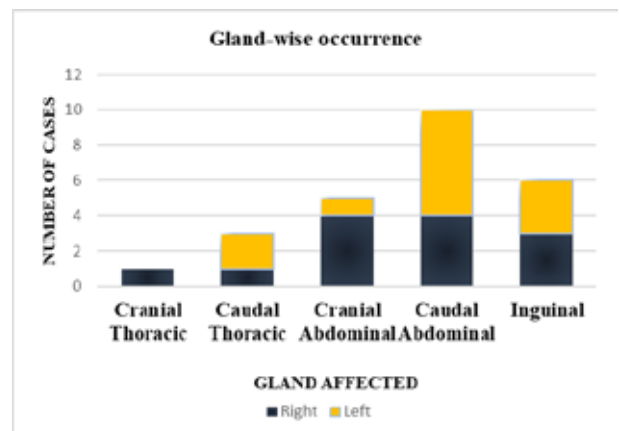


Fig. 3. Gland-wise occurrence of CMTs

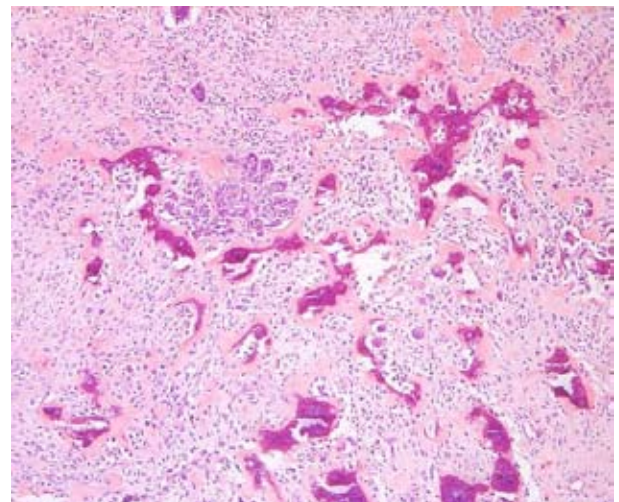


Fig. 4. Neoplastic epithelial cells surrounded by proliferating myoepithelium and multifocal ossification in mixed mammary tumour

sex hormones, such as oestrogen and progesterone in the mammary gland during the oestrous cycle.

The breed-wise occurrence of CMTs is given in Fig. 2. In our study, mammary tumours were most frequently seen in Labradors followed by German Shepherd and Spitz. This result was consistent with the earlier study conducted by Sruthi *et al.* (2024) who also reported the highest number in Labrador. The breed-wise occurrence depends on the research region and breed preference in that locality.

The gland-wise occurrence is given in Fig. 3. Most mammary tumours were observed in the caudal abdominal glands (40%) followed by the inguinal glands (24%). Only one case involving the cranial thoracic gland was observed. John *et al.* (2022) also reported the highest number of mammary tumour affections in the caudal abdominal glands. This might be due to the abundant glandular tissue and prolonged secretory activity of caudal glands compared to the cranial pairs.

The mammary tumours in this study displayed a wide range of gross pathological features. Most of the tumours appeared firm in consistency and exhibited a round to oval morphology, with some tumours firmly adherent to the skin and others presented in a pedunculated form. These observations agree with the findings of Kumar and Parasar (2020), who similarly documented both sessile and pedunculated masses. Few tumour masses exhibited surface ulcerations, with a few displaying deeper ulcerations. This aligns with the observations of Sai *et al.* (2024), who also reported skin ulcerations in some cases, along with maggot infestation. Few tumour masses displayed a greyish-white appearance on their cut surfaces, along with the presence of cystic structures, consistent with the findings of Shafiee *et al.* (2013). Mixed tumours, in particular, were characterised by a hard texture upon sectioning, revealing white cartilaginous areas within their structure. These characteristics were similarly reported by Yogita *et al.* (2015), who also reported the features of mixed tumours in a same manner.

Histologically, mixed carcinoma was found to be the most frequent (24%) followed by complex carcinoma (20%). Other histological types such as tubular carcinoma, tubulopapillary carcinoma and malignant myoepithelioma, comprised 12 per cent each. This was followed by carcinosarcoma (8%) and four per cent each of solid carcinoma, carcinoma arising in a complex adenoma and malignant myoepithelioma. This is in line with the results of Raval *et al.* (2018) who also reported the highest incidence of mixed mammary tumours. The cell component of mammary tumours including epithelial cells, myoepithelial cells or stromal cells can undergo metaplastic changes resulting in the formation of bone or cartilage in mixed mammary carcinomas. Histologically, this subtype was characterised by malignant epithelial cells forming large, irregular tubules with benign proliferation of myoepithelial cells supported by fibrovascular connective tissue stroma. Foci of cartilage were identified, exhibiting no atypical changes (Fig. 4). Simple carcinomas accounted for the largest proportion (65%) in a study conducted by Kavya *et al.* (2020). In this study, special type-epithelial neoplasms or sarcomas were not identified. The variations in the types and numbers of tumours identified across various studies could be due to the utilisation of different classification systems or variations in assessment methodologies. Histological grades of different types of CMTs obtained in the present study is given in Table 1.

The majority of the malignant mammary tumours were categorised as intermediate grade (64%; 16/25), followed by low grade (24%; 6/25) and high grade (12%; 3/25), as per the criteria of Pena *et al.* (2013). Similar results were obtained by Baba *et al.* (2016) and Christy *et al.* (2022) where a prevalence of Grade II tumours was noticed. Kavya *et al.* (2020) also employed the same criteria for grading and obtained similar results.

Conclusion

This study shows the high incidence of malignant canine mammary tumours, primarily in female dogs who are sexually intact and between the ages of seven and

Table 1: Histological grades of different types of CMTs (n=25)

Tumour type	Grade I	Grade II	Grade III	Total
Tubular carcinoma		2	1	3
Tubulopapillary carcinoma	1	2		3
Complex carcinoma	1	4		5
Mixed carcinoma	2	4		6
Solid carcinoma		1		1
Carcinoma arising in a complex adenoma	1			1
Carcinoma and malignant myoepithelioma	1	1	1	3
Malignant myoepithelioma		1		1
Carcinosarcoma		1	1	2
Total	6	16	3	25

nine years. Preventive methods include spaying at an early age since a high frequency of malignant tumours is noticed in sexually intact female canines. Spaying, particularly before the first estrus, greatly lowers the risk of mammary tumours. Regular veterinary check-ups and mammary gland assessments can also help with early detection and intervention, especially for dogs in high-risk age groups and breeds.

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Conflict of interest

The authors declare that they have no conflict of interest.

References

- Baba, O. K., Sood, N.K. and Gupta, K. 2016. Classification, grading and prognostic evaluation of canine mammary tumours. *Ind. J. Vet. Pathol.* **40**: 183-186.
- Bray, F., Ferlay, J., Soerjomataram, I., Siegel, R.L., Torre, L.A., Jemal, A. 2018. Global cancer statistics 2018. GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer. J. Clin.* **68**: 394-424.
- Bray, F., Laversanne, M., Sung, H., Ferlay, J., Siegel, R.L., Soerjomataram, I. and Jemal, A. 2024. Global cancer statistics 2022: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer. J. Clin.* **74**: 229-263.
- Christy, M.J., Sajitha, I.S., Devi, S.S., Dhanush, K.B. and Sudheesh, S.N. 2022. Study on histopathological subtypes and grading of canine mammary tumours. *J. Vet. Anim. Sci.* **53**: 85-88.
- Dileepkumar, K.M., Maiti, S.K., Kumar, N. and Zama, M.M.S. 2014. Occurrence of canine mammary tumours. *Ind. J. Can. Pract.* **6**: 179-183.
- Goldschmidt, M., Peña, L., Rasotto, R. and Zappulli, V. 2011. Classification and grading of canine mammary tumors. *Vet. Pathol.* **48**: 117-131.
- Hemanth, I., Kumar, R., Varshney, K.C., Nair, M.G., Kumar, B.R., Sivakumar, M., and Thanislass, J. 2015. Epidemiological and clinical studies on canine mammary tumours. *J. Vet. Res.* **24**: 11-14.
- John, B., Devi, S.S., Sajithal, S., Prasanna, K.S. and Anoop, S. 2022. Occurrence and pathology of mammary tumours in dogs of central Kerala. *J. Pharm. Innov.* **11**: 911-918.
- Kavya, M., Sajitha, I.S., Anoopraj, R., Anoop, S. and Ajith, J.G. 2020. Occurrence and histopathological classification of canine mammary tumours in Wayanad, Kerala. *J. Pharm. Innov.* **9**: 220-223.
- Kumar, P. and Parasar, M.C. 2020. Occurrence of mammary tumour in dogs. *J. Agric. Res. Adv.* **2**: 29-32.
- Meuten, D.J., Moore, F.M. and George, J.W. 2016. Mitotic count and the field of view area: time to standardize. *Vet. Pathol.* **53**: 7-9.
- Meuten, D.J. 2017. *Tumours in Domestic Animals*. (5th Ed.). Iowa State Press, Iowa, 735p.
- Moulton, J.E., Taylor, D.O.N., Dorn, C.R. and Andersen, A.C. 1970. Canine mammary tumours. *Pathol. Vet.* **4**: 289-320.
- Pena, L., Andres, P.D., Clemente, M., Cuesta, P. and Perez-Alenza, M.D. 2013. Prognostic value of histological grading in noninflammatory canine mammary carcinomas in a prospective study with two-year follow-up: relationship with clinical and histological characteristics. *Vet. Pathol.* **50**: 94-105.
- Petrov, E.A., Ilievska, K., Trojancanec, P., Celeska, I., Nikolovski, G., Gjurovski, I. and Dovenski, T. 2014. Canine mammary tumours-clinical survey. *Maced. Vet. Rev.* **37**: 129-134.
- Queiroga, F.L., Raposo, T., Carvalho, M.I., Prada, J. and Pires, I. 2011. Canine mammary tumours as a model to study human breast cancer: most recent findings. *In Vivo.* **25**: 455-465.
- Raval, S.H., Joshi, D.V., Parmar, R.S., Patel, B.J., Patel, J.G., Patel, V.B., Ghodasara, D.J., Chaudhary, P.S., Kalaria, V.A. and Charavada, A.H. 2018. Histopathological classification and immunohistochemical characterisation of canine mammary tumours. *Ind. J. Vet. Pathol.* **42**: 19-27.
- Sai, T.R., Kumar, V.A., Kumar, K.S. and Kumar, B.A. 2024. Diagnosis of canine mammary tumours. *Int. J. Vet.* **9**: 452-45.
- Salas, Y., Márquez, A., Diaz, D. and Romero, L. 2015. Epidemiological study of mammary tumours in female dogs diagnosed during the period 2002-2012: A growing animal health problem. *PLoS ONE.* **10**: 1-15. Available: <https://doi.org/10.1371/journal.pone.0127381>. [25 Oct. 2023].
- Shafiee, R., Javanbakht, J., Atyabi, N., Kheradmand, P., Kheradmand, D., Bahrami, A., Daraei, H. and Khadivar, F. 2013. Diagnosis, classification

- and grading of canine mammary tumours as a model to study human breast cancer: an Clinico - Cytohistopathological study with environmental factors influencing public health and medicine. *Cancer. Cell. Int.* **13**: 1-11.
- Sruthi, S., Prasanna, K.S., George, A.J., Sajitha, I.S., Sudheesh, S.N., Varuna, P.P. and Bharathi, R. 2024. Mammary Tumors in dogs: Age, Breed, Gender, Rearing, and Diet Factors. *Ind. J. Vet.* **101**: 34-38.
- Suvarna, S.K., Layton, C. and Bancroft, J.D. 2018. *Bancroft's Theory and Practice of Histological Techniques*. (8th Ed.). Elsevier, Amsterdam, 557p.
- Tamilvani, P., Anoopraj, R., George, A.J., Pradeep, M., Asaf, M., Palekkodan, H., Dhanush Krishna, B. and Nair, A.P. 2024. Occurrence of Canine Mammary Tumours in Wayanad District, Kerala. *Ind. J. Vet.* **101**: 38-41.
- Tavasoly, A., Golshahi, H., Rezaie, A. and Farhadi, M. 2013. Classification and grading of canine malignant mammary tumours. *Vet. Res. Forum.* **4**: 25-30.
- Yogita, P., Dattatray, K., Gajendra, K. and Renuka N. 2015. Gross and cytological evaluation of canine spontaneous mammary neoplasms and its correlation with histopathology and morphometric analysis. *Int. J. Vet. Sci.* **4**: 104-110. ■