RESEARCH ARTICLE
Open Access

Journal of Veterinary and Animal Sciences
ISSN (Print): 0971-0701, (Online): 2582-0605
https://doi.org/10.51966/jvas.2024.55.2.304-311

Occurrence and pathology of cutaneous tumours in dogs[#]

P. N. Athira[1], R. Anoopraj[2*], P. Hamza[2], M. Pradeep[2], K. B. Dhanush[2], S. Sooryadas[3], S. Devika[1] and A. J. George[4]
Department of Veterinary Pathology
College of Veterinary and Animal Sciences, Pookode, Wayanad- 673576
Kerala Veterinary and Animal Sciences University
Kerala, India

Citation: Athira, P.N., Anoopraj, R., Hamza, P., Pradeep, M., Dhanush, K.B., Sooryadas, S., Devika, S. and George, A.J. 2024. Occurrence and pathology of cutaneous tumours in dogs.
J. Vet. Anim. Sci. **55**(2):304-311
DOI: https://doi.org/10.51966/jvas.2024.55.2.304-311

Received: 08.09.2023 *Accepted: 23.01.2024* *Published: 30.06.2024*

Abstract

The current research work was undertaken to study the occurrence and pathology of cutaneous tumours in dogs and their age, breed, location and gender-wise distribution. A total of 33 samples suspected of cutaneous tumours were collected from the cases presented to Teaching Veterinary Clinical Complex (TVCC), Pookode, Wayanad, Kerala during a period of 12 months from June 2022 to June 2023. Based on histopathology, most of the tumours were diagnosed as benign. Majority of the tumours were of mesenchymal origin. Among different histological types, highest occurrence was that of squamous cell carcinoma (SCC) and trichoblastoma followed by histiocytoma, lipoma, mast cell tumour, hepatoid gland adenocarcinoma and haemangioma. Although, the incidence was higher among males and among the dogs belonging to the age group of 5-10 years, it was not statistically significant. Among different breeds, highest occurrence was observed in Labrador Retriever followed by German Shepherd. The study also warrants large scale epidemiological studies to identify the risk factors and to unravel the etiopathogenesis of canine cutaneous neoplasms.

Keywords: *Cutaneous tumours, dogs, occurrence, histopathology*

Cutaneous neoplasms in dogs continue to be an important disease in pet animal practice and the most leading cause of death in dogs (Rafalko *et al*., 2023). Dogs are twice as likely as humans to develop tumours (Rungsipipat *et al*., 2003). As being companion animals, sharing a common environment with humans, they can acquire a variety of spontaneous tumours during their

[#]*Part of MVSc thesis submitted to Kerala Veterinary and Animal Sciences University, Pookode, Wayanad, Kerala*

1. *MVSc Scholar*
2. *Assistant Professor*
3. *Assistant Professor, Department of Veterinary Surgery and Radiology*
4. *Professor and Head*

**Corresponding author: anoopraj@kvasu.ac.in, Ph.9495361872*

lifetime similar to humans (Gamlem *et al*., 2008). Tumours of skin are the most and second–most common tumours reported in male and female dogs, respectively accounting for approximately one-third of all tumours encountered in dogs (Graf *et al.,* 2018). These tumors can be benign or malignant and may arise from various cell types present in the skin and can affect dogs of all ages, breeds and sizes. The high incidence of development of tumours in skin could be due to continuous exposure of skin to various physical, chemical and other environmental factors (Subapriya *et al*., 2021). This may also be due to early detection of these cutaneous lesions. The incidence of cutaneous tumors in canines has been on the rise in recent years, making it an important area of research and veterinary attention. Several surveys undertaken in different countries have revealed geographical variations in the occurrence and type of skin tumours that develop in dogs. The discrepancies are attributable to geographical differences in environmental carcinogen exposure and breed popularity (Mukaratirwa *et al*., 2005). This article aims to provide an overview of the occurrence and clinicopathological features of cutaneous neoplasms in dogs during the period of June 2022 to June 2023 in and around Wayanad.

Materials and methods

The present study involved collection of suspected cutaneous neoplastic samples from the canine cases presented to Teaching Veterinary Clinical Complex, Pookode. A total of 33 samples were collected during a period of 12 months from June 2022 to June 2023. Clinical data of cases such as age, species, breed, sex, location, shape and size were recorded. The samples were fixed in 10 per cent neutral buffered formalin (10% NBF), processed and stained using routine haematoxylin and eosin (H&E) staining method for histopathological examination. Chi-square test with Yate's correction and Fischer's exact tests were used to find out the relationship between tumour occurrence and other categorical variables using GraphPad Prism v.9.

Results and discussion

Tumours in the present study were classified into epithelial/ melanocytic origin and mesenchymal origin based on World Health Organisation (WHO) classification. Among all the tumours of cutaneous origin, five cases (15.15 per cent) each of squamous cell carcinoma (SCC) and trichoblastoma were observed. It was followed by four cases (12.12 per cent) of histiocytoma, three cases (9.09 per cent) of lipoma, mast cell tumour, hepatoid gland adenocarcinoma, haemangioma and two cases (6.06 per cent) of melanoma, haemangiopericytoma, angiofibroma and one case (3.03 per cent) of liposarcoma. Among all tumours, the occurrence of squamous cell carcinoma and trichoblastoma were found to be more in the present study. This result was found in agreement with observations made by Lafta and Alaboddy (2020) in their study on incidence of cutaneous tumours in dogs.

Trichoblastoma

Five cases of trichoblastoma were examined and among these, two cases revealed a solid pattern with mild to moderately dense fibrous stroma dividing neoplastic cells into multiple islands (Fig. 1). One case showed a medusoid pattern in which multiple long, thin cords of cells appeared to be arising from a central core (Fig. 2) and one case had a granular cell type pattern. Ribbon type of trichoblastoma was identified in one case in which the neoplastic cells were arranged in two or three cell thick cords. The neoplastic cells had scanty basophilic cytoplasm with indistinct cell borders, round to oval nucleus and hyperchromatic inconspicuous nucleoli with a palisading arrangement. These findings were in accordance with the reports of Goldschmidt and Goldschmidt (2017).

Squamous cell carcinoma

Out of the five cases of squamous cell carcinoma (SCC) examined in the study, three cases were well differentiated and two cases were moderately differentiated. The well-differentiated neoplasm was characterised by neoplastic squamous epithelial cells invading the dermis and subcutaneous tissue along with distinct keratin pearl formation, the cells were arranged in concentric layers with central core of keratin (Fig. 3). The neoplastic cells were large and ovoid to polyhedral with pale eosinophilic

abundant cytoplasm and the nuclei were round to oval, vesicular and centrally located with single prominent nucleoli and frequent mitotic figures. These observations were in agreement with the findings of Kashyap *et al*. (2013). The moderately differentiated neoplasms were characterised by multiple variably sized islands of neoplastic epithelial cells with fewer keratin pearls (Fig. 4).

Hepatoid gland adenocarcinoma

Histopathological examination of hepatoid gland adenocarcinoma revealed multiple lobules of hepatocytes like neoplastic cells that were separated by variable amounts of fibrovascular stroma. The reserve cells were characterised by round, small cells with basophilic cytoplasm and hyperchromatic nuclei that were arranged at the periphery of the lobules. The neoplastic cells were pleomorphic with abundant, highly eosinophilic cytoplasm, which was sometimes vacuolated and granular. The nuclei were pleomorphic, large and located centrally with prominent nucleoli and occasional mitotic figures were evident (Fig. 5). These findings were in concordance with observations of Yumusak *et al*. (2016).

Melanoma

Histopathological examination of two cases of digital melanoma revealed melanocytic cells which were obscured by melanin pigment and were arranged in nests and sheets separated by thin fibrous stroma in dermis and dermo-epidermal junction (Fig. 6). The melanocytic cells were large round to polygonal with distinct cell borders containing oval vesicular nuclei with multiple prominent nucleoli. These findings were in accordance with reports of Goldschmidt and Goldschmidt (2017).

Lipoma

All three cases of lipoma examined in the present study were histologically characterised by neoplastic adipocytes with vacuolated cytoplasm that pushed the nuclei into periphery and appeared flattened along the cell membrane (Fig. 7). A thin to thick fibrous tissue stroma separated adipocytes into multiple lobules. These findings were similar to the reports by Mathew *et al*. (2020).

Angiofibroma

Angiofibroma, microscopically, appeared as a moderately cellular mass composed of irregular group of blood vessels within a connective tissue matrix. Higher magnification revealed spindle or stellate-shaped fibroblasts with oval to elongated nucleus (Fig. 8). Present findings were in accordance with the observations made by Kluthcovsky *et al*. (2021).

Haemangioma

Histopathological examination of haemangioma revealed well-circumscribed cavernous type characterised by variably sized, widely dilated vascular channels filled with erythrocytes separated by varying amount of fibrous connective tissue stroma (Fig. 9). These channels were lined by a single layer of endothelial cells containing inconspicuous nuclei. These findings were in agreement with Lather *et al*. (2014).

Haemangiopericytoma

Histopathological examination of haemangiopericytoma revealed highly cellular mass composed of spindle cells arranged concentrically around capillaries, like whorls in a collagenous stroma (Fig. 10). Neoplastic spindle cells were having moderate eosinophilic cytoplasm with vesicular nuclei and inconspicuous nucleoli. Our findings were in agreement with reports of Simeonov *et al.* (2011).

Mast cell tumour

Three cases of mast cell tumours (MCT) were documented in the study. Based on the cellular and nuclear morphology, architecture and cellularity, two cases were graded as grade 1 (low grade) and one was grade 2 (intermediate grade) according to Patnaik three-tier grading system. Low grade MCT was characterised by cells arranged in rows separated by mature collagen bundles (Fig. 11). The cells were round with distinct

moderate cytoplasm and mostly eccentrically placed nucleus, which was round with condensed chromatin. Intermediate grade MCT was characterised by highly cellular mass with mast cells arranged in rows and sheets with bright eosinophilic bands of collagen along the course of neoplastic mast cells (Fig. 12). The moderate pale eosinophilic cytoplasm contained fine granules and round to oval, centrally or eccentrically placed nucleus.

Histiocytoma

Histopathologically, in all four cases of histiocytoma, the cells were arranged in sheets separated by thin band of collagen in the dermis replacing most of the adnexal structures. The cells were round with varying amount of pale eosinophilic, sometimes vacuolated cytoplasm and round to oval to intended nucleus was observed (Fig. 13). These findings were in accordance with observations of Goldschmidt and Goldschmidt (2017).

Liposarcoma

Histopathologically liposarcoma was characterised by round to large polyhedral cells arranged in sheets and lobules by intervening connective tissue septa. Smaller portion of cells had single large fat vacuole with peripheral nucleus. Some cells were foamy with variably sized vacuoles in the cytoplasm (Fig. 14). These findings were in agreement with Avallone *et al*. (2016).

Incidence of tumours

Out of 33 cutaneous tumour cases, 22 tumours (66.67 per cent) were diagnosed as benign and remaining 11 tumours (33.33 per cent) were diagnosed as malignant, based on histopathological examination. The increased incidence of benign tumours was in accordance with Graf *et al.* (2018) and Martins *et al*. (2022) who reported 57.52 per cent and 62.90 per cent of tumours as benign in their study. However, this observation was not in agreement with Sharma *et al.* (2018) and Karnik *et al*. (2020) who reported increased incidence of malignant tumours in their studies. On gross examination, majority of tumours had round to oval shape with size varied from 1 cm to 14 cm. Majority of the tumours were soft to firm in consistency and greyish-white colour on cut section. Most cases of squamous cell carcinoma, mast cell tumour, trichoblastoma and hepatoid gland adenocarcinoma were ulcerated. Histopathological examination revealed a higher occurrence of mesenchymal tumours (54.54 per cent). This observation was in consistent with reports of Machado *et al*. (2018) and Kok *et al.* (2019).

In the present study, the highest risk of occurrence of cutaneous tumours was seen in the age group of 5-10 years (42.42 per cent) followed by in less than five years (39.39 per cent) and those in the age group of greater than 10 years (18.18 per cent). Even though more number of tumours were observed in age group of 5-10 years, there was no significant difference in the occurrence of cutaneous tumours ($p>0.05$) between different age groups. Senthil *et al*. (2020) observed higher occurrence in the age group of 5-10 years (53.80 per cent) followed by >10 years (23.30 per cent) and below five years (23.10 per cent); whereas, Bhanderi *et al*. (2022) observed highest frequency in <5 years (39.34 per cent) followed by 5-10 years (37.71 per cent) and >10 years (22.95 per cent). The variation in age susceptibility to the disease may be due to multiple factors including environmental factors like exposure to carcinogens and also due to breed variation in longevity and susceptibility to disease in the various reports.

The occurrence of cutaneous neoplasm was observed more in males (57.58 per cent) than in females (42.42 per cent). This result was in accordance with the observations recorded by Nair *et al*. (2021) and Subapriya *et al*. (2021) who reported higher incidence of skin neoplasm in male dogs than females. Though the occurrence of tumours was more in males, there was no significant difference in tumour occurrence ($p>0.05$) between males and females, which is in agreement with the study of Mathew *et al*. (2020). Among the presented cases, hepatoid gland adenocarcinoma was found only in male dogs and all other tumours were observed both in male and female dogs. This was in accordance with the reports of Shabeeba *et al*. (2021) and Subapriya *et al*. (2021). This might be due to the normal

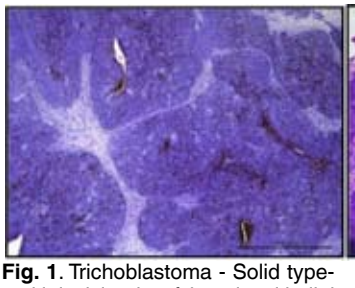

Fig. 1. Trichoblastoma - Solid type- multiple islands of basal epithelial cells surrounded by moderate connective tissue stroma (H&E, x100)

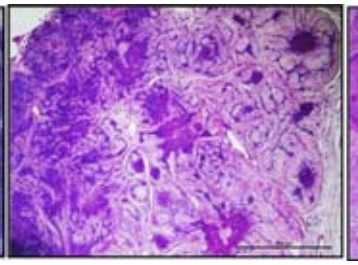

Fig. 2. Trichoblastoma- Medusoid pattern-cells arranged in thin cords of branching and radiating columns from central nests (H&E, x100)

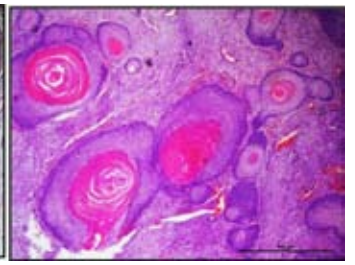

Fig. 3. Well-differentiated SCC- Multiple islands separated by fibrous tissue stroma with keratin pearl formation (H&E, x40)

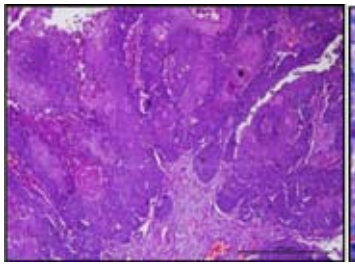

Fig. 4. Moderately differentiated SCC- Cord like arrangement of epithelial cells with keratinisation (H&E, x100)

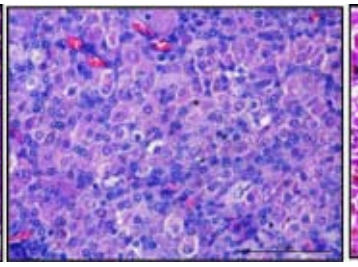

Fig. 5. Hepatoid gland adenocarcinoma- Cells with granular eosinophilic cytoplasm, anisocytosis, anisokaryosis (H&E, x400)

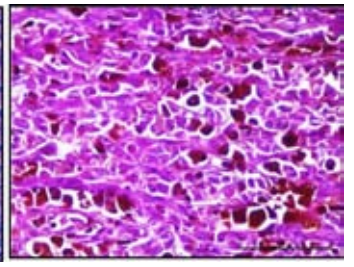

Fig. 6. Melanoma- Polyhedral cells with eosinophilic cytoplasm, vesicular nucleus with multiple prominent nucleoli (H&E, x400)

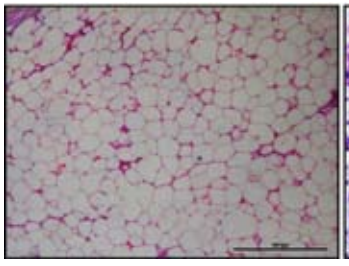

Fig. 7. Lipoma- Closely packed variably sized round to polyhedral cells with single vacuolated cytoplasm (H&E, x100)

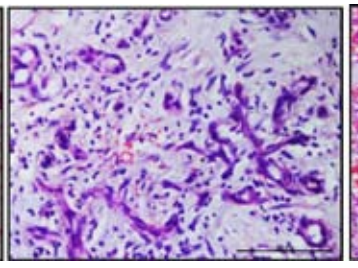

Fig. 8. Angiofibroma- Multiple narrow vessels surrounded by spindle shaped fibroblasts (H&E, x400)

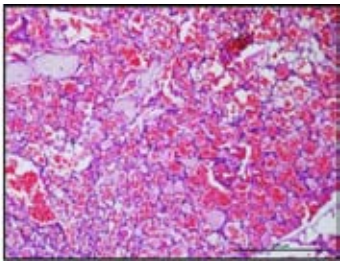

Fig. 9. Haemangioma- Variably sized vascular channels separated by connective tissue stroma (H&E, x40)

expression of androgen receptors in the canine hepatoid gland cells and the association of hepatoid tumours with the male sex hormone androgen as stated by Kaldrymidou *et al*. (2002).

The occurrence of cutaneous neoplastic conditions was observed more in Labrador Retriever (33.33 per cent; 11/33) followed by German shepherd (18.18 per cent; 6/33), Rottweiler and Boxer (12.12 per cent each; 4/33), spitz and non-descript dogs (9.09 per cent each; 3/33). Similarly, highest incidence of tumours in Labrador dogs was recorded by Karnik *et al*. (2020) and Nair *et al*. (2021). A higher incidence of tumours was noticed in purebred dogs than non-descript dogs. This was in concordance with the observations recorded by Hemanth *et al*. (2015) and Vascellari *et al*. (2016). The breed predilection noted in the present study, though cannot be generalised, could partly be due to difference in risk associated with various predisposing alleles in the different dog breeds and can also be due to specific breed popularity in an area.

Out of 33 tumour samples examined in the current study, highest occurrence of

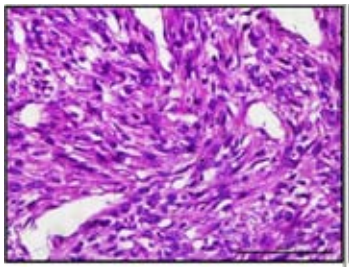

Fig. 10. Haemangiopericytoma- Spindle cells arranged in whorls around capillaries (H&E, x400)

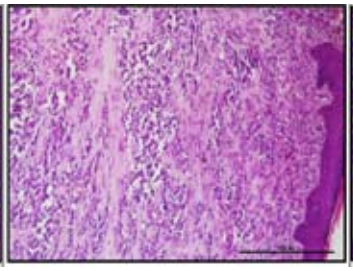

Fig. 11. MCT- Grade I- Infiltration of mast cells into the dermis arranged in rows and sheets separating collagen bundles (H&E, x100)

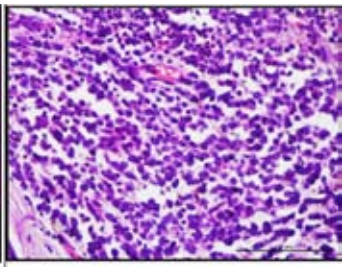

Fig. 12. MCT- Grade II-Round to polyhedral neoplastic cells with moderate pale pink cytoplasm containing fine granules (H&E, x400)

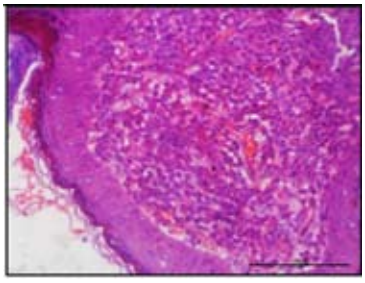

Fig. 13. Histiocytoma- Cells arranged like sheet with moderate eosinophilic cytoplasm and round to oval to intended hyperchromatic nuclei (H&E, x400)

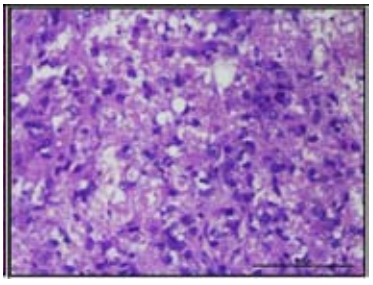

Fig. 14. Liposarcoma- Cells with indistinct cell borders, several small vacuoles, adipocytes with multiple round nuclei, anisocytosis, anisokaryosis (H&E, x400)

tumours was reported in trunk (39.39 per cent), followed by perianal and head (15.15 per cent each) and 0.09 per cent each on limb and digit. Two cases each was reported from tail and neck. Our findings on location wise occurrence of skin neoplasms differed with the observations of Subapriya *et al.* (2021) who recorded 33.13 per cent of neoplasms on limbs followed by 24.30 per cent on trunk in a study of a cutaneous tumours. However, Chikweto *et al*. (2011) reported a high incidence of skin tumours on trunk as reported in the present study. This could be due to exposure of this vast area to the environmental carcinogens including prolonged solar exposure.

Conclusion

The study was conducted to record the occurrence and clinicopathological features of canine skin neoplasms. The current study identified 33 cases of cutaneous tumours in dogs and histopathological examination confirmed most of the neoplasms as benign and also helped in the classification of the tumours into different histotypes. Epidemiological predilection factors such as age, breed, gender and location were recorded. The data recorded in the present study would be a beneficial reference for the veterinary clinician to make a preliminary diagnosis of cutaneous tumours. The study also warrants large scale epidemiological studies to identify the risk factors and understand etiopathogenesis of canine cutaneous neoplasms, which will give new insights in to the diagnosis, treatment and even prevention of this disease.

Acknowledgment

Authors acknowledge Department of Veterinary Pathology, Department of Veterinary Surgery and Radiology, CVAS, Pookode, Kerala Veterinary and Animal Sciences University.

Conflicts of interest

There were no conflicts of interest reported by the authors.

References

Avallone, G., Roccabianca, P., Crippa, L., Lepri, E., Brunetti, B., Bernardini, C., Forni, M., Olandese, A. and Sarli, G. 2016. Histological classification and immunohistochemical evaluation of MDM2 and CDK4 expression in canine liposarcoma. *Vet. pathol*. **53**: 773-780.

Bhanderi, D.R., Jhala, S.K., Suthar, D.N., Dabas, V.S., Bhatt, A.B. and Patel, K.D. 2022. An epidemiological study of canine neoplasms. *Pharma Innovation*. **11**: 1176-1178.

Chikweto, A., McNeil, P., Bhaiyat, M.I., Stone, D. and Sharma, R.N. 2011. Neoplastic and nonneoplastic cutaneous tumors of dogs in Grenada, West Indies. *Int. Sch. Res. Notices*. **2011**: 1-6.

Gamlem, H., Nordstoga, K. and Glattre, E., 2008. Canine neoplasia–introductory paper. *Apmis*. **116**: 5-18.

Goldschmidt, M.H. and Goldschmidt, K.H. 2017. Epithelial and melanocytic tumours of the skin. In. Meuten D.J. (ed.), *Tumors in Domestic Animals*. (5th Ed.). Wiley Blackwell, Danvers, pp. 88-141.

Graf, R., Pospischil, A., Guscetti, F., Meier, D., Welle, M. and Dettwiler, M. 2018. Cutaneous tumors in Swiss dogs: retrospective data from the Swiss Canine Cancer Registry, 2008–2013. *Vet. Pathol*. **55**: 809-820.

Hemanth, I., Kumar, R., Varshney, K. C., Nair, M. G., Ramesh Kumar, B., Sivakumar, M. and Thanislass, J. 2015. Epidemiological and clinical studies on canine mammary tumours. *Ind. J. Vet. Res*. **24**: 11-14**.**

Kaldrymidou, H., Leontides, L., Koutinas, A.F., Saridomichelakis, M.N. and Karayannopoulou, M. 2002. Prevalence, distribution and factors associated with the presence and the potential for malignancy of cutaneous neoplasms in 174 dogs admitted to a clinic in northern Greece. *J. Vet. Med*. **49**: 87-91.

Karnik, M., Anjankumar, K.R., Jeevan, K., Gowda, Y., Rakshith, K., Shettar, M., Azeemullah, H.R., Yashas, R.K., Rajashekaraiah, R., Mahesh, V. and Rao, S. 2020. Incidence and histopathological studies on tumours of dog in Bengaluru, India. *Int. J. Curr. Microbiol. App. Sci*. **9**: 747-752.

Kashyap, D.K., Tiwari, S.K., Giri, D.K., Dewangan, G. and Sinha, B. 2013. Cutaneous and subcutaneous tissue neoplasms in canines: Occurrence and histopathological studies. *Afr. J. Agric. Res.* **8**: 6569-6574.

Kluthcovsky, L.C., de Lima Queiroz, T.N., Somensi, M., Castro, J.L.C. and Engracia Filho, J.R. 2021. Angiofibroma of the nasal cavity in a Dog: Case Report. *Top. Companion. Anim. Med.* **44**: 100530p.

Kok, M.K., Chambers, J.K., Tsuboi, M., Nishimura, R., Tsujimoto, H., Uchida, K. and Nakayama, H. 2019. Retrospective study of canine cutaneous tumors in Japan, 2008–2017. *J. Vet. Med. Sci*. **81**: 1133-1143.

Lafta, I.J. and Alabbody, H.H. 2020. Incidence of cutaneous and subcutaneous tumors of dogs from Baghdad city: Clinical, cytological and histopathological features. *Iraqi J. Vet. Sci*. **34**: 129-137.

Lather, D., Nehra, V., Gupta, R.P., Jakhar, K.K., Agnihotri, D. and Chaudhary, R.N. 2014. Cutaneous haemagioma in a dog-a case report. *Haryana Vet*. **54**: 89-90.

Machado, G.A.C., Fontes, T.N., Larangeira, D.F., Estrela-Lima, A., Moreira, E.L.T., Ribeiro, L.S., Pinto, M.P.R. and Peixoto, T.C. 2018. Incidence of skin tumors in dogs in Salvador, Bahia state, Brazil (2007-2016). *Pesqui Vet Bras*. **38**: 2146–2149.

Martins, A.L., Canadas-Sousa, A., Mesquita, J.R., Dias-Pereira, P., Amorim, I. and Gartner, F. 2022. Retrospective study of canine cutaneous tumors submitted to a diagnostic pathology laboratory in

Northern Portugal (2014–2020). *Canine. Med. Genet*. **9**: 1-14.

Mathew, R., Sajitha, I.S., Nair, S.S., Krishna, B.D., Devi, S.S. and Abraham, M.J. 2020. A Study of occurrence, gross and histopathological characteristics of canine cutaneous neoplasms. *Indian J. Anim. Res*. **54**: 1367-1372.

Mukaratirwa, S., Chipunza, J., Chitanga, S., Chimonyo, M. and Bhebhe, E. 2005. Canine cutaneous neoplasms: prevalence and influence of age, sex and site on the presence and potential malignancy of cutaneous neoplasms in dogs from Zimbabwe. *J. S. Afr. Vet. Assoc*. **76**: 59-62.

Nair, S.S., Narayanan, M.K., Anoop, S., Krishna, B.D., Usha, N.P. and Martin, K.J. 2021. Occurrence of canine mammary and skin/subcutaneous neoplasms in and around Thrissur district of Kerala during 2017-2020: a review of 265 cases. *J. Vet. Anim. Sci*. **52**: 350-356.

Rafalko, J.M., Kruglyak, K.M., McCleary-Wheeler, A.L., Goyal, V., Phelps-Dunn, A., Wong, L.K., Warren, C.D., Brandstetter, G., Rosentel, M.C., DiMarzio, L. and McLennan, L.M. 2023. Age at cancer diagnosis by breed, weight, sex, and cancer type in a cohort of more than 3,000 dogs: Determining the optimal age to initiate cancer screening in canine patients. *Plos one*. **18**: e0280795.

Rungsipipat, A., Sunyasootcharee, B., Ousawaphlangchai, L., Sailasuta, A., Thanawongnuwech, R. and Teankum, K. 2003. Neoplasms of dogs in Bangkok. *Thai J. Vet. Med*. **33**: 59-66.

Senthil, N.R., Chakravarthi, R. and Vairamuthu, S. 2020. Retrospective studies on tumor conditions in dogs over a period of four years (2014-2018). *Pharma Innovation*. **9**: 224-227.

Shabeeba, P.M., Sajitha, I.S., Devi, S.S., Divya, C. and Nair, S.S. 2021. Histopathological study of canine hepatoid gland tumours. *J. Vet. Anim. Sci*. **52**: 277-280.

Sharma, N., Gupta, A., Bhat, R. and Shah, O. 2018. Epidemiological studies on canine tumours in Jammu. *Int. J. Livest. Res*. **8**: 246-254.

Simeonov, R., Dinev, I., Simeonova, G., Goranov, N., Paskalev, M., Krastev, S., Todorova, I., Chaprazov, T., Roidev, R., Borissov, I., Hubenov, H. and Dinev, D. 2011. Prevalence of canine epithelial, melanocytic and mesenchymal tumours of the skin and soft tissues: A 10-year study. *Bulg. J. Vet. Med*. **14**: 171–178.

Subapriya, S., Pazhanivel, N., Gokulakrishnan, M., Nagarajan, B., Kavitha, S., Sumathi, D. and Vairamuthu, S. 2021. Incidence and pathology of skin tumours in dogs. *Pharma Innovation*. **10**: 620-629.

Vascellari, M., Capello, K., Carminato, A., Zanardello, C., Baioni, E. and Mutinelli, F. 2016. Incidence of mammary tumors in the canine population living in the Veneto region (Northeastern Italy): Risk factors and similarities to human breast cancer. *Prev*. *Vet. Med*. **126**: 183-189.

Yumusak, N., Caliskan, M. and Kutsal, O. 2016. Fine needle aspiration cytology (FNAC) in the diagnosis of canine hepatoid gland tumors-A comparative study with histopathology. *Vet. Fak. Derg*. **63**: 259-266. ■