

## INCIDENCE AND HISTOPATHOLOGICAL DIAGNOSIS OF CANINE MAMMARY TUMORS

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## SUMMARY

A total of 62 suspected spontaneous tumors from different regions were received from different species of canines. Among them 31 were diagnosed as mammary gland tumors on the basis of histopathological examination. Grossly, the shape of the mammary tumors was oval to round shape, irregular, multilobulated. Inguinal mammary glands were most commonly affected than thoracic or abdominal mammary glands. Microscopic examination of growths revealed highest incidence of malignant mammary tumors in dogs aged between 8 to 12 years. Among benign tumors, simple adenoma, benign mixed mammary tumors, fibro adenoma and myoepithelioma were identified. In malignant tumors, mixed mammary tumors, papillary adenocarcinoma, tubular carcinoma, micro papillary carcinoma, solid carcinoma, chondro sarcoma, fibrosarcoma and osteosarcoma were observed.

**Keywords:** Benign, Histopathology, Malignant, Mammary Gland, Tumors

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Mammary tumors in canines is an emerging health problem showing clinical and molecular similarities with human breast cancer and are good models for breast cancer in humans. Canine mammary tumors are the most prevalent neoplasms among intact females which are not spayed at an early age; accounting for almost 50% of all canine neoplasms (Moe, 2001). The incidence rate per year is 198 cases in every 100,000 dogs (Meuten, 2016). Most frequently mammary gland tumors are found in 5 years and older bitches (Murphy, 2008). The occurrence of mammary tumors in dogs less than five years old is rare and, in most cases, only benign tumors are diagnosed at that age (Kurzman and Gillbertson, 1986). In bitches, between 41 and 53% of the mammary tumors that occur are considered to be malignant (Lana *et al.*, 2007). The present study was aimed to know incidence of mammary gland tumors in canine and to classify naturally occurring canine mammary tumors on histopathological basis.

A total of 62 spontaneously occurring suspected canine mammary tumor samples were collected from Super Special Veterinary Hospital, Vijayawada and other government veterinary hospitals in 10% neutral buffered formalin alongwith case history including age, sex, breed and location of tumor. Representative tumor tissues were dehydrated in increasing grades of alcohol, cleared in xylene and embedded in paraffin blocks. Tissue sections with 4-5 µm thickness were subjected to haematoxylin and eosin (H&E) for histopathological study (Bancroft and Stevens, 1996).

Out of 62 specimens, 31 were confirmed as mammary

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tumor, of which 9 (29.03%) were benign and 22 (70.97%) were malignant tumors. Breed-wise and age-wise occurrence of canine mammary tumors and its histological classification are given in table 1. In this present study, the highest incidence of mammary tumors was recorded in dogs aged between 8-12 years (58.07%) followed by 4-8 years (25.83%) and above 12 years (16.13%) whereas no case was recorded in young age group of 0-4 years. Similar findings of less occurrence of mammary tumors in dogs between 0 to 3 years was reported by Egenvall *et al.* (2005) and it increased with age and reaches the maximum between 9 and 11 years (Zahra *et al.*, 2017). Among breeds maximum occurrence was observed in mixed breeds (22.58%) and non descriptive (22.58%) followed by Spitz (16.13%), Pomeranian (16.13%) and other breeds like Labrador (9.68%), German Shepherd (3.23%), Dalmatian (3.23%), Doberman (3.23%) and Daschund (3.23%). Breed wise incidence in this study reflects the breed distribution in the study area. Nieves *et al.*, 2018 stated that mixed breed dogs were more likely to suffer from mammary tumors than purebred dogs, with these tumors being more frequently malignant.

Gross morphology was studied in 16 cases out of a total 31 cases of mammary tumors. The shape of the mammary tumors was oval to round shape in 8 cases (Fig. 1), irregular in 5 cases (Fig. 2), multilobulated in 3 cases. The tumors were soft to hard in consistency in 10 cases, followed by hard in 4 cases, elastic and fluctuate in 2 cases. Inguinal mammary glands (9 cases) were most commonly affected than thoracic (4 cases) or abdominal mammary glands (3 cases). These findings were similar to the earlier

**Table 1. Breed-wise and age-wise occurrence of canine mammary tumors**

| Breed           | Age in years |      |           |       |        |       |           |       |          |      |           |       | Total  |           |       |       |       |
|-----------------|--------------|------|-----------|-------|--------|-------|-----------|-------|----------|------|-----------|-------|--------|-----------|-------|-------|-------|
|                 | 04-08        |      |           |       | 08-12  |       |           |       | above 12 |      |           |       | Total  |           | Total |       |       |
|                 | Benign       |      | Malignant |       | Benign |       | Malignant |       | Benign   |      | Malignant |       | Benign | Malignant |       |       |       |
| Mixed breed     | 1            | 3.23 | 2         | 6.45  | 1      | 3.23  | 2         | 6.45  | -        | -    | 1         | 3.23  | 2      | 6.45      | 5     | 16.13 | 22.58 |
| Labrador        | -            | -    | -         | -     | -      | -     | 1         | 3.23  | 1        | 3.23 | 1         | 3.23  | 1      | 3.23      | 2     | 6.45  | 9.68  |
| Daschund        | -            | -    | -         | -     | 1      | 3.23  | -         | -     | -        | -    | -         | -     | 1      | 3.23      | -     | -     | 3.23  |
| Spitz           | 1            | 3.23 | 1         | 3.23  | -      | -     | 3         | 9.67  | -        | -    | -         | -     | 1      | 3.23      | 4     | 12.90 | 16.13 |
| German Shepherd | -            | -    | -         | -     | -      | -     | 1         | 3.23  | -        | -    | -         | -     | -      | -         | 1     | 3.23  | 3.23  |
| Dalmatian       | -            | -    | 1         | 3.23  | -      | -     | -         | -     | -        | -    | -         | -     | -      | -         | 1     | 3.23  | 3.23  |
| Doberman        | -            | -    | -         | 1     | 3.23   | -     | -         | -     | -        | -    | -         | 1     | 3.23   | -         | -     | 3.23  |       |
| Pomeranian      | 1            | 3.23 | -         | -     | 1      | 3.23  | 3         | 9.67  | -        | -    | -         | -     | 2      | 6.45      | 3     | 9.68  | 16.13 |
| Non descriptive | -            | -    | 1         | 3.23  | 1      | 3.23  | 3         | 9.67  | -        | -    | 2         | 6.45  | 1      | 3.23      | 6     | 19.35 | 22.58 |
| Total           | 3            | 9.69 | 5         | 16.14 | 5      | 16.15 | 13        | 41.92 | 1        | 3.23 | 4         | 12.90 | 9      | 29.03     | 22    | 70.97 |       |

reports. (Harsha *et al.*, 2018). Histopathological investigation revealed 9 (29.03%) benign and 22 (70.97%) malignant tumors among 31 mammary gland tumors. Among benign tumors, simple adenoma (3; 9.68%), benign mixed mammary tumors (3; 9.68%), fibro adenoma (2; 6.45%) and myoepithelioma (1; 3.23%) were identified. In malignant tumors mixed malignant mammary tumors (7; 22.58%) were predominant followed by papillary adenocarcinoma (4; 12.90%) and tubular carcinoma (4; 12.90%), micro papillary carcinoma (2; 6.45%) fibrosarcoma (2; 6.45%), solid carcinoma (1; 3.23%), chondrosarcoma (1; 3.23%) and osteosarcoma (1; 3.23%) were reported.

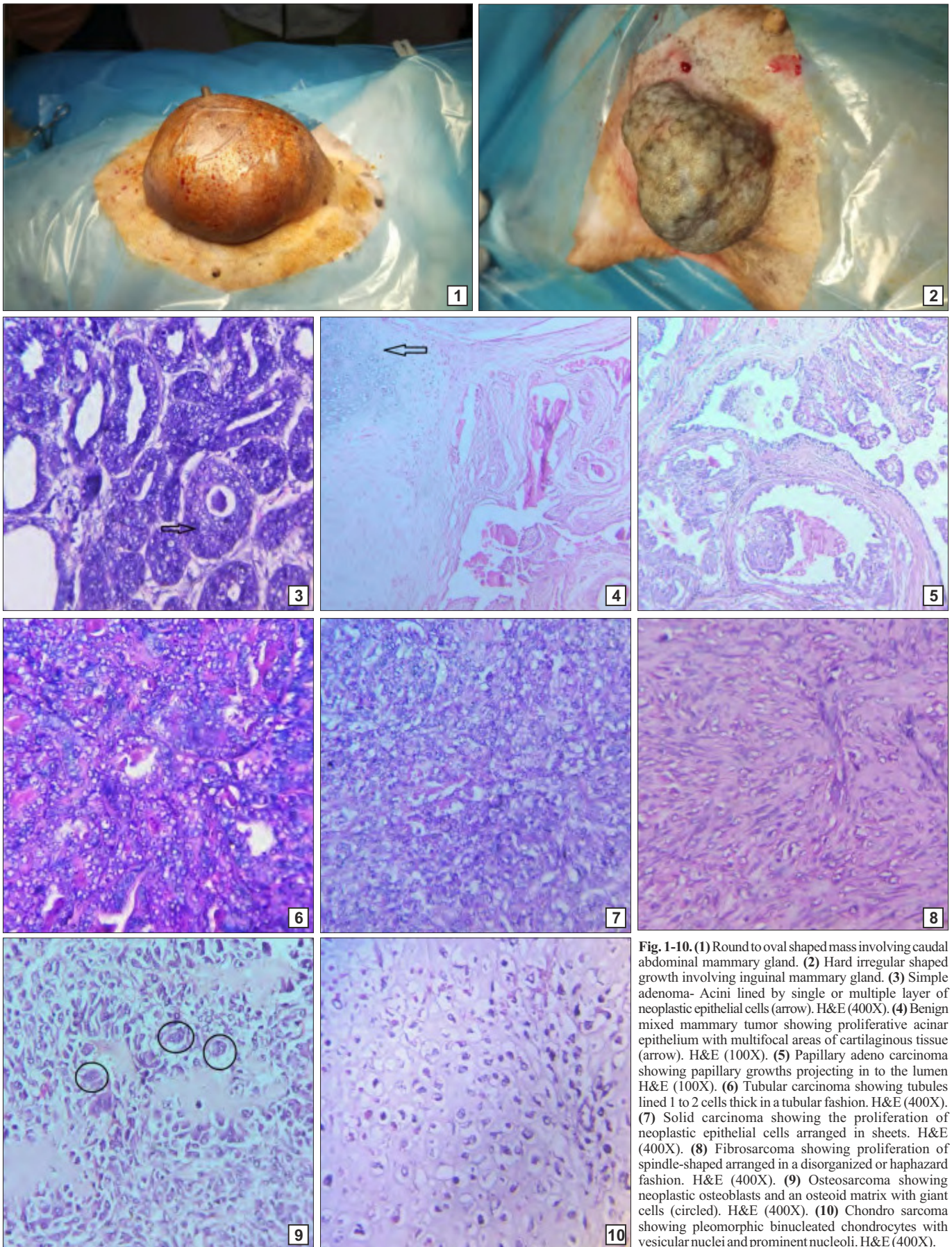
In benign tumors three cases of simple adenoma consisting of acini lined by single or multiple layer of cuboidal or columnar epithelial cells with round central nuclei containing eosinophilic secretions in the lumina with scant fibrous stroma (Fig. 3). In myoepithelioma, spindle to stellate cells with moderate amount of cytoplasm, poorly demarcated cell borders round to fusiform nuclei and a single nucleolus observed. In benign mixed mammary tumors there was mild proliferation of spindle to stellate shaped myoepithelial cells and acinar epithelium with multifocal areas of cartilaginous tissue (Fig. 4). Fibroadenoma consists of acini lined by cuboidal or columnar cells, with round and uniform nuclei with extensively proliferated fibrous connective tissue stroma. These histological findings of benign tumors and its distribution pattern were identical to the findings of earlier workers. (Reddy *et al.*, 2009; Goldschmidt *et al.*, 2011).

Among malignant mammary tumors, mixed malignant tumor was predominant type characterised by extensive proliferation of both epithelial and connective tissue components. The neoplastic cells were cuboidal to

columnar epithelial cells, arranged in irregular tubules and nests, and supported by fine fibro vascular stroma. There were islands of chondroid and osteoid metaplasia with neoplastic cells in lacunae. These histological findings were in accordance with the previous reports of Reddy *et al.* (2009) and Zahra *et al.* (2017). Papillary adeno carcinoma revealed proliferation of glandular epithelial cells arranged in finger like projections. These papillary growths projecting in to the lumen of acini were supported by a fine fibro vascular connective tissue stroma (Fig. 5). Micro papillary carcinoma revealed neoplastic cells forming small intra luminal aggregates without fibro vascular connective tissue support, similar to the findings of earlier reports (Reddy *et al.*, 2009). In tubular carcinoma the cells were arranged in a tubular fashion, tubules lined 1 to 2 cells thick, and cells with variable morphology (Fig. 6). Nuclei hyper chromic with multiple nucleoli. Solid carcinoma revealed the proliferation of neoplastic epithelial cells arranged in sheets obliterating normal glandular pattern. The neoplastic cells revealed hyper chromatic nuclei, prominent nucleoli and mitotic figures coarsely stippled chromatin and a single central basophilic nucleolus (Fig. 7). Anisokaryosis and anisocytosis were evident with mitotic figures. These histological features were similar to the findings described by Muniappan *et al.* (2019) and Goldschmidt *et al.* (2011). Tavasoly *et al.* (2013) stated that solid carcinomas were uncommon and indicative of higher malignancy.

In this present study connective tissue tumors like fibrosarcoma (2; 6.45%), osteosarcoma (1; 3.23%) and chondro sarcoma (1; 3.23%) observed. Fibrosarcoma and osteosarcomas were the most frequent connective tissue tumor encountered in mammary gland (Cassali *et al.*, 2002). Histological section of fibrosarcoma revealed proliferation of spindle-shaped cells that produce collagen





**Fig. 1-10.** (1) Round to oval shaped mass involving caudal abdominal mammary gland. (2) Hard irregular shaped growth involving inguinal mammary gland. (3) Simple adenoma- Acini lined by single or multiple layer of neoplastic epithelial cells (arrow). H&E (400X). (4) Benign mixed mammary tumor showing proliferative acinar epithelium with multifocal areas of cartilaginous tissue (arrow). H&E (100X). (5) Papillary adeno carcinoma showing papillary growths projecting in to the lumen H&E (100X). (6) Tubular carcinoma showing tubules lined 1 to 2 cells thick in a tubular fashion. H&E (400X). (7) Solid carcinoma showing the proliferation of neoplastic epithelial cells arranged in sheets. H&E (400X). (8) Fibrosarcoma showing proliferation of spindle-shaped arranged in a disorganized or haphazard fashion. H&E (400X). (9) Osteosarcoma showing neoplastic osteoblasts and an osteoid matrix with giant cells (circled). H&E (400X). (10) Chondro sarcoma showing pleomorphic binucleated chondrocytes with vesicular nuclei and prominent nucleoli. H&E (400X).

arranged in a parallel, disorganized or haphazard fashion (Fig. 8). Osteosarcoma revealed with presence of neoplastic osteoblasts and an osteoid matrix (Fig. 9). Chondrosarcoma characterised by the presence of pleomorphic chondrocytes with round hyper chromatic nuclei, binucleated or multinucleated with prominent nucleoli and basophilic chondroid matrix (Fig. 10). In conclusion malignant mammary gland tumors are frequent lesions in canines with highest incidence in dogs aged between 8 to 12 years with highest occurrence of mixed malignant mammary tumors followed by papillary adenocarcinoma and tubular carcinoma.

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