CLASSIFICATION AND STAGING OF CANINE MAMMARY GLAND TUMOURS

KISHOR, T. K.,1 RAO, S.,1 SATYANARAYANA, M. L.,1 NARAYANASWAMY, H. D.,1 BYREGOWDA, S. M.,2 NAGARAJA, B. N.,3 PURUSHOTHAM, K. M.2 AND KAVYA, N.2

1Department of Veterinary Pathology, Veterinary College, Hebbal, Bangalore, 560024; 2Institute of Animal Health and Veterinary Biologicals, Hebbal, Bangalore, 560024; 3Department of Veterinary Surgery and Radiology, Veterinary College, Hebbal, Bangalore, 560024. E-mail: kishvety599@gmail.com, Cell: 09448567036

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Abstract: The present study was conducted with an objective to classify and stage the canine mammary gland tumors. A total of 40 mammary gland tumour cases were collected and out of which 39 cases (97.5 per cent) were carcinomas and one case (2.5 per cent) was sarcoma. The most frequently represented tumor type was complex carcinoma (40.0%) followed by simple carcinoma (22.5%), solid carcinoma (22.5%), mixed carcinoma (7.5%), anaplastic carcinoma (5.0%) and fibrosarcoma (2.5%). Out of 40 tumors studied, 21 cases (52.5%) were in stage I, 17 cases (42.5%) in stage II and two cases (5.0%) in stage III. Analysis of breed-wise occurrence of mammary neoplasms revealed highest number of tumours in Pomeranian (35.0%) followed by German shepherd (20.0%), Labrador (17.5%), non-descript (12.5%), Cocker spaniel (7.5%), and Dachshund (7.5%). The age group at which mammary tumours occurred most frequently was 8-10 years (33.0%), followed by 10-12 years (25.0%), 6-8 years (20.0%), >12 years (15.0%) and ≤ 6 years (7.0%). Gilbertson and Misdorp method of staging used in this study was less complicated and more comparable with that used in human cancers. The routine use of this method would help the pathologist and clinician to make more accurate diagnosis and treatment in canine mammary gland tumors and facilitate comparative studies of canine and human research.

Key words: Mammary tumour, Canine

INTRODUCTION

Cancer, a fatal condition, has remained as a formidable health challenging issue from past few decades. However, major advances and breakthroughs have helped to understand cancer better and made it more manageable. Cancer in dogs is a common occurrence and needs immediate and decisive Veterinary attention. Due to advances in Veterinary health care, survivability of dogs has increased and also along the incidences of cancer. Cancer is now one of the leading causes of disease-related deaths in dogs and has gained exceptional importance.

Mammary gland tumours in dogs are the most common neoplasms only second to skin neoplasms and bear similarities at structural as well as molecular levels with human breast cancer. Hence canine mammary tumors are considered as ideal for comparative evaluation of the molecular mechanisms of carcinogenesis [1]. The high prevalence of spontaneous mammary cancer in
domestic dogs and cats closely mimics the disease in woman, making these species more suitable comparative models [2]. A number of new methods are hence under investigation to improve the diagnostic and prognostic accuracy [3,4].

Higher incidence of cancer deaths in canine mammary tumors is due to lack of accurate prognosis. Prognosis is based on several tumour and host characteristics, with histological type being the most important [5,6]. Tumour grade and degree of invasion (stage) are also of prognostic significance [7,8]. The aim of this study was to classify and staging of spontaneous canine mammary gland tumors.

**MATERIALS AND METHODS**

Collection and classification of spontaneous canine mammary gland tumors: A total of forty, surgically excised spontaneous mammary gland tumors were collected from Department of Veterinary Surgery and Radiology, Veterinary College, Bangalore and CUPA Animal Hospital, Bangalore over a period of 12 months. From the excised tumor tissue, representative samples were collected from multiple sites for histopathological examination in 10% normal buffered formalin.

**Histological preparations:** The representative tissue samples obtained from spontaneous canine mammary gland tumors and fixed in 10% normal buffered formalin were processed by routine paraffin embedding technique. Sections of 4-μm thickness were cut using Leitz rotary microtome and were stained with Haematoxylin and Eosin [9]. For classification of canine mammary gland tumours, a diagnostic criterion proposed by Goldschmidt et al. [10] was adopted.

**Histological staging of canine mammary gland tumors:** The criteria proposed by Gilbertson et al. [7] and Misdrop et al. [6] methods were adopted for staging the tumours as Stage 0 (neoplastic cells confined to mammary ducts and ductules without stromal invasion). Stage I neoplastic cells (found invading surrounding connective tissue stroma and capsule). Stage II (neoplastic cells found invading lymphatic or blood vessels). Stage III (neoplastic cells found metastasized to regional lymph nodes or to distant organs).

**RESULTS AND DISCUSSION**

The samples considered for the study included 40 spontaneous tumors of mammary glands. Results showed that all the cases were malignant, out of which, 39 (97.5%) cases were carcinomas and 1 (2.5%) was sarcoma. The higher incidence of malignant neoplasms compared to benign neoplasms at varying percentages has been observed and documented by several earlier workers [11-14]. These records including the present observation indicate that the mammary gland tumors with highest incidence of malignant types account as the leading cause of cancer related deaths in dogs.

The age group at which mammary tumours occurred most frequently was 8-10 yrs (13 cases; 33.0%), followed by 10-12 yrs (10 cases; 25.0%), 6-8 yrs (8 cases; 20.0%), >12 yrs (6 cases; 15.0%) and ≤ 6 yrs (3 cases; 7.0%). Moulton et al. [15] observed that mammary gland tumours occurred rarely in female dogs younger than 2 years of age and the incidence increased after 5 years of the age with its peak at the age of 10 years and subsequent decrease after 12 years of age, which corroborated with the present findings of most tumour cases (31/40; 78%) being in 5-10 yrs, 6 in more than 12 yrs and 3 in less than 6 yrs of age group.

Analysis of breed-wise occurrence of mammary neoplasms revealed highest number of tumours in Pomeranian (14; 35 %) followed by German Shepherd (8; 20%), Labrador (7; 17.5%), non-descript (5; 12.5%), Cocker spaniel (3; 7.5%), and...
Dachshund (3; 7.5%). The earlier reports on breed predisposition of mammary tumours differed from the present observation, which could be attributed to the fact that different geographical areas have different pattern of breed distribution [16,17] and their presentation to the hospitals.

Rezaie et al. found that 70.6% of bitches had tubulopapillary carcinoma, 23.5% solid carcinoma, and 5.9% cribriform carcinoma [13]. Ezerskye et al. showed that the most common tumor types of mammary glands in bitches were simple carcinoma, complex carcinoma and carcinosarcoma 46.0%, 27.0% and 13.0%, respectively [18]. In malignant mammary tumors, epithelial types included simple carcinoma (9; 22.5%), complex carcinoma (16; 40.0%), solid carcinoma (9; 22.5%), mixed carcinoma (3; 7.5%) and anaplastic carcinoma (2; 5.0%), whereas mesenchymal tissue tumor was fibrosarcoma (1; 2.5%) (Table 1). These results were in agreement with above researchers who recorded highest occurrence of adenocarcinoma in their studies also.

The pattern of histopathological arrangement of different malignant epithelial tumors of present study varied. Simple carcinomas occurred as tubular, papillary, tubulopapillary and papillary cystic types. In tubular type, the pattern of arrangement of cells was predominantly tubular with cuboidal lining neoplastic epithelial cells; papillary types with arrangement of neoplastic cells in the form of projections, mostly into ducts and tubules; tubulopapillary type with both tubular and papillary pattern and papillary cystic type with both papillary and cystic structures. Solid carcinoma was sub classified to comedo, cribriform and solid patterns. The amount of connective tissue stroma varied between the types and showed invasion by neoplastic cells and infiltration with mononuclear cells which were also the observation of several earlier workers [10,14,19].

The simple carcinoma comprised one cell type of neoplastic cell population (Fig. 1). Complex carcinoma comprised neoplastic population of both glandular epithelium and myoepithelium and solid carcinoma with compact arrangement of glandular cells (Fig. 2). Mixed carcinoma comprised one cell type of neoplastic population with benign mesenchymal tissue either cartilage or bone (Fig. 3) and anaplastic with highly anaplastic type of cells (Fig. 4). Several workers have also encountered similar types of epithelial tumors [13,19,20].

Fibrosarcoma was recorded in one case and microscopically revealed interlacing bundles of spindle to stellate shaped cells with elongated plumpynuclei and varying amount of collagen material in between the neoplastic cells (Fig. 5). The invasion of adjacent stromal tissue by neoplastic cells was also observed. These findings tallied well with those of Moulton and Shettar [15,21].

In the present investigation, the histological staging was carried out as per the guidelines of Gilbertson and Misdrop [6,7]. Out of 40 malignant mammary tumours, the histological features indicative of stage I, with invasion of neoplastic cells into surrounding connective tissue stroma (Fig. 6) was observed in 21 cases, stage II in 17 cases and stage III in two cases (Table 2).

The study revealed that simple, complex, solid and anaplastic types carcinomas with histological stage II and III showed invasion into lymphatics (Fig. 7), blood vessels and to regional lymphnodes (Fig. 8) and lungs, which clearly indicated that tumours with higher histological stage progress rapidly in their growth and become invasive and metastatic, which was also the opinion of Jayachandra and Naveen [19,20].

Perusal of literature revealed that papillary adenocarcinoma was the most common type of canine mammary gland tumour that showed higher histological stage and post surgical mortality [19,20]. Among adenocarcinomas the simple type has been reported to be more malignant with higher percentage of mortality by several earlier workers [5,19,20,22,23] who described that the simple type of carcinoma grows generally by highly infiltrative manner where a complex type by expansion. However, in this study 10 complex carcinomas were in stage I, four in stage II and two in stage III, which indicated that the stage of tumour does not depend upon the type of tumour but on several other variables.

On follow up study of 40 mammary tumours, it was observed that two cases of stage III, six of stage II and five of stage I were dead in a time interval
of two weeks to six months. Also recurrence of tumour was observed in seven cases of stage II and two of stage I within seven months of period and rest of the 14 cases in stage I and four of stage II cases remained tumour free following excision (Table 3). This observation indicated that higher the stage grade more guarded was the prognosis. Thus histological staging could be considered as a simple method to determine the prognosis and for further suitable therapy.

**REFERENCES**


