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Diagnosis and management of neoplasms in six canines

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Abstract

Neoplasms in animals and humans occur when cells with altered DNA begin to grow uncontrollably. The term neoplasm originates from the Greek words neo and plasma, meaning new growth. This uncontrolled growth can form a tumour and may be either benign (non-cancerous) or malignant (cancerous). These abnormal cells divide continuously, pushing out and replacing healthy tissues. Different tumours noticed in dogs are mammary tumors, basal cell carcinoma, mast cell tumors, lipoma, hemangioma, hemangiosarcoma, fibroma, fibrosarcoma and many more. Mammary tumours are the most commonly detected tumour in intact female dogs and also seen in some male dogs and it remains a major cause of mortality. Dogs naturally develop mammary tumors that exhibit many biological, clinical, pathological, and molecular similarities to human breast cancer. Mammary tumours have been reported as the most frequently occurring type after skin tumours. The standard treatment for tumors in dogs begins with surgery as the primary option, and may be supplemented with chemotherapy, radiation therapy, immunotherapy, cryotherapy, hyperthermia, and hormone based treatments depending on the type and nature of the tumours. So the present study was conducted in six clinical cases, all the dogs were estimated for different haemato-biochemical parameters before surgery followed by 14th and 45th day post surgery. All the dogs were subjected for surgical excision of tumors under balanced general anaesthesia and the samples were subjected for histopathological examination. Based on the histopathological findings the tumours were diagnosed as different types of benign and malignant tumours.

Keywords: Neoplasm, mammary tumour, benign, malignant, surgery and histopathology

Introduction

Cancer is a multistep and multi-factorial disease process resulting from the accumulation of genetic mutations and the disruption of normal epigenetic regulatory mechanisms, ultimately leading to the transformation of normal cells into highly malignant cancer cells (Argyle *et al.*, 2020 and You *et al.*, 2012) ^[2, 12]. Neoplastic conditions are broadly classified into benign and malignant forms. Among domestic animals, dogs are reported to have the highest incidence of neoplastic disorders compared to other species (Gupta *et al.*, 2014) ^[6]. Canine mammary neoplasms (CMNs) are the second most frequently diagnosed tumors in dogs, following skin tumors. These tumors develop as a result of uncontrolled cell growth triggered by genetic, hormonal, or environmental disturbances, and their occurrence is influenced by factors such as breed, reproductive status, hormonal activity, diet, and exposure to carcinogenic agents (Dharmi *et al.*, 2010; Roshni *et al.*, 2013) ^[4, 8]. They account for approximately 50 percent of all tumors in intact female dogs, of which 40-50 percent are malignant (Sorenmo, 2003) ^[9]. In a study of canine mammary tumor cases involving 108 glands, 70 percent were classified as malignant, 26 percent as benign, and 4 percent as hyperplastic. Most cases occurred in middle-aged to older female dogs, with an average age of 8 years and the highest incidence between 6 and 8 years (Hareesh *et al.*, 2025) ^[7]. Basal cell carcinoma (BCC), one of the most common epithelial neoplasms, represents the most prevalent carcinoma type worldwide. The pathogenesis of BCC involves a complex interplay between environmental, phenotypic, and genetic factors (Dika *et al.*, 2020) ^[5]. The high incidence of cutaneous and mammary tumors in dogs may be attributed to the constant exposure of the skin and associated tissues to various physical, chemical, and environmental carcinogens, which can promote cellular transformation and tumor development.

Materials and Methods

The present study was conducted on six clinical cases of dogs presented to the Teaching Veterinary Clinical Complex, Veterinary College, Bidar, with various tumors. Detailed clinical information including age, species, breed, sex, tumor location, shape, and size were recorded for all cases. Diagnostic imaging techniques such as radiography, ultrasonography, and computed tomography were employed to evaluate the affected regions and to assess the thorax and abdomen for possible metastasis. Fine needle aspiration cytology (FNAC) of the tumor masses and sentinel lymph nodes was performed, and cytological smears were stained with giemsa and field stains to confirm neoplasia and determine tumor type. Routine haematological and biochemical evaluations were conducted on the day of presentation, as well as on the 14th and 45th days post-surgery. Haematological parameters such as haemoglobin (Hb), red blood cell (RBC) count, total leucocyte count (TLC), differential leucocyte count (DLC), packed cell volume (PCV), and platelet count were assessed using M/S Mindray BC-2800 Vet haematological analyzer. Biochemical estimations included kidney function tests (serum creatinine, blood urea nitrogen) and liver function tests (SGPT, SGOT, ALP, total protein, serum albumin, globulin, total bilirubin, direct bilirubin, indirect bilirubin) along with random blood sugar levels evaluated using M/S Agappe, Nano plus machine.

Premedication consisted of Atropine sulphate (0.045 mg/kg, S.C.) followed by a combination of Dexmedetomidine (10 µg/kg), Butorphanol tartarate (0.2 mg/kg), and Midazolam (0.2 mg/kg) administered intramuscularly in a single syringe. Anaesthetic induction was achieved with Ketamine

hydrochloride @ 2.5 mg/kg, and anaesthesia was maintained with isoflurane @ 1.5-2 percent concentration. All dogs underwent surgical excision of the tumors along with removal of sentinel lymph nodes under balanced general anaesthesia. The excised tissues were fixed in 10 percent neutral buffered formalin, processed, and stained with haematoxylin and eosin (H and E) for histopathological evaluation. Post-operative management included inj. ceftriaxone-tazobactam @ 25 mg/kg, for 5-7 days, inj. tramadol hydrochloride 2 mg/kg on the day of surgery, followed by tab. piroxicam 0.3 mg/kg for 14 days and tab. pantoprazole @ 1 mg/kg for 5 days. Antiseptic dressing was performed regularly. All dogs recovered uneventfully, and sutures were removed on the 14th postoperative day. The recurrence of tumors, disease-free interval, duration of survival, and any surgical complications were recorded during the follow up period.

Results

The study included six dogs affected with various surface tumors, comprising two mongrels, and one each of Dachshund, Siberian Husky, Golden Retriever, and Dobermann breeds. The affected animals included three males and three females. The median age was 8.17 years (ranging from 5 to 14 years), with the highest incidence observed in dogs above eight years of age. Among the six cases, four dogs were diagnosed with mammary tumors, one of which also had a concurrent lipoma while the remaining two dogs were affected with basal cell carcinoma. Ulceration of the tumors due to chronicity was observed in two of the six cases.

Table 1: Details of the dogs with diagnosis

Sr. No	Age (years)	Sex	Breed	Body weight (kg)	Reproductive status	Histopathological diagnosis	Nature of mass
1	9	M	Mongrel	25	Neutered	Basal cell carcinoma	Ulcerated
2	14	M	Mongrel	26	Neutered	Tubular carcinoma	Ulcerated
3	8	F	Dachshund	15.30	Neutered	-Micropapillary tubular carcinoma -Cystic papillary tubular carcinoma	Non ulcerated
4	5	M	Siberian husky	16	Intact	Basal cell carcinoma	Non ulcerated
5	8	F	Golden retriever	36	Neutered	-Lipoma -Cystic tubular adenoma	Non ulcerated
6	5	F	Dobermann	23	Intact	Micropapillary tubular carcinoma	Non ulcerated

Basal cell carcinomas were located on the forelimb in the mongrel and on the lateral thigh in the Siberian husky. In dogs with mammary tumors, lesions involved multiple glands bilaterally in the Dachshund, thoracic glands in the male mongrel, and abdominal glands in the Golden Retriever, which also had a lipoma on the cranial abdomen. The Dobermann exhibited an inguinal gland tumour. Among the affected dogs, four were neutered after reaching sexual maturity, while two remained intact. Of all the cases, five dogs were found to have malignant tumours, whereas one dog had a benign tumour. Recurrence of tumour was noticed in dog 2 after two month of surgery.

Histopathological examination revealed various tumour types including tubular carcinoma, micropapillary tubular carcinoma, cystic papillary tubular carcinoma, cystic tubular adenoma, lipoma, and basal cell carcinoma. Two of the dogs exhibited more than one tumour type.

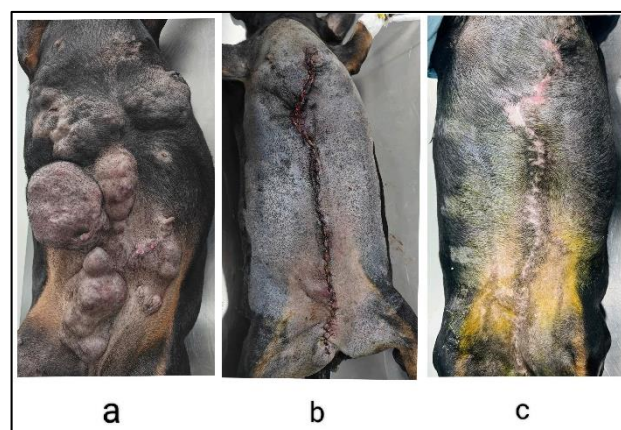


Fig 1: Case 3-Dachshund dog-all the glands affected with mammary tumours: a-before surgery, b-after bilateral chain mastectomy and c-after a month of surgery.

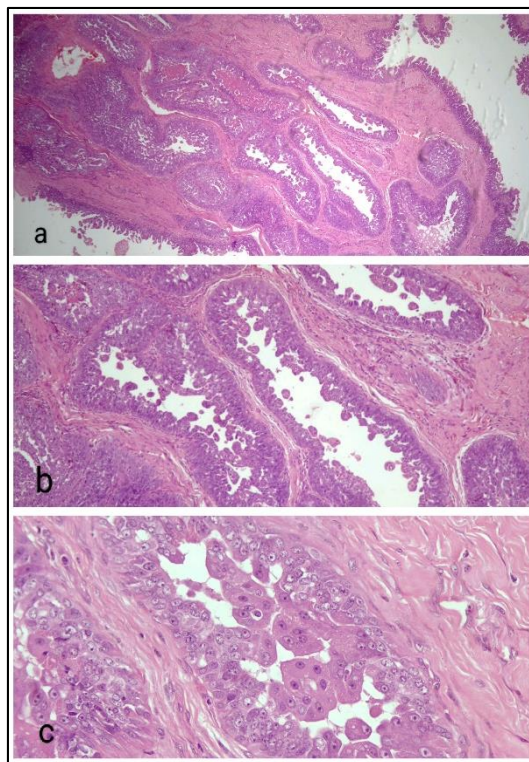


Fig 2: Micropapillary tubular carcinoma H and E staining: a-4X, b-10X and c-40X.

Micropapillary tubular carcinoma was characterized by multiple lobules composed of neoplastic epithelial cells arranged in tubular and finger-like papillary projections. (a) The tubules were lined by epithelial cells exceeding four cell layers in thickness, (c) proliferating toward the lumen. (b) Multifocal areas displayed micropapillary projections

with slit like spaces among proliferating neoplastic cells. The nuclei were vesicular with one to two prominent nucleoli, and the cytoplasmic borders were indistinct with eosinophilia. Mitotic figures averaged four to five per high power field. Marked nuclear pleomorphism, anisocytosis, anisokaryosis, and loss of cellular polarity were evident.

Table 2: Haematological parameters

S. No.	Parameter	0 th day	14 th day	45 th day
1	Haemoglobin (% or g/dL)	12.97±1.15	12.35±0.77	13.45±0.82
2	Total erythrocyte count (TEC) (X 10 ⁶ /μL)	5.98±0.59	5.66±0.37	6.25±0.36
3	Total leucocyte count (TLC) (X 10 ³ /μL)	14.05±1.59	13.00±1.97	10.92±0.83
4	Neutrophils (%)	75.41±3.09	71.34±4.63	73.72±5.32
5	Lymphocytes (%)	18.84±0.74	19.62±3.64	18.61±4.32
6	Monocytes (%)	3.13±1.34	2.89±1.41	6.99±4.06
7	Eosinophils (%)	2.29±0.74	2.85±0.41	3.66±0.51
8	Basophils (%)	0.92±0.41	1.56±0.36	1.85±0.62
9	Platelets (X 10 ³ /μL)	322.50±28.39	302.33±19.94	337.67±19.23
10	PCV (%)	38.08±3.30	37.27±2.23	39.17±2.97

A slight variation in the haematological parameters was noticed at different interval, however all the values were within the normal range throughout the study.

Table 3: Blood biochemical parameters

S. No.	Parameter	0 th day	14 th day	45 th day
1	Creatinine	0.93±0.11	0.97±0.08	0.96±0.08
2	BUN	15.75±2.38	22.42±5.66	17.57±2.68
3	SGPT	57.33±12.49	68.5±9.89	49.83±6.88
4	SGOT	56.00±7.64	56.17±7.99	47.33±6.24
5	Total proteins	7.18±0.24	6.93±0.21	7.27±0.16
6	Albumin	2.75±0.12	2.85±0.21	3.02±0.08
7	Globulin	4.17±0.16	3.97±0.14	4.30±0.13
8	Alkaline phosphatase	525.17±130.51	683.67±249.51	540.67±156.23
9	Direct bilirubin	0.17±0.03	0.22±0.07	0.14±0.01
10	Indirect bilirubin	0.12±0.03	0.20±0.04	0.25±0.11
11	Total bilirubin	0.28±0.05	0.42±0.06	0.27±0.45
12	Random blood sugar	80.08±3.61	80.23±4.28	86.67±4.13

All the biochemical parameters were having slight variations at different intervals however they were in normal physiological range except serum albumin, globulin, direct bilirubin, indirect bilirubin and total bilirubin values which were having significant difference at different time interval.

Discussion

In this study 66 percent of the cases are mammary tumours and 34 percent cases are of other surface tumors like basal cell carcinoma and lipoma. Out of the total cases five cases were histopathologically malignant in nature and only one case was benign neoplasm. Out of four mammary tumor cases 75 percent were malignant and 25 percent are benign neoplasms which were in accordance with the previous reports (Sorenmo, 2003; Anjan Kumar., 2009 and Hareesh *et al.*, 2025)^[9, 1, 7]. Affected dogs were between the ages 5 to 14 years, with the median of 8.17 years with highest incidence in middle aged dogs of 5-8 years. Two dogs had ulcerated tumors indicating chronic nature of the tumours. Total leucocyte counts were high before surgery may be due to the infection and chronic ulceration in some dogs which reduced after the surgery. There were slight variations in all the haematological parameters, however all the parameters were in normal physiological limits. Blood biochemical parameters like SGPT, SGOT and Alkaline phosphatase were on higher side before surgery which could be increased due to variety of reasons, including indirect hepatocellular damage, paraneoplastic syndrome, muscles damage by tumors and non specific effect due to chronic illness. These values were further increased after surgery due to surgical stress and muscle damage caused during surgery. The values reduced after 45 days due to removal of primary cause, resolution of secondary effects and enzyme turnover showing improvement in condition and quality of life. There was a recurrence of small tumors at thoracic region within two months of surgery in dog 2 and died after five months, showing the severity of the malignant tumor.

Conclusion

In the present study out of six affected dogs three were males and three were females with various surface tumours. Different breeds of dogs comprising two mongrels, and one each of Dachshund, Siberian Husky, Golden Retriever, and Doberman. The median age was 8.17 years (ranging from 5 to 14 years), with the highest incidence observed in dogs above eight years of age. Among the six cases, four dogs were diagnosed with mammary tumors (66.67%) one of which also had a concurrent lipoma (16.67%), showed the highest incidence among different tumours in this study, while the remaining two dogs were affected with basal cell carcinoma (33.33%). Ulceration of the tumors due to chronicity was observed in two of the six cases. All dogs recovered uneventfully within 14 days of surgery, however there was a recurrence noticed in only one dog which ended up in death after five months. Improvement in overall health of dogs was noticed by clinical signs like improved body condition, reduced licking of sites, improvement in overall activity and playfulness as well as with improvement in haemato-biochemical parameters.

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