CLINICOPATHOLOGICAL STUDIES OF NEOPLASM IN CANINES

T H E S I S

Submitted in partial fulfillment of the requirements for the Degree of

MASTER OF VETERINARY SCIENCE

IN

VETERINARY PATHOLOGY

BY

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Enrolment No: V/14/086

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Appendix – B

DECLARATION BY THE STUDENT

I hereby declare that the experimental research work and interpretation of the thesis entitled **"CLINICOPATHOLOGICAL STUDIES OF NEOPLASM IN CANINES"** or part thereof has not been submitted for any other degree or diploma of any University, nor the data have been derived from any thesis/publication of any University or scientific organization. The sources of materials used and all assistance received during the course of investigation have been duly acknowledged.

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DECLARATION OF ADVISORY COMMITTEE

GUNJATE ADITYA BABASAHEB has satisfactorily prosecuted his course of research for a period of not less than one semester and that the thesis entitled, **"CLINICOPATHOLOGICAL STUDIES OF NEOPLASM IN CANINES"** submitted by him is the result of research work is sufficient to warrant its presentation to the examination in the subject of **VETERINARY PATHOLOGY** for the award of **MASTER OF VETERINARY SCIENCE (M.V.Sc)** degree by the Maharashtra Animal and Fishery Sciences University, Nagpur.

We also certify that the thesis or part thereof has not been previously submitted by him for a degree of any other university.

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CERTIFICATE

This is to certify that the thesis entitled, **"CLINICOPATHOLICAL SUDIES OF NEOPLASM IN CANINES"** submitted by Mr.**Gunjate Aditya Babasaheb** to the Maharashtra Animal and Fishery Sciences University, Nagpur, in partial fulfillment of the requirement for the degree of **MASTER OF VETERINARY SCIENCE** has been approved by the Student's Advisory Committee after examination in collaboration with the External Examiner.

Name & Signature Of External Examiner

Signature & Seal Head of the Department

Advisor/Guide

ADVISORYCOMMITTEE

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Date:

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LIST OFABBREVIATIONS

Abbreviations		Full Forms
ANOVA	:	Analysis of Variance
ALB	:	Albumin
ALP	:	Alkaline Phosphatase
CREAT	:	Creatinine
CRP	:	C - Reactive Protein
CTCL's	:	Cutaneous T Cell Lymphoma
CBCL's	:	Cutaneous B Cell Lymphoma
CD4+	:	Cluster of Differentiation 4+
CD8+	:	Cluster of Differentiation 8+
COPD	:	Chronic Obstructive Pulmonary Disease
CEA	:	Carcino-Embryonic Antigen
DLC	:	Differential leucocyte count
ESR	:	Erythrocyte sedimentation rate
EDTA	:	Ethylene Diamine Tetra Acetic acid
ECG	:	Electrocardiography
FNAC	:	Fine Needle Aspiration Cytology
GLOB	:	Globulin
Hb	:	Hemoglobin
Mg	:	Milligram
NLR	:	Neutrophil to Lymphocyte ratio
PCV	:	Packed Cell Volume
POSSUM	:	Physiological and Operative Severity Score for the enumeration of Mortality and Morbidity.
PI	:	Peterson's Index
PNI	:	Prognostic Nutritional Index
PSA	:	Prostate Specific Antigen
SGPT	:	Serum Glutamic Pyruvic Transaminase
SGOT	:	Serum Glutamic Oxaloacetic Transaminase
SCC	:	Squamous Cell Carcinoma
TEC	:	Total Erythrocyte Count
TLC	:	Total Leucocyte Count
TNM	:	Tumor Node Metastasis
TP	:	Total Protein

Chapter 1

INTRODUCTION

Neoplasia/Neoplasm/Tumor/Cancer is the uncontrolled, abnormal growth of cells or tissues in the body. Neoplasm can be benign or malignant. Benign neoplasms do not grow aggressively, do not invade the surrounding body tissues, and do not spread throughout the body. On the other hand, malignant neoplasm tends to proliferate rapidly, invade the tissues around them, and spread or metastasize to other body parts. The word "cancer" is often confused with neoplasia, but only malignant neoplasms are truly cancer.

Synonymously the terms neoplasia, tumor, and cancer are sometimes used and may refer to various types of growths (even non-cancerous or benign growths). It is important to understand how abnormal cells grow and how regulated average cell growth. Throughout life, cells are continually being born and dying. When that process is disrupted, cells behave abnormally, and abnormal tissues form (neoplasms).

The global burden of cancer is projected to increase from 13.3 to 21.4 million incident cases between the years 2010 and 2030 due to demographic changes alone, dominated by a growing burden in low and middle-income countries like India (**McCormack and Boffetta, 2011**).

At first, chemotherapy was considered the dogma for treating various cancers. Presently this technique is on wane for many cancer patients. Genetic tests can now reveal whether chemotherapy would be beneficial. For many, there are better options with an ever-expanding array of drugs, including estrogens blockers and drugs that destroy cancer by attacking specific proteins on the surface of tumours. There is also a growing willingness among oncologists to scale back unhelpful treatments. The result spares thousands each year from the dreaded chemotherapy treatment, with its accompanying hair loss, nausea, fatigue, and potential to cause permanent damage to the heart and

nerves in the hands and feet. Cheaper and faster genetic sequencing is playing an essential role in the change. The technology has made it easier to test tumours if they respond to targeted drugs.

Cancer is a common problem in dogs; although all breeds of dog and crossbred dogs may be affected, it is notable that some breeds of pedigree dogs appear to be at increased risk of certain types of cancer, suggesting an underlying genetic predisposition to cancer susceptibility. The etiology of most cancers is likely to be multifactorial, the limited genetic diversity seen in purebred dogs facilitates genetic linkage or association. studies on relatively small populations compared to humans, and by using newly developed resources, genome-wide association studies in dog breeds prove to be a powerful tool for unraveling complex disorders. (**Dobson, J. M , 2013**)

As compared to a human, in canines, neoplasms are more frequent **(Dhami *et al.,* 2010)**.The causative agent of tumours in the dog is multifactorial (**Roshni *et al.,* 2013**), which include the participation of sex hormones, genetic, oncogenic viruses, immunological factors, environmental factor, and environmental carcinogens. These tumours can be seen in most of the canine breeds in varying geographical areas covering different age groups (**Kashyap *et al.,* 2013**).

Diagnosis of tumours at an early stage has become extremely important, this plays vital role in successful treatment. Histopathology is the most important mode of diagnosis of tumours, but the time taken and possibility of complication during the surgery has reduced its importance.

Diagnostic cytology involves microscopic evaluation of cells to determine the nature of lesions and diagnosis of the disease at the earliest. The cytological interpretation is valuable in establishing the diagnosis and identifying the process.

Innumerable interdisciplinary approaches have contributed significantly to the progress in cancer diagnosis, but still, term cancer has remained an enigma posing a problem to both the human and animal kingdom. Hence, this study was

conducted to understand the clinicopathological and histopathological studies of tumour and their various impacts on the various biochemical parameters of the body.

OBJECTIVES

1.1. To study clinical presentation and histopathological features of neoplastic lesion in dogs.

1.2. To study the haematological and biochemical profile of canines with neoplasm.

1.3. To study the correlation between serum calcium level and neoplastic conditions.

Chapter 2

REVIEW OF LITERATURE

2.1. Incidence/Prevalence of neoplasm in canines:

Kumar *et al*.,(2020) had performed a study to find out the prevalence of various types of tumors in dogs in the area of Himachal Pradesh. The surgically removed tumor tissue samples were fixed with 10% neutral buffered formalin, processed, stained with hematoxylin and eosin, and examined under the microscope. A total of 56 dogs were found to be affected by one or another type of neoplasm during the period from 2016 to 2018. The prevalence of these neoplasms was categorized according to sex, age, location-wise and tissue type on histological examination. The present study showed female dogs had the highest prevalence rate of 55.36% compared with male dogs 44.64%. The dogs of the age group of six to nine years had the highest prevalence rate of 35.71% and lowest 37.50% in the age group of less than 3 years. Genitalia was found to be the most common site affected by the tumor. A transmissible venereal tumor (TVT) has the highest prevalence rate of 37.50% followed by squamous cell carcinoma (12.50%) and mammary carcinoma (10.79%).

Sharma *et al*.,(2018 a) had carried out a study on 2500 canine cases which were referred to the department of Surgery and Radiology. Out of 2,500 cases, 50 cases were diagnosed as tumours on the basis of cytology or histopathology of excision/needle biopsy. The overall prevalence of canine tumours during the one year study period was found out to be 2%. The prevalence of benign and malignant tumours was 46% and 54% respectively. Out of 50 canines diagnosed with tumours, 24 were males (48%) and 26 were females (52%). Organ-wise distribution of tumours included, mammary gland tumour (24%), skin and adnexa

(20%), venereal (16%), female reproductive tract (14%), male reproductive tract (8%), melanoma and oral cavity (8%), appendicular skeleton (6%), spleen (2%) and Liver (2%). Breed-wise occurrence of neoplasms was found higher in Labrador dogs and Mongrels (non-descript) as compared to other breeds. Labrador breed of dog had 17 tumour cases followed by non-descript dogs (15), Spitz (7), German Shepherd (5), Neapolitan Mastiff (2), Rottweiler, Dalmatian, Cocker Spaniel, and Pointer, one tumour case each. Age wise prevalence of canine tumours was observed as 0-5 year age group (24%; 12 cases), 6-10 year age group (60%; 30 cases), and 10-15 year old dogs (16%; 8 cases).

Sharma *et al*.,(2018 b) had studied the canine cases referred to the department of Surgery and Radiology with the history of enlargement of one or more mammary glands (from last three months to two years). The incidence of mammary tumours was 24% (12 out of 50) among the different tumours and 0.48% among all canine cases. The affected animals were aged 5-13 years with a mean value of 9.1±0.64 years. The malignant tumours accounted 41.66% of the mammary tumours. The metastasis lesions in the form of multiple soft tissue nodules were observed in the lungs of only three of the five malignant tumours. Surgery being the mainstay of the management for canine mammary tumours, simple or regional mastectomy was performed in all cases in the present study. All the animals had uneventful recovery and sutures were removed without any complication of wound. However, long term follow up for 3-11 months revealed that two of the animals with adenocarcinoma and one animal with myoepithelioma died.

Arya *et al*.,(2018) had conducted an experiment to know the incidence of neoplasm in canines from Patna region of Bihar. The incidence of neoplasm in bitch was found to be higher as compared to male dogs. Highest risk of development of several cancers were found in

the dogs of age group 9-12years, followed by 6-9years, 12-15 years, 3-6Yeaars and 0-3 Years respectively. Incidence of neoplasm were highest in pomeranian breed followed by Germen shepherd, Labrador retriever, Golden Retriver, Dalmitian and non descript respectively. Neoplasm of mammary gland, genital organs and skin were found to be more common.

Baioni *et al.*,(2017) had performed the studies on estimating the canine cancer incidence: finding from a population based tumour registry in north western Italy In its 90 months of operation from 2001 to 2008 (the observation period in this study), the population based Piedmont Canine Cancer Registry collected data on 1175 tumours which was confirmed by histopathological diagnosis. The incidence rate was 804 per 100,000 dog-years for malignant tumours and 897 per 100,000 dog-years for benign tumours. Higher rates for all cancers were observed in purebred dogs, particularly in Yorkshire terrier and Boxer. The most prevalent malignant neoplasms were cutaneous mastocytoma and hemangiopericytoma, and mammary gland complex carcinoma and simplex carcinoma.

Roshini *et al.*,(2013) had conducted a study on 55 dogs presented with the history of tumorous growth. Age, sex, breed and site of tumour/ growth of all the animals were recorded. The biopsy samples were collected for histopathological examination. The age of affected animals varied from 1-15 years. The highest occurrence was recorded in the age group of 4-6 years (30.9%). Both male and female animals were equally affected. Skin neoplasms were found to be more in males (69.2%) than in females (30.8%). Three male animals (75%) were affected with oral tumours as compared to one case of female (25%). All cases of perianal adenoma/adenocarcinoma were seen in male animals only. Thirty one cases were observed in non-descript animals (50.9%) followed by Pomeranian, Labrador (n= 8, 14.5%), German Shepherd (n=5, 9.09%),

Rottweiler (n=2, 3.63%) and Basset hound, Doberman, German short hair, Great Dane (n=1, 1.8%) respectively. Out of 55 suspected cases, eleven samples (20.01%) were diagnosed as inflammatory hyperplastic growths and forty four cases (80.0%) were diagnosed as neoplastic upon histopathology. Out of 44 cases, 14 cases were diagnosed as mammary tumours (benign 14.5% and malignant 10.9%),) followed by histiocytoma (8.6%), venereal granuloma (6.8%), perianal gland adenocarcinoma (3.6%), epulis (3.4%), fibroma (3.4%), leiomyosarcoma (3.4%), perianal gland adenoma (1.7%) leiomyoma (1.7%), seminoma (1.7%), sertoli cell tumour (1.7%), melanoma (1.7%), sqmaous cell carcinorma (1.7%), fibrosarcoma (1.7%), meibomian gland adenoma (1.7%), skull bone tumours (1.7%) and hemangiopericytoma (1.7%).

Giri *et al.*,(2013) has carried out an investigation to study the occurrence and histopathology of spontaneously occurring tumours in skin and subcutaneous tissues in canines. A total of 32 grossly suspected cases of spontaneously occurring cutaneous and subcutaneous tumours were collected during the period from October 2010 to September 2011 in canines of Durg district and adjoining areas of Chhattisgarh to detect the prevalence based on age, sex, breed, and site on the body. Out of these 25 cases were confirmed as tumours based on histopathological findings. The results revealed that, the dogs had higher prevalence (56%) than bitches (44%). Geriatric dogs (32%) were found to be affected more with various neoplastic conditions. Pomeranian breed showed highest prevalence (32%) followed by Spitz (28%). Histopathologically, 10 cases were malignant (40%) in nature and included basal cell carcinoma, squamous cell carcinoma, rhabdosarcoma, tubulo-papillary adenocarcinoma, venereal granuloma, and fibrosarcoma. Moreover, the other 15 (60%) neoplastic cases were benign in nature and included fibroma, histiocytoma, fibroadenoma and leiomyoma. The overall mean ages for benign and malignant tumours were 10 years and 6.79 years, respectively.

Chikweto *et al.*,(2011) had performed a retrospective survey between 2002 and 2007 on samples from dogs residing in Grenada. In a series of 225 skin masses examined, the proportion of neoplasms was 72% whereas nonneoplastic tumors accounted for 15.6%, and inflammatory conditions constituted 12.4%. There were 10 types of nonneoplastic tumors with hamartoma as being the most common (28.5%), followed by sebaceous hyperplasia (25.7%) and fibroepithelial polyps (22.8%). The 10 most common cutaneous neoplasms were hemangiosarcomas (19.1%), histiocytomas (8.6%), melanocytomas (8%), mast cell tumors (6.8%), lipomas (6.8%), hemangiopericytomas (6.2%), papillomas (5.6%), fibrosarcomas (5.6%), hemangiomas (4.9%), and squamous cell carcinomas (4.3%). Tumors of vascular origin and transmissible venereal tumors were more common in dogs in our study than reported from other regions. They had also reported that more than half of the samples (58%) were from the mixed local breed of dog referred to as the Grenadian pothound.

Vascellari *et al.*,(2009) had performed the studies on animal tumour registry of two provinces in northern Italy: incidence of spontaneous tumours in dogs and cats. They had reported that the estimates of canine and feline populations of the catchment area turned out to be of 296,318 (CI +/- 30,201) and 214,683 (CI +/- 21,755) subjects, respectively. During the first three years, overall 2,509 canine and 494 feline cases of neoplasia were diagnosed. In dogs, the estimated annual incidence rate (IR) per 100,000 dogs for all tumours was 282 in all the catchment area, whereas in cats the IR was much lower (IR = 77). Malignant and benign tumours were equally distributed in male and female dogs, whereas cats had a 4.6-fold higher incidence of malignant tumours than benign. In both dogs and cats, purebreds had an almost 2-fold higher incidence of

malignant tumours than mixed breeds. Tumour incidence increased with age in both dog and cat populations.

Pawar (2009) had conducted a study on the growth in canines. In this study they had studied 46 growth cases. As per the reports 63.04% were found to be malignant, 28.60% to be benign and 4.76 to be inflammatory. Also the incidence of mammary gland tumour was highest. According to age groups highest prevalence was in the age group of 9-12 years. The more prevalence was noticed in males as compared to females. According to the breeds Non-descript animals were found to posses' higher prevalence.

Pakhrin *et al.*,(2007) had conducted a retrospective study of canine cutaneous tumors in Korea. During this study which was over the period of 42 month from January 2003 to June 2006, a total of 2,952 canine biopsy specimens were received from the Veterinary Medical Teaching Hospital of Seoul National University and from veterinary practitioners across the nation. Out of these, 748 (25.34%) cases were diagnosed as canine cutaneous tumors in the Department of Veterinary Pathology, College of Veterinary Medicine, Seoul National University, Korea. Thirty-eight different types of cutaneous tumors were identified and categorized into epithelial and melanocytic tumors (56.95%), mesenchymal tumors (38.90%), and hematopoietic tumors (4.14%) located in the skin. Among these, 69.25% were benign and 30.74% were malignant. The top ten most frequently diagnosed cutaneous tumors were epidermal and follicular cysts (12.70%), lipoma (11.36%), mast cell tumors (8.82%), cutaneous histiocytoma (7.49%), basal cell tumors (6.82%), sebaceous gland adenoma (6.68%), sebaceous gland hyperplasia (5.08%), hepatoid gland adenoma (3.61%), apocrine adenocarcinoma (3.07%), and fibroma (2.81%), in order of prevalence. They comprised 68.45% of all cutaneous tumors. These top ten cutaneous

tumors were distributed on the trunk (30.08%), head and neck (20.9%), extremities (19.14%), anal and perianal area (8.59%), and tail (3.91%). The age of the dogs with the ten most frequent tumors had a mean age of 8.3 years, with a range of 2 months to 19 years. When all types of tumors were considered together in the entire population, there was no difference in incidence according to sex.

2.2. Haematology and biochemistry:

Priyadarshini *et al.*,(2021) had performed the investigation on the dogs affected with transmissible venereal tumours and performed the various studies for haematolgical, biochemical, cytological and histopathological examination. The prevalence of canine venereal tumour was found to be 25.46 per cent with respect to all reproductive diseases and 34.15 per cent of all types of tumours in dogs in and around Bhubaneswar, Odisha. The incidence was more in young female dogs of age group 2 to 11 years (46.34%) with a mean age of 5.17 years. Non-descript/ indigenous breeds (73.17%) were more affected as compared to pure breeds of dogs. Haematological examination of suspected cases revealed normocytic –hypochromic anaemia, neutrophilic leucocytosis with thrombocytopenia and lymphopenia. Serum biochemical examination of affected cases revealed hypoproteinemia, hypoalbuminemia, hypoglobulinemia, hypoglycemia, decreased triglyceride and higher levels of LDH, blood urea nitrogen, creatinine, calcium, increased levels of alanine aminotransferase and alkaline phosphatase. Gross examination revealed presence of tumour masses around the genital organs with pinkish or hyperemic cauliflower like appearance with ulcerations and bleeding. Cytological and histopathological examinations of suspected cases revealed typical pleomorphic neoplastic round cells with marked anisocytosis, anisokaryosis, vacuolated cytoplasm, large central to eccentric nuclei, increased mitoses, hyperchromsia which are suggestive of Transmissible

venereal tumours. Cytological, histopathological along with haematological and biochemical studies can be profitably utilized for early diagnosis and prognosis of canine transmissible venereal tumours.

Fauzi *et al.*,(2021) had performed the studies on a Golden Retriever bitch, 10 years old her conditions was discharge from the vagina, stink smell, polyuria, polydipsia and swelling in the vaginal area that begin to appear one month ago. Physical examination results found her weight 30 kg, scored three for body condition score (scale 1-5), body temperature at 38ºC, pale mucous membrane, and Capillart Reill Time > 2 seconds. Hard mass was palpable in the vaginal area. Based on the anamnesis, physical examination and clinical symptoms, the bitch appeared have some different diagnosis such as pyometra, endometritis, vaginitis, and vaginal tumors. Hematology, radiograph, and histopathological laboratory tests were performed to confirm the diagnosis. Hematologic results showed the bitch suffered from leukocytosis of 41.7 x 103/µL, granulocytosis 36.5 x 103/µL, and hyperchromic microcytic anemia. The results of the radiograph examination showed a radiopaque solid mass in the vagina and uterus. The results of the histopathological examination found there were hyperchromasia nuclei and pleomorphism.

Nair *et al.*,(2021) had studied the Hematological and biochemical parameters during the surgical management of clinical cases of mammary and superficial neoplasms in thirty six dogs. The dogs were studied in three groups of twelve animals each as group- I with surgery alone, group –II with neoadjuvant chemotherapy followed by surgery and group – III with surgery followed by adjuvant chemotherapy. Vinblastine-Prednisolone and Doxorubicin - Prednisolone chemotherapy protocols was adopted in six animals each in group II and III. The haematological and biochemical parameters were interpreted using repeated measures ANOVA to test the variance within the three groups on biweekly interval

observations and to test the significance between three groups. Statistically significant variation n ($P<0.05$) on mean haemoglobin, mean platelet count, Total leucocyte count, Differential Leucocyte Count (DLC) and biochemical parameters -ALP ,BUN and Creatinine values were observed within the groups and between the groups with marked change on the day of presentation in animals of group III with advanced stages of neoplasm. Hematological and biochemical parameters also showed as significant variations after the chemotherapy.

Ahmad *et al*.,(2018) had performed the studies on Assessment of tumor-induced pain and C-reactive protein levels in dogs with canine transmissible venereal tumors. The aim of this study was to determine the impact of tumor volume on generalized behavior, pain perception, and serum C-reactive protein (CRP) in dogs with canine transmissible venereal tumors (CTVTs). Hematological profiles including complete blood count and CRP were analyzed using an automatic hematology analyzer and immunoturbidimetric assays, respectively. Chi-square and regression analysis statistics were used for data analysis. Results of the study revealed a statistically significant ($R2 = 0.798$) impact of tumor volume on pain scores in corresponding individuals. Hematological parameters and serum CRP values were observed in normal ranges and did not reveal any significant association with tumor volume. It may be concluded that increasing tumor size may result in localized pain and mild behavioral alterations in affected dogs. However, hematology profiles and serum CRP levels are independent of the localized tumor proliferation.

Kumar *et al*.,(2018) had performed a study on the occurrence, clinico-Haemato-biochemical and histopathological studies on mammary gland tumor in geriatric dogs. In which it was found that Mammary gland tumor was recorded in 18.2% of female geriatric dogs of Jammu. Grossly, red, purple or flesh color, irregular shaped, soft and hard

masses, firmly attached to the skin on different pairs of teats were recorded in affected dogs. On histopathological examination, all the six cases of mammary gland tumor were identified as adenocarcinoma i.e. 100% mammary tumors were found to be malignant. Haemato-biochemical profile of the affected dogs revealed significantly ($P<0.05$) lower mean values of haemoglobin, higher total leucocyte counts (17.59±2.45 x103/µL) and neutrophil counts (79.5±1.99%) whereas lymphocyte count was lower (12.72±1.68%) as compared to the healthy control group. Platelet count was also significantly higher in the affected dogs (453.00±25.18 x106/µL). No significant deviation was recorded in biochemical parameters.

Mohapatra *et al.*,(2016) had studied serum biochemical parameters such as blood urea nitrogen (BUN), serum creatinine, aspartate transaminase (AST), alanine transaminase (ALT), alkaline phosphatase, total protein, albumin and globulin in dogs with mammary tumours when compared with healthy control group of animals no significant differences were noticed.

Milijaševic *et al.*,(2014) had performed studies on Acute toxic effects of single dose dacarbazine: hematological and histological changes in an animal model. In haematological study of the fibrosarcoma group revealed to posses anemia, thrombocytopenia and leukocytosis were found in the control group of hamsters with fibrosarcoma, whereas animals with fibrosarcoma treated with DTIC developed anemia, thrombocytopenia and leukopenia.

Ramani *et al.*,(2014) had prepared a case report on lower eye lid reconstructive surgery after sebaceous gland adenoma resection in a Germen shepherd dog. They had also performed the haematological examination which revealed to be within normal ranges.

Gupta *et al*.,(2014) had performed a study on 40 canines presented with the history of any swelling or growth in one or all of the mammary glands. Signalment and history was recorded properly and then the animals were subjected to detailed physical examination. Fine needle aspiration biopsy (FNAB) of the tumorous mass was taken to give preliminary diagnosis. The distant metastasis was confirmed via lymph node palpation, chest radiography and ultrasonography. Based on treatment regimen followed the animals were divided into two groups: group I (n= 29) in which only surgery was performed and group II (n= 6) in which surgery as well as chemotherapy was performed while remaining 5 animals were not given any treatment. Different haematological (Hb, TLC, DLC and PCV) and biochemical (BUN, CRTN, ALT, AST, ALKP and TP) were recorded preoperatively, postoperatively and after chemotherapy at required intervals. In group II animals chemotherapy was started 15 days after surgery and the regimen followed was inj. Vincristine @ 0.5mg/m2BSA and inj. Methotrexate @ 9- 15mg/m2BSA, i.v. on day 1 followed by tab. Cyclophosphamide @ 50mg/m2 po from 2nd to 5th day. Maximum (57.5%) no. of cases were recorded in Samoyed breed and the median age of affected animals was 10.8 years (2-15). Diagnostic accuracy, sensitivity and specificity of FNAB were 77.14%, 78.78% and 100% respectively. 74.28% of cases showed pulmonary metastasis in lung radiography. All haematological and biochemical parameters remained within normal range during the course of therapy except significant decrease in ALKP values after surgery in both groups. Majority (96.96%) of the neoplasms were malignant and there was no significant difference in the mean survival time and survival rate after surgery in both groups and among different surgical technique. The most significant finding was that all the live animals in group II were less than 8 years of age suggesting that the combination used in the present study was safe and effective in comparatively young animals.

Fridlender and Albelda (2012) had studied and stated that neutrophils play an established role in host defense and in killing invading microorganisms. Although neutrophils are traditionally considered in the context of their antibacterial functions, it is becoming increasingly clear that tumor-associated neutrophils (TAN) play a major role in cancer biology. Neutrophils make up a significant portion of the inflammatory cell infiltrate in many models of cancer. Like all other leukocytes, they move into tissues under the influence of specific chemokines, cytokines and cell adhesion molecules. The tumor microenvironment has been shown to be responsible for their recruitment in cancer. We have found that TAN are a distinct population of neutrophils, differing markedly in their transcriptomic profile from both naive neutrophils and the granulocytic fraction of myeloid-derived suppressor cells. Studies have demonstrated specific examples of tumor-mediated signals (such as transforming growth factor-β) that induce the formation of a pro-tumorigenic (N2) phenotype capable of supporting tumor growth and suppressing the antitumor immune response. However, there are also studies showing that TAN can also have an antitumorigenic (N1) phenotype. Herein, we explore the literature on the different mechanisms of TAN recruitment to tumors, the unique characteristics of TAN and what shapes their pro- and/or antitumor effects.

Pawar(2009) had performed the studies on the canine neoplasm and had also studied the haematology and biochemistry profile of the patient. Haematology revealed reduction in Hb and RBC in metastatic and malignant neoplasm which was ulcerated. Significant increase in neutrophilic count was also noticed. Serum biochemistry profile revealed significant increase in globulin and decrease in A: G ratio.

Teramukai *et al*.,(2009) had studied and examined the impact of pretreatment neutrophil count on survival in patients with advanced non-small-cell lung cancer (NSCLC). A total of 388 chemo-naı¨ve patients

with stage IIIB or IV NSCLC from a randomised controlled trial were evaluated. The effects of pretreatment peripheral blood neutrophil, lymphocyte and monocyte counts and neutrophil–lymphocyte ratio on survival were examined using the proportional hazards regression model to estimate hazard ratios after adjustment for covariates. The optimal cut-off value was determined by proportional hazards regression analysis with the minimum P value approach and shrinkage procedure. After adjustment for prognostic factors, the pretreatment elevated neutrophil count was statistically significantly associated with short overall (P = 0.0008) and progression-free survival (P = 0.024), whereas no association was found between prognosis and lymphocyte or monocyte count. The cut-off value selected for neutrophil count was 4500 mm–3 (corrected hazard ratio, 1.67; 95% confidence interval (CI), 1.09–2.54). The median survival time was 19.3 months (95%CI, 16.5–21.4) for the low neutrophil group (<4500 mm–3, n = 204) and was 10.2 months (95%CI, 8.0–12.3) for the high-neutrophil group (P4500 mm–3, n = 184). We confirmed that pretreatment elevated neutrophil count is an independent prognostic factor in patients with advanced NSCLC receiving modern chemotherapy. Neutrophil count is easily measured at low cost, and it may be a useful indicator of patient prognosis.

Qureshi (2006) has studied levels of ionized calcium, total calcium and albumin corrected calcium in human patients with different malignant disorders for the diagnosis of hypercalcaemia of malignancy Blood Ca++ levels in patients suffering from malignant disorders were found significantly high (mean ± SD: 1.30+017 mmol/L) as compared to control subjects (mean ± SD: 1.23+0.03 mmol/L) ($p<0.001$). The number of patients with hypercalcaemia of malignancy detected by Ca++ estimation was significantly higher (38%) as compared to total calcium (8.4%) and albumin corrected calcium ACC (10.6%) ($p<0.001$).

Adak (2005) reported the mean values of hemoglobin (Hb), packed cell volume (PCV) ,total erythrocyte count (TEC), total leucocyte count (TLC) and platelet count as 10.93±0.54, 34.68±1.79, 5.86±0.32, 17235±1607.53, and 8.84±0.99 respectively. Statistically, there was no significant difference in the hematological parameter except for platelet count, which was significantly higher in case of tumor affected animals.

Erlinger *et al*.,(2004) had conducted the studies with the topic "WBC Count and the Risk of Cancer Mortality in a National Sample of U.S. Adults: Results from the Second National Health and Nutrition Examination Survey Mortality Study" . During this study it was noticed that inflammation has been shown to be a risk factor for several chronic diseases. The current study included 7,674 Second National Health and Nutrition Examination Survey (NHANES II) participants, 30 to 74 years of age, between 1976 and 1980. Mortality follow-up through December 31, 1992 was assessed using the National Death Index and Social Security Administration Death Master File. A graded association between higher WBC and higher risk of total cancer mortality was observed [highest versus lowest quartile (relative risk [RR] 2.23; 95% confidence interval [CI], 1.53-3.23)] after adjusting for age, sex, and race. After further adjustment for smoking, physical activity, body mass index, alcohol intake, education, hematocrit, and diabetes, WBC remained significantly associated (P trend = 0.03) with total cancer mortality [highest versus lowest quartile (RR 1.66; 95% CI, 1.08-2.56)]. In stratified analyses, increased WBC was associated with higher risk of non-lung cancer (P trend = 0.04), but not lung cancer (P trend = 0.18). Among non smokers, a 1 SD increase in WBC (2.2 × 109 cells/L) was associated with greater risk of total (RR 1.32; 95% CI, 1.05-1.67) and non-lung (RR 1.30; 95% CI, 1.03-1.63) cancer mortality. These findings support the hypothesis that inflammation is an independent risk factor for cancer mortality. Additional studies are needed to determine whether

circulating levels of inflammatory markers are associated with increased risk of incident cancer.

Weiss (2002) had studied anaemia of chronic disease (ACD), the most frequent anaemia among hospitalized patients, which develops under chronic inflammatory disorders such as chronic infections, cancer or autoimmune diseases. There are a number of different pathways which contribute to ACD, such as diversion of iron traffic, a diminished erythropoiesis, a blunted response to erythropoietin, erythrophagocytosis and bone marrow invasion by tumour cells and pathogens. Nevertheless, ACD is a reflection of an activated immune system and possibly results from an innovative defence strategy of the body in order to withdraw the essential growth factor iron from invading pathogens and to increase the efficacy of cell-mediated immunity.

Caro *et al*.,(2001) had performed the studies on anemia as an independent prognostic factor for survival in patients with Cancer. They had recorded that anemia is possible due to direct interference by the malignancy in RBC production. Alternatively they have also stated anemia may be an indirect effect of high tumor burden and/or biological effects, for ich they have set an example of cytokine interference with RBC production.

McMilan *et al*.,(2001) had performed the studies to determine the association between hypoalbuminemia and poor prognosis in patients with cancer is well recognized. In this study, they examined the relationship between circulating albumin concentrations, weight loss, the body cell mass (measured using total body potassium), and the presence of an inflammatory response (measured using C-reactive protein) in male patients (n = 40) with advanced lung or gastrointestinal cancer. Albumin concentrations were significantly correlated with the percent ideal body weight ($r = 0.390$, $p < 0.05$), extent of reported weight loss ($r = -0.492$, p

< 0.01), percent predicted total body potassium (adjusted for age, height, and weight, r = 0.686, p <0.001), and log10 C-reactive protein concentrations (r = -0.545, p < 0.001). On multiple regression analysis, the percent predicted total body potassium and log10 C-reactive protein concentrations accounted for 63% of the variation in albumin concentrations (r2 = 0.626, p < 0.001). The interrelationship between albumin, body cell mass, and the inflammatory response is consistent with the concept that the presence of an ongoing inflammatory response contributes to the progressive loss of these vital protein components of the body and the subsequent death of patients with advanced cancer.

Naeini (1997) had performed the studies on 12 year old female German shepherd dogs, affected with mammary tumor, did not reveal any significant difference in the values of hematological profiles and clotting time.

Freeman *et al*.,(1995) had performed the studies on Peripheral Blood T Lymphocytes and Lymphocytes Infiltrating Human Cancers Express Vascular Endothelial Growth Factor: A Potential Role for T Cells in Angiogenesis. During this study CD3+ peripheral blood T lymphocytes were evaluated for expression of vascular endothelial growth factor (VEGF), an endothelial cell mitogen and potent angiogenic factor. Also human prostate and bladder cancers (prostatic adenocarcinoma and transitional cell carcinomas) were evaluated for VEGF mRNA expression by in situ hybridization. Tumor-infiltrating lymphocytes (TIL), identifiable immunocytochemically as T cells, along with tumor cells in these cancers, expressed VEGF mRNA. TIL in bladder cancers could be labeled with a specific anti-VEGF mAb, indicating that TIL are likely to be able to secrete VEGF protein in situ at bioactive concentrations. The finding that peripheral T cells and TIL in human tumors synthesize a factor known to be a specific mediator of

neovascularization suggests a role for T lymphocytes as cellular effectors of angiogenesis.

Spivak (1994) had performed the studies and recorded that there are multiple mechanisms for causing anemia which have been identified. Which include blood loss that is either intrinsic or iatrogenic, nutritional deficiencies involving primarily iron or folic acid, hemolysis (autoimmune, traumatic, or drug-induced), bone marrow failure due to tumor encroachment, myelofibrosis, or marrow necrosis, infection, inflammation, or simply the presence of a cancer elsewhere in the body.

Sawyers *et al*.,(1992) had studied the production of granulocyte-macrophage colony-stimulating factor in two patients with lung cancer, leukocytosis, and eosinophilia. They had studied and stated that leukocytosis in association with malignancy has been well described, but the cause is not known. One potential explanation is production of a colony-stimulating factor by the tumor, and this has been demonstrated in vitro. The authors report two patients with lung cancer, leukocytosis, and eosinophilia. The pleural fluid of both patients contained malignant cells and biologically active granulocyte-macrophage colony-stimulating factor (GM-CSF), as demonstrated by radioimmunoassay, enzyme-linked immunosorbent assay (ELISA), and colony-forming unit-granulocyte-macrophage (CFU-GM) assay. To determine whether GM-CSF is normally detectable in pleural fluid, the authors performed assays on an additional 11 patients with pleural effusions of various origins but without peripheral blood leukocytosis and eosinophilia; only 1 patient had a detectable level of GM-CSF (i.e., $\geqslant$ 0.1 ng/ml). Because GM-CSF usually is not present in pleural fluid, the authors postulate that the high levels of GM-CSF found in the pleural fluid of these two patients was produced by their tumors, and production of GM-CSF by their lung cancers likely caused the leukocytosis with eosinophilia.

Shoenfeld *et al.*,(1986) had conducted the study on the topic leukocytosis in non hematological malignancies-A possible tumor-associated marker. During this study Leukocytosis (WBC counts 10,000/mm3) was detected in 77 out of 252 patients (30%) with ten different types of non-hematological malignancy (NHM) at the time of diagnosis. A full search including serological and bacteriological screening was performed to exclude other possible causes of leukocytosis. Among the different tumors, carcinomas of the lung and colorectum were the most prevalently associated with leukocytosis. Absolute monocytosis was found in 25% of the patients and absolute eosinophilia in only 4.8%. The leukocytosis was attributed mainly to an increase in the mature polymorph-nuclear, suggesting a release mechanism of WBC from storage pools by factors secreted or induced by the tumor. Neither the age nor the sex of the patients affected the incidence or magnitude of leukocytosis. However, the presence of metastases was associated with a significantly higher incidence of leukocytosis ($p<0.05$). The associated leukocytosis may be regarded as a poor prognostic sign, and was associated with a significantly ($p<0.007$) shorter survival time. In contrast, absolute lymphocytosis may have a positive effect on the survival time ($p=0.01$). Tumor-associated leukocytosis may be an additional tumor-associated marker, of value in assessing and monitoring patients with NHMs.

Ramsey *et al.*,(1969) had performed the studies on endobronchial lipoma. In this haematological study was also performed which revealed HB 17.5 gm per 100 cc, hemocrit 53 percent and WBC 12,600 with a normal differential. Urinalysis was normal. Sputum cytologies were negative for malignant cells.

2.2.1. **Serum C reactive protein and albumin:**

Ahmad *et al.*,(2018) had performed the studies on Assessment of tumor-induced pain and C-reactive protein levels in dogs with canine

transmissible venereal tumors. The aim of this study was to determine the impact of tumor volume on generalized behavior, pain perception, and serum C-reactive protein (CRP) in dogs with canine transmissible venereal tumors (CTVTs). Hematological profiles including complete blood count and CRP were analyzed using an automatic hematologyanalyzer and immunoturbidimetric assays, respectively. Chi-square and regression analysis statistics were used for data analysis. Results of the study revealed a statistically significant (R2 = 0.798) impact of tumor volume on pain scores in corresponding individuals. Hematological parameters and serum CRP values were observed in normal ranges and did not reveal any significant association with tumor volume. It may be concluded that increasing tumor size may result in localized pain and mild behavioral alterations in affected dogs. However, hematology profiles and serum CRP levels are independent of the localized tumor proliferation.

Nakagawa *et al*.,(2014) had performed the study to determine "The Modified Glasgow Prognostic Score as a Predictor of Survival After Hepatectomy for Colorectal Liver Metastases".

Nivy *et al*.,(2014) had performed a cohort study on Serum acute phase protein concentrations in dogs with spirocercosis and their association with esophageal neoplasia. Serum acute phase proteins (APPs) are utilized in diagnosis and prognosis of various canine diseases as markers of inflammation. This study characterized serum APPs concentrations in dogs with benign and malignant esophagealspirocercosis and evaluated their accuracy in differentiating benign from malignant lesions. Seventy-eight client-owned dogs with esophagealspirocercosis were included. Serum C-reactive protein (CRP), haptoglobin, serum-amyloid A (SAA) and albumin concentrations were measured upon diagnosis and follow-up visits, and compared with healthy dogs, and between malignant and benign cases. Haptoglobin,

CRP and SAA concentrations were higher, and albumin concentration was lower ($P < 0.001$ for all) in infected dogs com-pared to healthy controls. Dogs with suspected neoplasia had significantly higher CRP($P = 0.011$), haptoglobin ($P = 0.008$) and SAA ($P = 0.05$), and lower albumin ($P = 0.012$) concentrations compared to dogs with benign esophageal nodules. APPs moderately discriminated between suspected malignant and benign esophageal disease. None of the dogs with suspected neoplasia had concurrent normal concentrations of all APPs. The present results indicate that canine spirocercosis is characterized by an acute phase reaction, both at presentation and during treatment. When concentrations of all four APPs are within reference range, esophageal malignancy is highly unlikely. Although concentrations of all positive APPs were significantly higher in suspected neoplastic cases compared to benign ones, moderate discriminatory power limits their clinical use. Neither APP was useful to monitor response to treatment.

Wysocki *et al*.,(2013) had performed the studies with the aim to assess the alterations of serum C-reactive protein (CRP) and albumin levels in colorectal cancer patients who underwent preoperative radio(chemo)therapy and those who did not.

Watanabe *et al*.,(2014) deduced that the nutritional status of a patient with malignant disease was known to be associated with survival, and can be assessed by serum protein levels. There was increasing evidence that a systemic inflammatory response is of prognostic value in patients with various types of cancer. An elevated serum C-reactive protein (CRP) concentration was associated with a poor prognosis in colorectal, breast and ovarian cancer. Hypoalbuminemia which was often associated with elevated CRP levels, has been reported to be a good predictor of poor prognosis in many types of cancer. Systemic inflammation occurs by various mechanisms involving numerous pro-inflammatory cytokines and other protein mediators. Similar findings

were made by Wysocki et al, (2013). Onesti et al, (2014) in a study on inflammatory changes in cancer found that C- reactive protein and albumin levels have been shown to predict outcomes in patients with biliary, colorectal, prostate, and other tumors

Pastore *et al*.,(2013) concluded that cancer patients have an acute phase response stereotype, observed by a C-Reactive Protein (CRP) increase and a decrease in albumin. This relationship was similar between different cancer types. So, these parameters (CRP and albumin), appraised routinely in cancer patients, could be used to build a nutritional indicator. Scores based on hypoalbuminemia and elevated CRP have the advantage of being based on routinely available, well- standardized measurements that are simple to use. The albumin concentration in the blood is associated with nutritional status, and its synthesis is decreased in individuals with systemic inflammation as the liver prioritizes acute phase protein synthesis. Chronic systemic inflammation has an important role in inducing progressive weight loss and muscle loss. Systemic inflammation was marked by an imbalance between pro-inflammatory and anti-inflammatory cytokines, leading to high CRP blood levels.

Toiyama *et al.*,(2011) had performed the studies on Evaluation of an inflammation-based prognostic score for the identification of patients requiring postoperative adjuvant chemotherapy for stage II colorectal cancer.

Proctor *et al*.,(2010) had performed the studies to determine the relationship between the presence and site of cancer, an inflammation-based prognostic score and biochemical parameters. It was noticed thatpatients with cancer had higher C-reactive protein and lower albumin levels (and thus a higher mGPS), higher adjusted calcium, Alkphos and GGT levels, but lower aspartate transaminase (AST) and alanine transaminase (ALT) levels (all $P<0.001$). The

strongest associations (Spearman's correlation ⩾0.3) in both the non-cancer and cancer groups were found between albumin, C-reactive protein and Alkphos, AST and ALT, AST and GGT and ALT and GGT (all P<0.001). On multivariate analysis, the associations with the presence of cancer remained with age, deprivation, C-reactive protein, albumin, adjusted calcium, Alkphos and GGT (all P<0.01). Patients following a diagnosis of cancer had lower albumin levels and thus higher mGPS (all P<0.001).

Allin *et al*.,(2009) had studied the hypothesis that baseline plasma levels of C-reactive protein (CRP) are associated with risk of incident cancer in the general population and early death in patients with cancer. After this study they concluded that elevated levels of CRP in cancer-free individuals are associated with increased risk of cancer of any type, of lung cancer, and possibly of colorectal cancer. Moreover, elevated levels of baseline CRP associate with early death after a diagnosis of any cancer, particularly in patients without metastases.

Marsik *et al*.,(2008) undertook a study on C-reactive protein leading to mortality in a hospital set up and found that patients with increased CRP had a higher risk of dying from cancer. An increased CRP as an inflammatory marker also seems to be predictive for cancer risk. Additionally, in patients with cancers such as hepatocellular carcinoma, preoperative serum CRP concentrations were an independent and significant indicator of poor prognosis and early recurrence. The role of CRP as a predictor of survival had been shown in multiple myeloma, Marsik et al, (2008) undertook a study on C-reactive protein leading to mortality in a hospital set up and found that patients with increased CRP had a higher risk of dying from cancer. An increased CRP as an inflammatory marker also seems to be predictive for cancer risk. Additionally, in patients with cancers such as hepatocellular carcinoma,

preoperative serum CRP concentrations were an independent and significant indicator of poor prognosis and early recurrence. The role of CRP as a predictor of survival had been shown in multiple myeloma.

Leitch *et al.*,(2007) had studied the Comparison of the prognostic value of selected markers of the systemic inflammatory response in patients with colorectal cancer. The aim of this study was to compare the prognostic value of an inflammation-based prognostic score (modified Glasgow Prognostic Score (Mgps) 0=C-reactive protein <10 mg l−1, 1=C-reactive protein >10 mg l−1, and 2=C-reactive protein >10 mg l−1 and albumin<35 g l−1) with that of components of the white cell count (neutrophils, lymphocytes, monocytes and platelets using standard thresholds) in patients with colorectal cancer. Two patient groups were studied: 149 patients who underwent potentially curative resection for colorectal cancer and 84 patients who had synchronous unresectable liver metastases. In those patients who underwent potentially curative resection the minimum follow-up was 36 months and 20 patients died of their cancer. On multivariate survival analysis only TNM stage (HR 3.75, 95% CI 1.54–9.17, P=0.004), monocyte count (HR 3.79, 95% CI 1.29–11.12, P=0.015) and mGPS (HR 2.21, 95% CI 1.11–4.41, P=0.024) were independently associated with cancer-specific survival. In patients with synchronous unresectable liver metastases the minimum follow-up was 6 months and 71 patients died of their cancer. On multivariate survival analysis only single liver metastasis >5 cm (HR 1.78, 95% CI 0.99–3.21, P=0.054), extra-hepatic disease (HR 2.09, 95% CI 1.05–4.17, P=0.036), chemotherapy treatment (HR 2.40, 95% CI 1.82–3.17, P<0.001) and mGPS (HR 1.44, 95% CI 1.01–2.04, P=0.043) were independently associated with cancer-specific survival. In summary, markers of the systemic inflammatory response are associated with poor outcome in patients with either primary operable or synchronous unresectable colorectal cancer. An acute-phase protein-based prognostic score, the

mGPS, appears to be a superior predictor of survival compared with the cellular components of the systemic inflammatory response.

Heikkila *et al*.,(2007) had performed a study with the objective to review and summarise the published evidence for an association between circulating concentrations of C reactive protein (CRP) and cancer through a systematic review. 90 discrete studies were identified. 81 (90%) were prevalent case–control or cross-sectional studies, and only 9 studies had a prospective design. In most prevalent studies, CRP concentrations were found to be higher in patients with cancer than in healthy controls or controls with benign conditions. Of the nine large prospective studies identified in this review, four reported no relationship between circulating CRP levels and breast, prostate or colorectal cancers, and five studies found that CRP was associated with colorectal or lung cancers. Most of the studies evaluating CRP as a diagnostic marker of cancer did not present relevant statistical analyses. Furthermore, any association reported in the prevalent studies might reflect reverse causation, survival bias or confounding. The prospective studies provided no strong evidence for a causal role of CRP in cancer. Instead of further prevalent studies, more large prospective studies and CRP gene–cancer association studies would be valuable in investigating the role of CRP in cancer.

Hansen(2004) had performed the studies with the objective, "Canine serum CRP measurements are applicable for routine purposes in canine medicine".

2.3. Ionic calcium and 1,25-dihydroxyvitamin D:

Hirschfeld *et al*.,(2017) had studied two cases of humoral hypercalcemia of malignancy complicating infantile fibrosarcoma. They had report two infants with infantile fibrosarcoma (IFS) complicated by

severe hypercalcemia. Assessment demonstrated suppressed parathyroid hormone and 1,25-dihydroxyvitamin D levels with elevated circulating levels of parathyroid hormone related protein, indicating the diagnosis of humoral hypercalcemia of malignancy . Higher concentration of ionic CA was found in both the cases. Hypercalcemia manifested clinically with neurologic symptoms and soft tissue calcium deposition and required aggressive management with intravenous fluids, diuretics, and supplemental electrolytes.

Hamidi *et al*.,(2016) had conducted a study on a case of parathyroid carcinoma associated with multiple brown tumors mimicking fibrous histiocytoma. On examination she was noticed to be morbidly obese and bedridden with limited range of movement of the extremities. No neck or bony masses were palpable. Lab testing showed elevated calcium (12.8 mg/dL), parathyroid hormone (PTH) (1466 pg/ml), alkaline phosphatase (459 IU/L) and low vitamin D at 7ng/ ml.

Messinger *et al*.,(2009) had studied the Ionized Hypercalcemia in Dogs: A Retrospective Study of 109 Cases. During the period from 1998 to 2003. They found out that the Neoplasia, specifically lymphosarcoma, followed by renal failure, hyperparathyroidism, and hypoadrenocorticism were the most common causes of ionized hypercalcemia. Dogs with lymphoma and anal sac adenocarcinoma have higher serum ionic Ca concentrations than those with renal failure, hypoadrenocorticism, and other types of neoplasia. The magnitude of serumionized hypercalcemia did not predict specific disease states. From this study it was concluded that Serum-ionized hypercalcemia was most commonly associated with neoplasia, specifically lymphosarcoma. Although dogs with lymphosarcoma and anal sac adenocarcinoma had higher serum ionic Ca concentrations than dogs with other diseases, the magnitude of the serum ionic Ca concentration could not be used to predict the cause of hypercalcemia. Total serum calcium and corrected calcium

concentrations did not accurately reflect the calcium status of the dogs in this study.

2.4. Histopathology

Nakagaki *et al.*,(2022) They found that mammary neoplasms are the most frequently diagnosed tumors in female dogs and are classified into various histological types, including solid carcinomas. They proposed a subclassification of solid carcinomas based on morphological and immunohistochemical characteristics, and correlated the subtypes with prognostic factors. A total of 135 cases of solid mammary carcinoma were selected from 3,400 canine mammary neoplasms. Epidemiological and survival data were obtained, and immunolabelling for chromogranin A, pancytokeratin, cytokeratin 14, Ki67 and p63 was performed. Solid carcinomas were classified into six subgroups: malignant adenomyoepithelioma (68/135), carcinoma with solid pattern (22/135), malignant myoepithelioma (16/135), basaloid carcinoma (14/135), neuroendocrine carcinoma (10/135) and solid papillary carcinoma (5/135). Shorter survival time was associated with lymphatic invasion (P = 0.009) in the initial clinical staging (I–III). When considering all clinical stages (I–V), vascular invasion (P <0.001) and the presence of regional metastasis (P = 0.004) were important prognostic factors. Basaloid carcinoma and solid papillary carcinoma did not reach the median survival time for early-stage cases, and malignant myoepithelioma had the highest median survival in advanced stages. Carcinoma with a solid pattern was associated with a higher number of regional metastases. Distinguishing the various histological and immunophenotypic subtypes that exhibit a solid arrangement, using histological and immunohistochemical criteria, is essential for understanding the behavior of these neoplasms and selecting more appropriate and specific therapies.

Kumar *et al*.,(2020) had researched Deep feature learning for histopathological image classification of canine mammary tumors and human breast cancer. They had introduced this a dataset of CMT histopatho- logical images (CMTHis). Also they have proposed a framework based on VGGNet-16, and evaluated the performance of the fused framework along with different classifiers on the CMT dataset (CMTHis) and human breast cancer dataset (BreakHis). They also explored the effect of data augmentation, stain normalization, and magnification on the performance of the proposed framework. This proposed framework, with support vector machines, resulted in mean accuracies of 97% and 93% for binary classification of human breast cancer and CMT, respectively, which validates the efficacy of the proposed system.

Pinker and Daniel (2019) had studied the tuberous sclerosis complex (TSC) as an autosomal dominant syndrome due to a mutation in the TSC2 or TSC1 gene. They have presented a case report and associated literature review of a toddler with a posterior scalp lesion which was identified as a soft tissue fibroma upon histopathology. Unlike angiofibromas, soft tissue fibromas in the head and neck are not common in patients with TSC. This soft tissue tumor may be considered one of the major criteria in diagnosing TSC. The microscopic description indicated that the lesion was formed by bundles of intersecting collagen with scattered spindle cells and rounded cells contained within. No giant cells or mitotic figures were seen. Histological features included cytoplasmic reactivity for smooth muscle actin, NKIC3 and factor XIIIa. The infiltrating cells did not stain for S100 protein or melanin-A. The cells were also noted to be focally positive for CD34.

Soujanya and Madhuri (2019) had performed a study on a round, firm, solid, whitish-grey coloured nodular growth which was surgically removed from the elbow region of a dog and provided for diagnosis to

Department of Pathology, College of Veterinary Science, Korutla. Histopathological examination was performed, and lesions were noted. Microscopically, the nodular mass is composed of spindle-shaped fibrous connective tissue cells with spindle-shaped nuclei forming compact interlacing and intersecting bundles. Bright pink-colored long and wavy collagen fibers running in all directions were noticed. Nuclear, cellular pleomorphism and nuclear hyperchromatism was seen. The tumor cells were running haphazardly and had a scant amount of cytoplasm. The cell boundaries were poorly defined. The nuclear to cytoplasm ratio was increased. Mitotic figures and numerous blood vessels were noticed. The collagen fibers and fibrocytes are arranged in a concentric manner around the blood vessels. Thus in this case, the tumour was confirmed as cutaneous fibrosarcoma based on histopathology.

Subapriya *et al*.,(2018) had conducted a study on a one year old, female, Labrador dog which was presented with a history of a big mass in the right hindlimb. The mass was felt to be hard on clinical examination. Fine needle aspiration cytology (FNAC) was performed, which revealed pleomorphic fibrocytes with prominent nucleoli. This mass was then surgically excised. Histopathological section showed fibrocytes arranged in varying patterns with numerous mitotic figures. Immunohistochemical study revealed positive expression for vimentin and no expression for cytokeratin. Based on the above findings, the mass was confirmed to be fibrosarcoma.

Munday *et al*.,(2017) had studied and provided a chapter named tumors of alimentary track in the book named tumors of domestic animals. In this chapter, the author has described the histopathological description of various tumors.

Mohapatra *et al*.,(2016) Histopathological examination is always regarded as a gold standard for the diagnosis of cancer. It has greater

application in the differential diagnosis of benign and malignant cases. It is also quite useful for predicting the prognosis by identifying metastasis, lymphovascular invasion and degree of malignancy. In this study, mostly the canine mammary tumors were malignant, of which epithelial tumors, including carcinomas and adenocarcinomas, are the most common histological types. The histological features of various tumors recorded in the present study are following the earlier reports. It is very helpful in classifying the tumors into various histological types to understand the tumor's biological behavior for predicting the prognosis of tumors.

Birhan and Chanie(2015) had put forth a review on Canine Transmissible Venereal Tumor: from Morphologic to Biochemical and Molecular Diagnosis. I this they have included the histopathological features which exhibit Round to polyhedral shaped cells arranged or grouped in strings inter spread with delicate conjunctival stroma when stained with hematoxylin and eosin tumor cells are usually arranged radially around blood and lymphatic vessels and have a high nucleus to cytoplasm ratio with around nucleus and chromatin ranging from delicate to course and prominent nucleoli and cytoplasmic vacuoles the cells contain a large amount of cytoplasm that is highly acidophilic with poorly defined limits there is also frequent infiltration of lymphocytes plasma cells and macrophages which suggest the role of immune-mediated control.

Strakov and Murchison(2014) had analysed historical literature and obtained Canine transmissible veneral tumor, prevalence information was collected from 645 veterinarians and animal health workers in 109 countries in order to estimate CTVT’s former and current global distribution and prevalence. The analysis confirmed that CTVT is endemic in at least 90 countries worldwide across all inhabited continents. CTVT is estimated to be present at a prevalence of one percent or more in dogs in at least 13 countries in South and Central

America as well as in at least 11 countries in Africa and 8 countries in Asia. In the United States and Australia, CTVT was reported to be endemic only in remote indigenous communities. Comparison of current and historical reports of CTVT indicated that its prevalence has declined in Northern Europe, possibly due to changes in dog control laws during the nineteenth and twentieth centuries. Analysis of factors influencing CTVT prevalence showed that presence of free-roaming dogs was associated with increased CTVT prevalence, while dog spaying and neutering were associated with reduced CTVT prevalence. Our analysis indicated no gender bias for CTVT and we found no evidence that animals with CTVT frequently harbour concurrent infectious diseases. Vincristine was widely reported to be the most effective therapy for CTVT.

Knapp *et al*.,(2014) had studied naturally occurring bladder cancer in dogs which very closely mimics human invasive bladder cancer, specifically high-grade invasive transitional cell carcinoma. Results of cellular and molecular studies and -omics analyses in dogs are expected to lead to improved detection of TCC and preneoplastic lesions, earlier intervention, better prediction of patient outcome, and more effective TCC management overall. Studies in dogs are being used to help define heritable risks and environmental risks and to evaluate prevention and treatment approaches that benefit humans as well as dogs. A naturally occurring model for cancer biology and drug development. The histopathology revealed High-grade, invasive transitional cell carcinoma (urothelial carcinoma) of urinary bladder. The microscopic examination revealed invasion of the lamina propria by a disorganized mass of atypical urothelial epithelium. The overlying urothelium was eroded. Hematoxylin and eosin (H&E). Detail of the neoplastic growth was marked anisocytosis and anisokaryosis are observed. Note several mitotic figures. H&E.

Roshni (2013) had performed the studies on incidence and clinicopathology of canine mammary tumours and efficacy of curcumin on DMBA induced mammary tumours in Sprague dawley rats.

Bertagnolli *et al.*,(2012) had studied and made a review on Canine Mammary Mixed Tumours. As per their study the Mammary mixed tumors are the most frequent neoplasia in female dogs. In addition to their histomorphologic similarities, mixed tumors and pleomorphic adenomas have the potential to become malignant and give rise to carcinomas in mixed tumors and carcinomas ex-pleomorphic adenoma, respectively. The factors associated with malignant transformation are still poorly known in the case of canine mixed tumors. However, this form of neoplasia tends to be associated with a better prognosis than other malignant histological types.

Desoutter *et al*.,(2012) had studied Clinical and histologic features of 26 cases of canine peripheral giant cell granuloma (formerly giant cell epulis). Two main histologic categories were evident: (1) ‘‘classic’’ peripheral giant cell granuloma, characterized by variable numbers of multinucleated giant cells (MNGCs) admixed with densely cellular mononuclear spindle-shaped cells in variable amounts of collagenous matrix, and (2) the ‘‘collision’’ peripheral giant cell granuloma, with features of both a peripheral giant cell granuloma and a fibromatous epulis of periodontal ligament origin. It was noticed that in the 16 dogs for which the outcome was known, 2 peripheral giant cell granulomas recurred after excision. No age or sex predilection was evident; however, lesions were more common in maxillary than in mandibular gingiva. In contrast to cats, peripheral giant cell granulomas in dogs behave like fibromatous epulides of periodontal ligament origin and seldom recur after excision. Positive staining with TRAP (tartrate-resistant acid phosphatase) of the MNGCs and a fraction of the mononuclear cell population is consistent with osteoclastic origin.

Pereira *et al*.,*(*2013) found that the adenomas were characterized by the presence of epithelial cells with abundant and eosinophilic cytoplasm, low pleomorphism, and basal cells with small and hyperchromatic nuclei. The cells were organized in islands separated by well-vascularized connective tissue. The presence of basaloid cells with a large nucleus, loose chromatin, evident nucleolus, and occasional mitosis was noted. Cell islands separated by connective tissue were also present. In some samples, focal areas of squamous metaplasia were noted, and also areas with high-grade anaplasia, suggesting malignant transition. In carcinomas, the noticed proliferation pattern was cribriform. The cells presented a large and clear nucleus, loose chromatin, evident nucleolus, cytoplasm with poorly defined borders, and frequent mitosis.

Gupta *et al*.,(2012) had performed the epidemiological studies on canine mammary tumors and their relevance to Breast cancer in humans which is one of the most common cancer in women. Its incidence is reported to be rising globally and more so in developing countries. In this pursuit, huge naturally occurring canine mammary tumors may provide a valid answer to impending questions in a shorter time frame. This article deals with global and Indian scenario related to epidemiology of canine mammary tumours and its relevance as a model for human breast cancer.

Manor *et al*.,(2011) had analysed 58 new cases of Oral lipoma. In this they had performed histopathological examination which revealed classic lipoma comprised 28 cases (48%), followed by 19 cases of fibrolipoma (33%), 4 cases of intramuscular lipoma (7%), 2 cases of minor salivary gland lipoma (3.5%), 2 cases of angiolipoma (3.5%), and 3 cases of spindle cell lipoma (5%) (Fig. 1). In the cases diagnosed as spindle cell lipoma, immunohistochemical analysis showed positivity for vimentin and CD34 protein and negativity for S-100 protein and human

muscle actin in the spindle cells. In one case diagnosed as spindle cell lipoma, the karyotype was normal.

Chandrashekaraiah *et al*.,(2011) in a study of squamous cell carcinomas, found that cords or nests of proliferating neoplastic cells consisting of immature polyhedral cells at the periphery and eosinophilic lamellated keratin pearls at the center featured well-differentiated tumors. The amount of keratin was abundant in all well differentiated types. The proliferating cells revealed moderate cellular pleomorphism, large vesicular nuclei, prominent nucleoli, variable mitotic activity and prominent intercellular bridges. Moderately differentiated squamous cell carcinomas were characterized by proliferating cells forming cords or nests of cells separated by thin fibrous stroma, irregularity in cell orientation, loss of prickle cell appearance, prominent mitotic activity, individual cell keratinization vacuolar degeneration in large cells and occasional nests of neoplastic cells invading the deeper tissue which consisted of abundant fibrous stroma. Of the two poorly differentiated squamous cell carcinomas encountered in the present study one was histologically confirmed as spindle cell type, which comprised highily proliferating large pleomorphic spindle and polygonal cells with abundant pale to eosinophilic vacuolated cytoplasm. Further, it also revealed absence of lobulation or cord formation, occasional whorled arrangement of cells, moderate to high degree of cellular anaplasia, pleomorphism and mitotic activity, minimum fibroplasia and infiltration of inflammatory cells. In another case, the poorly differentiated Squamous cell carcinomas appeared as island of moderately pleomorphic cells Tormed into clusters with no keratinization or cord formation.

Misago *et al*.,(2010) had performed the studies on the revaluation of folliculosebaceous cystic hamartoma: the histopathological and immunohistochemical features. The histogenesis of folliculosebaceous cystic hamartoma (FSCH), including the origin of the frequently

associated adipocytes and other mesenchymal components, remains unclear. There are controversial problems regarding FSCH, such as the relationship between FSCH and trichofolliculoma (TF), and the exact concept of sebaceous TF. Fourteen FSCHs and 1 sebaceous TF were revaluated for the histopathology and studied for immunohistochemical profile of various cytokeratins, hair follicular stem cell markers, and others. The nestin expression was partly upregulated in the sebaceous duct structures and the proliferating spindle cells in the surrounding connective tissue in some lesions. S-100 protein staining clarified the presence of lipogenesis in these nestin-expressed lesions, and the nestin-positive spindle cells were also seen around the immature adipocytes. Some FSCHs showed the focal follicular differentiation, where no signs of catagen or telogen stage were seen. One peculiar case showed both FSCH and TF features equally. The possibility that the adipocytes and other mesenchymal components in FSCHs originated from the nestin-positive multipotent stem cells was suggested. It is not convincing that FSCH and TF represent a chronological change in the spectrum of the same condition. Each FSCH and TF is therefore considered to be a distinctive entity. They may develop under a similar pathogenesis differing from each other in the direction of fundamental differentiation. In contrast to the TF lesions, the unusual upregulation of nestin expression is occasionally seen in FSCH lesions, including their stromas, which may thus result in the production of various kinds of mesenchymal components in FSCHs.

Reddy *et al*.,(2009) had studied Histopathological classification and incidence of canine mammary tumors. This study aimed to classify different canine mammary tumors based on WHO recommendations. A total of 139 suspected spontaneous tumors were collected, out of which 128 were diagnosed as tumors.

Levy *et al*.,(2008) had studied Eyelid Pilomatrixoma: A Description of 16 cases. They have stated that pilomatrixoma is an uncommon benign neoplasm that originates from the matrix of the hair root. It occurs more frequently in children and adolescents' head and neck region, often involving the eyelid or eyebrow. Pilomatrixoma is often misdiagnosed clinically and the correct diagnosis can be established only after excision and histological examination. Pathologic diagnosis of pilomatrixoma is based on the finding of large masses of shadow cells, combined with basophilic cells, inflammation, foreign body giant cells, calcification, and ossification. They have reported 16 cases of eyelid pilomatrixoma that were treated in our department, and review the relevant literature.

Munson and Moresco (2007) had performed the studies on Comparative Pathology of Mammary Gland Cancers in Domestic and Wild Animals. During this study, domestic dogs and cats have a high prevalence of mammary tumors, and the majority of tumors in cats are aggressive cancers. The more common morphologic types of mammary cancer in canids and felids include tubulopapillary, solid, cribriform, comedo and anaplastic carcinomas. Dogs also develop complex carcinomas, which likely evolve from the complex adenomas or mixed tumors that are so common in this species and are promoted by exogenous progesterone treatment. Among zoo felids, jaguars are at higher risk for mammary cancer and also have a high prevalence of ovarian papillarycystadenocarcinomas, a profile similar to women with BRCA1 mutations. Overall, spontaneous mammary cancers in cats and dogs make excellent models for human breast cancer, and a “One Medicine” approach would greatly enhance the knowledge of mammary carcinogenesis across all species.

Marcos *et al*.,(2006) had performed the studies on Cutaneous transmissible venereal tumor without genital involvement in a

prepubertal female dog. In this study an 11-month-old prepubertal crossbreed female dog was presented with multiple nodular lesions disseminated over the cervical, back, flank, and abdominal regions. The lesions were ulcerated and cauliflowerlike, or nodular and subcutaneous, measuring up to 13 cm in diameter. Cytologic preparations of one of the lesions revealed a uniform population of round to oval cells, with lightly basophilic cytoplasm that contained multiple distinct vacuoles. Frequent mitotic figures and occasional lymphocytes were also observed. The cytologic diagnosis was cutaneous transmissible venereal tumor (TVT) in a progressing growth phase. Histologic and immunohistochemical findings confirmed this. Vaginal TVT was diagnosed later in the dog's mother. TVT is a contagious neoplasm of sexually mature dogs that usually is transmitted by coitus and affects the genital mucosa. To our knowledge, this is the first report of naturally occurring multicentric TVT in a prepubertal female dog and also is unique in its exclusively cutaneous (no mucosal) involvement. We speculate that transmission of neoplastic cells occurred during cohabitation and social/mothering behavior between the dogs.

Kyllar and Witter (2005) had studied oral disorders of the dog. Although many epidemiological studies on dental diseases in beagles bred under controlled conditions have been realized, information on the frequency of these alterations in populations of pet dogs, especially in Central Europe, is far from complete. Their study aimed to assess the prevalence of the most common oral diseases in dogs in a Czech urban region. A total number of 408 dogs, presented at a private Czech urban veterinary hospital for different reasons, were analyzed. Site specificity and severity of dental diseases were assessed using modified indexing systems. Dental alterations could be found in 348 out of 408 dogs (85.3%). The most frequent diseases found were (i) periodontitis (60.0% of 408 dogs), (ii) calculus (61.3%), (iii) missing teeth (33.8%), and (iv) abnormal attrition (5.9%). Furthermore, single cases of caries, tumors

and enamel hypoplasia could be observed. Periodontitis occurred preferentially in the upper jaw of small dogs and increased with age. The labial/buccal side of teeth was affected more severely than the lingual/palatinal side. Differences between left and right side could not be observed. Malocclusion and insufficient oral hygiene care seem to predispose to periodontitis. The prevalence of calculus formation did not differ between left and right side. However, the upper jaw showed a higher degree of affection than the mandible. On the labial/buccal side of the teeth, a thicker calculus layer could be observed than lingually/palatinally. Interestingly, the degree of calculus formation and of periodontitis did not correlate in all cases, supporting the hypothesis that supragingival calculus per se is not an irritant. The pattern of tooth loss was the same between left and right side and between upper and lower jaw.

Affolter and Moore (2002) had performed the studies on Localized and Disseminated Histiocytic Sarcoma of Dendritic Cell Origin in Dogs.The clinicopathologic, morphologic and immunophenotypic characteristics of canine localized and disseminated histiocytic sarcoma were examined in 39 dogs. Rottweilers, Bernese Mountain Dogs, and retrievers were most commonly affected (79%). Localized histiocytic sarcomas (19 dogs) arose from a single site, and metastatic lesions were observed in draining lymph nodes. Predilection sites were subcutis and underlying tissues on extremities, but tumors occurred in other locations, including spleen, lung, brain, nasal cavity, and bone marrow. Both localized and disseminated canine histiocytic sarcomas were composed of pleomorphic tumor cell populations. CD1+, CD4-, CD11c+, CD11d-, MHC II+, ICAM-1+, Thy-1± tumor cells were identified in all snap-frozen samples (31 dogs). This phenotype is characteristic for myeloid dendritic antigen-presenting cell lineage. Hence, canine localized and disseminated histiocytic sarcomas are

likely myeloid dendritic cell sarcomas. Dendritic antigen-presenting cells are a heterogeneous cell population regarding their ontogeny, phenotype, function, and localization. The exact sublineage of the proliferating dendritic antigen-presenting cells involved in canine histiocytic sarcomas remains to be determined. Phenotypic analysis of formalin-fixed tissues from eight dogs was limited by available markers. Morphologic features and the phenotype CD18+, CD3-, and CD79a- were the most useful criteria to indicate likely histiocytic origin.

Murad and Désirée (2001) had studied cutaneous squamous cell carcinoma. In 1994 in the United States, the lifetime risk of squamous-cell carcinoma was 9 to 14 percent among men and 4 to 9 percent among women. Although it is known that this neoplasm contributes substantially to morbidity and mortality among elderly persons, its incidence and the associated mortality rate cannot be determined precisely. The National Cancer Institute does not collect data on the incidence of or mortality from squamous-cell carcinoma, except for tumors of the genitalia. However, a sharp rise in incidence during the past two decades has been documented. According to longitudinal studies in both the United States and Canada, the age-adjusted incidence of squamous-cell carcinoma has grown by 50 to 200 percent over the past 10 to 30 years.8-10 In addition, the incidence doubles with each 8-to-10-degree decrement in geographic latitude and is highest at the equator.2 The age-adjusted incidence of this neoplasm among whites is 100 to 150 per 100,000 persons per year, and the age-specific incidence among persons over the age of 75 years is approximately 10 times that rate.

Almeida *et al*.,(2001) had studied expression of cyclo-oxygenase-2 in naturally occurring squamous cell carcinomas in dogs. Squamous cell carcinoma is one of the most common cancers in

humans and is also a frequently diagnosed neoplasm in dogs. Induction of cyclo-oxygenase-2 (COX-2), a key rate-limiting enzyme in prostaglandin biosynthesis, has been implicated in the oncogenesis of various cancers in humans, including squamous cell carcinomas. However, expression of COX-2 has not been reported in spontaneous squamous cell carcinomas of non-human species. Canine squamous cell carcinomas share several similarities with the human disease. Therefore, the objective of this study was to determine whether COX isoenzymes were expressed in naturally occurring cases of squamous cell carcinomas in dogs. Canine normal skin (n=4) and squamous cell carcinomas (n=40) were studied by immunohistochemistry and immunoblotting analysis using polyclonal antibodies selective for COX-1 or COX-2. COX-2 was strongly expressed by neoplastic keratinocytes in all cases of squamous cell carcinomas, whereas no COX-2 was detected in normal skin and in the nonneoplastic skin and oral mucosa included in the tumor tissue samples ($p < 0.01$). Immunoblotting analysis confirmed the restricted expression of COX-2 (72,000–74,000 molecular weight doublet) in squamous cell carcinomas only. In contrast, faint COX-1 staining was found in normal skin and in squamous cell carcinomas. This study demonstrates for the first time that COX-2 is induced in canine squamous cell carcinomas, and provides a new model to investigate the role and regulation of COX-2 gene expression in naturally occurring squamous cell carcinomas.

Misdorp (1999) had studied and published a book named Histological Classification of Mammary Tumors of the Dog and Cat: no. 7 (WHO International Classification of Tumors of Domestic Animals S.). This includes the histological description and classification of the mammary gland tumors of canines and felines.

Benjamin *et al.*,(1999) had performed the studies on Classification

and Behavior of Canine Mammary Epithelial Neoplasms Based on Life-span Observations in Beagles. As part of a study conducted the effects of low-level radiation, 1,343 Beagles, including 671 males and 672 females, were evaluated over their entire lifetime for the occurrence of mammary neoplasia; there were 139 control males and 138 control females and 532 irradiated males and 534 irradiated females. All nodules found in surgical specimens or at necropsy were evaluated histologically. The overall incidence, metastasis and recurrence rates, and contribution to mortality of mammary neoplasms were determined. Based on this unique opportunity to correlate morphologic characteristics with ultimate biological behavior of all mammary tumors in a defined canine population, we propose a histogenetically based reclassification of epithelial mammary tumors. Of the 672 female dogs, 70.8% (476) had at least one mammary neoplasm; 60.7% (408) had more than one. Two male dogs had mammary neoplasms. Of 1,639 mammary carcinomas in the 672 females, 18.7% (307) were classified as ductular carcinomas (arising from the small interlobular or intralobular ductules), whereas 80.7% (1,322) were classified as adenocarcinomas of other histogenetic origin. Of 73 fatal carcinomas, ductular carcinomas accounted for 48 fatalities (65.8%), whereas other adenocarcinomas accounted for only 20 fatalities (27.4%). Radiation had no effect on this ratio. Ductular carcinomas also had a higher rate of metastasis than did adenocarcinomas. Existing classifications of mammary carcinomas do not recognize the characteristic morphologic features, the degree of malignancy, and the prognostic importance of these ductular carcinomas. Metastasis rates did not differ between simple and complex carcinomas or between those lesions and adenocarcinomas in mixed tumors. True carcinosarcomas metastasized more frequently (100%, or 5/5) than did adenocarcinomas in mixed tumors (34.4%, or 22/64), emphasizing the importance of not lumping these tumors under the classification of malignant mixed tumors.

Lemarie *et al*.,(1995) Found that Mast cell tumor was a common neoplasm of dogs and reported to account for approximately 21% of all canine skin tumors.

Destexhe *et al*.,(1993) had performed the study on Immunohistochemical identification of Myoepithelial, Epithelial, and Connective Tissue Cells in Canine Mammary Tumors. During this study Fifty-eight formalin-fixed paraffin-embedded canine mammary tumors, 19 malignant and 39 benign, were used in this study. The main cell types, epithelial, myoepithelial, and connective, were identified, and myoepithelial cells represented the major component of most tumors, both benign and malignant. Myoepithelial cells had five patterns: resting and proliferative suprabasal cells, spindle and star-shaped interstitial cells, and cartilage. Reactivity to keratin 19, vimentin, α-actin, and S-100 protein suggested a progressive transformation from resting cells to cartilage. Epithelial cell reactivities were limited to keratins; only keratinized cells were positive for polyclonal keratins. Myofibroblasts were positive for both vimentin and α-actin, and connective tissue cells were positive for vimentin. Myoepithelial cells appeared to be the major component of carcinomas, justifying re-evaluation and simplification of histomorphologic classifications, with a "pleomorphic carcinoma" group including all carcinomas except squamous, mucinous, and comedo carcinomas. Immunohistochemical evaluation, in addition to routine hematoxylin and eosin histopathologic evaluation is recommended for precise classification of canine mammary tumors.

Gardner and Baker (1993) had studied and compared the microscopic features and clinical behaviour of the acanthomatous epulis in dogs with those of ameloblastoma in human beings. It was concluded that the acanthomatous epulis, (1) is an ameloblastoma, (2) arises from the gingival epithelium in some cases, but (3) may also arise

intraosseously and then break out of bone. We recommend the term canine acanthomatous ameloblastoma as being appropriate for this lesion.

HellmÉn (1992) had performed the studies on characterization of four in vitro established canine mammary carcinoma and one atypical benign mixed tumor cell lines. During this study five spontaneous canine mammary tumors were cultured in vitro and cell lines were established. The tumors included three frozen carcinomas, fine-needle aspirate from one fresh carcinoma, and one fresh atypical benign mixed tumor. The cell lines have so far been cultured for about 2 yr and passaged between 45 and 200 times. The cell lines expressed different types of intermediate filaments, including a heterogenous pattern. In some cases no intermediate filaments were expressed. Ultrastructure studies showed epithelial cells and cells intermediate between epithelial and myoepithelial types. Retrovirus associated A-particles were found in two carcinomas. The mixed mammary tumor cell line formed duct like structures in collagen substrate. The cell lines grew when inoculated s.c. into male nude mice. Two carcinomas caused lymph node metastases in two mice and another carcinoma single lung metastases in one tested mouse. DNA hypodiploidy, studied by flow cytometry, in one of the primary carcinoma was retained in vitro, and this cell line showed polyploidy during later passages. The other cell lines had a more unstable DNA profile, although a tendency for polyploidy was found. These findings were also illustrated in chromosome studies.

Hargis *et al*.,(1992) noted that chronic dermatosis and keratosis serve as pre-cancerous lesions due to prolonged exposure to sunlight. These subsequently get converted in to invasive carcinoma. The most common sites to be affected by solar radiation would be the unpigmented and sparsely haired areas of the abdominal, inguinal, prepucial and scrotal skin in animals.

Bostock (1986) found that mast cell were most common cutaneous neoplasms of the reported to account for approximately 17-21% of all canine skin tumors.

Deborah *et al*., (1986) found that Boxers, Boston terriers, English bull dogs, English bull terriers and possibly Labrador Retrievers showed a higher incidence of this neoplasm cutaneous MCTs generally present with of two types of gross. The most common was a raised, firm, and well-circumscribed mass, usually less than 3.0 cm in diameter. The erythematous or ulcerated surface. A less common form was a soft, poorly circumscribed, raised lesion that was usually haired and lacked ulceration or erythematous changes.

Duncan and Prasse (1979) had performed the studies on Cytology of Canine Cutaneous Round Cell Tumors: Mast Cell Tumor, Histiocytoma, Lymphosarcoma and Transmissible Venereal Tumor. During this study Sixty-four canine cutaneous round cell tumors were divided into 25 mast cell tumors, 15 histiocytomas, nine cutaneous lymphosarcomas and 15 transmissible venereal tumors. The final diagnosis was made from cytologic, clinical and histologic findings. Cytologic features were significantly distinctive in mast cell tumor, transmissible venereal tumor, and most cases of histiocytoma and lymphosarcoma to allow a diagnostic opinion. This opinion was supported by subsequent histologic examination. In some instances cytology was considered essential in rendering a diagnostic opinion even though histology was available.

Moulton (1978) is the author of a book named tumour in domestic animals, which comprises the description of the tumor's histological and gross features.

Cardiff *et al*.,(1977) had performed the studies on biology of breast preneoplasia. A discrete morphologically identifiable lesion with a high malignant potential is considered preneoplastic. Lobuloalveolar lesions have been identified in the human mammary gland which fit most of the criteria for preneoplasia. The lesions, hyperplastic atypical lobules, are multicentric, have a high statistical association with breast cancer and demonstrate a morphological progression through dysplasia to frank carcinoma. Other breast lesions have a high statistical association but no morphological progression can be seen and their neoplastic potential remains unknown. Although a strong morphological and statistical analogy exists between the human and animal models, the causes and biological potential of the human lesions await experimental proof.

Fenoglio *et al*.,(1976) had done Cardiac Rhabdomyoma: A Clinicopathological and Electron Microscopic Study. In this histopathological examination was also performed which revealed The tumors were circumscribed but not encapsulated and were easily distinguished from the surrounding myofibers. They ranged in diameter from several microns to several centimeters. The cells constituting these tumors tended to be larger (up to 80 p in diameter) than the surrounding myocardial fibers and appeared vacuolated. Occasional cells were smaller and had an eosinophilic granular cytoplasm. Glycogen was present in all of the rhabdomyoma cells but was abundant only in tissues fixed in alcohol, Classic “spider cells” were characterized by a centrally located mass of finely granular cytoplasm with thin, elongated projections and slender myofibiils extending to the periphery ; although rare, they were found in every case. More frequently the nucleus was displaced to the periphery of the cell and cross striations were identified around the periphery of the cell. Stromal collagen was usually scant, although in several tumors there was abundant collagen. In two cases there were microscopic foci of calcification within rhabdomyoma cells.

Foci of extramedullary hematopoiesis were identified in the majority of tumors from the newborn group.

Weijer *et al*.,(1972) had studied the morphology and biology of 179 malignant mammary tumors from 170 cats were described. The site of tumors was nearly equally distributed among the 4 pairs of glands. The recorded sex distribution was 114 intact females, 40 ovariectomized females (average age at spaying, 5.8 years), and 2 castrated males. The average age at first detection was 10.8 years, and average survival time after detection was 12.3 months; this poor prognosis was probably related to an average delay of 7 months before the first operation and the correlation of the 1-year survival with the tumor volume at first detection. Of the 129 necropsies, 120 showed metastases most commonly in drainage lymph nodes (82.8%), lungs (83.60%), pleurae (42.2%), and livers (23.6%). Subdivision by histologic pattern showed 53 tubular adenocarcinomas, 52 papillary adenocarcinomas, 35 solid carcinomas, 2 mucoid carcinomas, 34 compound carcinomas, and 3 sarcomas. Histologic grading revealed that 50% of the low-grade malignancy group survived more than 1 year in contrast to 10% of the high grade group.- J Natl Cancer Inst 49: 1697-1704,1972.

Taylor *et al*.,(1969) had studied morphologic and biologic characteristics of the canine cutaneous histiocytoma. During this study five hundred and twenty canine cutaneous histiocytomas (CCH) that developed in the dog population of Alameda and Contra Costa Counties, California, during 3 years were collected. Morphologic studies confirmed the non invasive character of the tumors and the proliferative histiocytic nature of the cells. The average annual incidence rate during the 3-year period was 117 per 100,000 dogs. Although the CCH occurred over most of the body, a high proportion were found on the head. Boxers and dachshunds had a significantly higher risk than all other breeds, and purebred dogs in general had a higher risk than crossbred dogs.

Widespread metastases or death as a result of CCH were not observed. Efforts to transmit this tumor to dogs and hamsters were unsuccessful as attempted to detect viruses, bacteria, or fungi as etiologic agents. The findings of this study help to establish the CCH as a distinct entity and make it possible to differentiate it from various mesodermal neoplasms based on morphological, biological, and epizootiological characteristics.

Chapter 3
MATERIAL METHOD

As described earlier, the following program of research work was followed to complete this experimental work.

3.1. Inclusion criteria:

Dogs of any age, sex, or breed presented with suspected growth were selected for the study.

3.2. The number of cases studied in the research program:

Fifty neoplastic cases of dogs presented with growth and were confirmed for neoplasm at Mumbai Veterinary College, Mumbai, Maharashtra, India and Private veterinary clinics in Mumbai were studied.

3.3. Collection of clinical samples:

Samples were collected by biopsy in 10% neutral buffered formalin from The Bai Sakarbai Dinshaw Petit Hospital For Animals and other private clinics in and around Mumbai city for histological classification and grading of tumours. Blood and serum samples were also collected for further analysis.

3.4. Collection of blood samples:

3.4.1. Materials:

The blood assembly was commercially available pre sterilised needles and syringes, K3 EDTA, and clot activator vials.

3.4.2. Method:

Blood collection was undertaken in dogs presented for growth which was surgically removed. The blood was taken from the cephalic vein using proper sterility and collected in EDTA vials for Complete Blood Count and Clot activator vials for biochemical estimation, Vit D, and ionic calcium.

3.5. Parameters to be studied:

The following parameters were screened during the period of study.

3.5.1. General, Clinical History

A detailed history was collected from the owner, which included details about the animal, a thorough clinical history, and the owner's contact information.

3.5.2. Physical examination

Description, type, consistency, and distribution of neoplasm were recorded and analysed.

3.5.3. Haematology

Whole blood samples were collected from the affected animals in EDTA tubes. Haematological parameters were performed by the automatic cell counter. DLC was performed as per the standard protocol.

The following parameters were studied in haematological profile,

1. Haemoglobin (Hb, gm%)
2. Haematocrit (PCV, %)
3. Total Erythrocyte Count (TEC, $10^6/mm^3$)
4. Total Leukocyte Count (TLC, $10^3/mm^3$)
5. Differential Leukocyte Count (%)

3.5.4. Serum biochemistry

Whole blood samples were collected in clot activator vials for biochemical estimation of the serum. The following methods were employed for estimating parameters:

1. Serum Total Protein by Biuret method
2. Serum Albumin by BCG dye method

3. Serum Globulin
4. Serum Calcium by Arsenazo method
5. C Reactive protein by turbidimetry method

3.5.5. Estimation of Vitamin D total by Radio Immune Assay.

Whole Blood, which was collected in clot activator vials, was used to estimate 25OH vitamin D concentration in serum.

Assay procedure followed:

1. Preparation of reagents: Let all the reagents come to room temperature and mix them thoroughly by gentle inversion before use. Alterations in physical appearance of kit reagents may indicate instability or deterioration.
2. Reconstitution of tracer: Reconstitute the tracer with whole content of the Tracer Buffer vial. After the reconstitution, tracer is stable for maximum one week, if at 2-8°C or at -20°C until expiry date (with only one thawing).
3. Reconstitution of calibrators and control samples: Reconstitute vials with the volume of distilled water indicated on the label. After reconstitution, calibrators and controls are stable for one week at 2 to 8°C. For longer storage periods, aliquots should be made and kept at –20°C until the expiry date of the kit. Avoid subsequent freeze-thaw cycles.
4. Reconstitution of Speciment Diluent: Reconstitute the Speciment diluent with 1 mL of distilled water.
5. Preparation of the working Wash solution Prepare an adequate volume of Working Wash solution by adding 69 volumes of distilled water to 1 volume of Wash solution (70x). Use a magnetic stirrer to homogenize. Discard unused working Wash solution at the end of the day.
6. Results are obtained from the standard curve by interpolation. The curve serves for the determination of 25OH Vit D

concentrations in samples measured at the same time as the calibrator.

7. Standard curve The results in the package insert were calculated using 4PL function with B/B0 (%) on vertical axis and the total 25OH Vit D concentration of the calibrators on the horizontal axis (ng/mL). Other data reduction methods may give slightly different results.
8. For each assay, the percentage of total tracer bound in the absence of unlabelled 25 OH vitamin D (B0/T) must be checked.
9. Samples: For each sample, locate the B/B0 (%) on the vertical axis and read off the corresponding 25OH Vit D total concentration on the horizontal axis. To convert ng/mL into pmol/mL, multiply results by 2.5.

3.5.6. Estimation of ionic calcium by ion selective electrode.

Whole Blood collected in clot activator vials was used to estimate ionic Calcium.

3.5.7. Histopathological examination of the collected tissue.

Formalin-fixed tissue was processed to obtain paraffin-embedded sections and routine H&E staining would be performed as per the standard protocol**.**

CHAPTER 4

RESULTS AND DISCUSSION

The present study entitled “Clinicopathological studies of neoplasms in canines” was undertaken in the Department of Veterinary Pathology, Mumbai Veterinary College, Mumbai, Maharashtra, India. The objectives were to study the occurrence, haematological and biochemical alteration in the neoplasic cases of canines in Mumbai and correlate the changes in the calcium levels.

The tumor samples were collected from 50 dogs of different breeds, age and sex. In addition the blood samples were also collected for the haematological and biochemical analysis of that particular animal whose tissue sample is collected. These tissue samples were then subjected for histopathological studies. The 25-hydroxy cholecalciferol , total calcium and ionic calcium was also analysed and recorded. All this data was used to correlate the serum calcium levels and the neoplastic condition of the animal.

Occurrence of neoplasms in canines:

In the present study, 50 tumor samples were collected from dogs aged between 3 years to more than 12 years. The details are depicted in **Table 1**.

The occurrence of Mammary gland tumor was highest with 24%(12) followed by adenoma of skin associated glands 14%(7), Fibrosarcoma 10% (5), Lipoma 10% (5), Transmissible veneral tumor 8%(4), Pilomatrixoma 6% (3),Round cell tumor 6% (3), Fibroma 4% (2), Epulis 4% (2),

Hemartoma 4% (2), Histiocytoma 2% (1), Rhabdomyoma 2%(1), Transitional cell Carcinoma 2% (1) ,Squamous cell carcinomas 2% (1) and mast cell tumor 2% (1). These results are in accordance with the studies conducted by **Sharma *et al.*,(2018 a), Roshni *et al.*,(2013).** Wherein these authors have reported similar kind of prevalence, with the highest occurance of mammary gland tumor.

In the earlier study carried out by **Baioni *et al.*,(2017),** benign tumors were more frequently occurring than malignant tumors. **Giri *et al.*,(2013)** had also conducted a study at Durg, Chhattisgarh, India to study the occurrence of neoplasm in canines and reported higher incidence of benign tumors than neoplastic. In the present study 38% (19/50) tumors were malignant and 62% (31/50) were benign neoplasms. Similar pattern were also reported by **Giri *et al.*,(2013)** and **Baioni *et al.*,(2017)**

Occurrence based on Gender:

Gender-wise occurrences of neoplasms recorded are presented in **Table 1 and figure 3**. In the present study, 62% (31/50) tumors were found in female dogs as compared to 38% (19/50) in males. **Kumar *et al.*,(2020)** also reported that the female had a higher prevalence of neoplastic condition in comparison to male dogs. Similar findings were also been reported by **Sharma *et al.*,(2018 a)**. Also, the findings of the present study do not correlate with the findings of that **Pawar(2009)** also who had reported a higher incidence in males(55.5%) than females(44.4%). This states that there is no significant difference between occurrences of tumors in either gender. Also **Pawar(2009)** had reported higher incidence in males(55.5%) than females(44.4%), which is not in coordination with the results obtained during the

research. This also states that there is no significant difference between occurance of tumors in either gender.

Occurrence based on Age

Age-wise occurrences of neoplasms are depicted in **Table 1.** The age of tumor-bearing animals ranged from 3 to 11 years old with an average of 7.28 years. Total 58% (29)of the tumors occurred in the age group of from 5 to 8 years, 30% (15) between 9 to 12 years and 12 % (6) in the age group of 1 to 4 years.

These observations are in accordance with **Kumar *et al.*,(2020)** who had recorded highest prevalence in the age group of 6-9years and lowest in the age group of 0-3 years. **Sharma *et al.*,(2018a) and Arya (2018)** had also reported the similar kind of prevalence. **Vascellari *et al.*,(2009)** and **Pakhrin *et al.*,(2007)** had recorded the mean age for tumor occurrence as 8.3years from a sample size of 748 neoplastic conditions.

Occurrence based on Breed

Occurrences of the neoplasms based on breed are depicted in **Table 1 and Figure 2**. As per the data, breed-wise occurrence of neoplastic cases is as follow, Non descript being 52%(26), Germen Shepherd 14%(7), Labrador 10%(5), Golden retriever 8% (4), pug 4%(2), Pomerenian and doberman with 4%(2) each and lastly cocker spaniels with 2%(1). **Roshni (2013)** and **Pawar (2009)** had also found that Non-descript dogs had a higher occurrence of tumors than the other breeds. **Chikweto *et al.*,(2011)** in their study donein West Indies also found that the local mixed breed dogs were more at risk of cutaneous neoplasms than pure bred dogs.

Hematology findings

Hematology findings are depicted in **Table 2 and 3.** Hematological findings were studied as per the tumors recorded. The cases are classified based on the type of tumor identified histologically.

Haemoglobin, TEC, PCV:

The mean values of haemoglobin (Hb) were 11.46±0.48 and 11.10±0.75, Total erythrocyte counts (TEC) as 5.67±0.17 and 5.40±0.17, Packed cell volume (PCV) as 36.05±1.27 and 35.6±2.21 respectively for groups Benign and malignant.

Haemoglobin values of both the groups were almost similar with negligible difference. Mean values of Total Erythrocyte Count and PCV were also similar. This indicated no alteration in the hematological findings. But on studying the results individually it was noticed that the observations varied for each case as per the location and histological classification. The recorded data as per histological classification is given in the **table 1** . For the cases of Adenocarcinoma mean values are in following sequence haemoglobin, PCV and TEC 12.64±1.29, 39.5±3.85 and 5.82±0.57 (respectively). For the cases of adenoma mean values are in following sequence haemoglobin, PCV and TEC 10.34±1.09, 31.6±3.04 and 5.07±0.47 (respectively). For the cases of fibrosarcoma mean values are in following sequence haemoglobin, PCV and TEC 9.48±1.61, 29.5±4.97 and 5.14±0.58 (respectively). For the cases of transmissible veneraltumor mean values are in following sequence haemoglobin, PCV and TEC 10.95±1.26, 34.65±3.75 and 6.4±1.09 (respectively). For the cases of epulis mean values are in following sequence haemoglobin, PCV and TEC

9.56±2.93, 39.3±1.2 and 6.63±0.55 (respectively). For the case of histiocytoma values are in following sequence haemoglobin, PCV and TEC respectively 10.6, 31.5 and 5.11. For the case of Rhabdomyoma values are in following sequence haemoglobin, PCV and TEC 12.4, 36.8 and 6.24 (respectively). For the cases of fibroma mean values are in following sequence haemoglobin, PCV and TEC 9.15±0.95, 29.9±6.2 and 4.585±0.42 (respectively). For the cases of lipoma mean values are in following sequence haemoglobin, PCV and TEC 12.88±1.06, 38.58±3.61 and 6.22±0.40 (respectively). For the cases of pilomatrixoma mean values are in following sequence haemoglobin, PCV and TEC 12.06±0.03, 36.8±1.3 and 5.58±0.01 (respectively). For the cases of round cell tomour mean values are in following sequence haemoglobin, PCV and TEC 11.46±1.03, 34.63±3.46 and 5.43±0.03 (respectively). For the case of mast cell tumor values are in following sequence haemoglobin, PCV and TEC 12, 38.1 and 5.84 (respectively).

In the present study the mean values of haemoglobin, PCV and TEC of both the groups ie. Benign and malignant do not show much difference. This shows that there is no alteration in the haemoglobin and haematocrit levels in the tumor-affected canines. **Gupta *et al.*,(2014)** had also performed the studies on the haematological analysis of the canine affected with tumor and found that whole of the haematological data remained within the normal reference range. **Priyadarshani *et al.*,(2021)** had performed the studies on the TVT and had recorded the normocytic and normochromic anemia. Similar observations with respect to haematological study with no significant difference was also noticed by **Adak (2005). Spivak (1994)** found that patients with tumors had multiple mechanisms for causing anemia.

Anemia is commonly found in malignant neoplasms. This could be due to disorders in haemoglobin metabolism or increased levels of inflammatory cytokines, which led to a lowered production or rapid destruction of RBCs, leading to a loss of haemoglobin **Caro *et al* (2001)**.**Weiss (2002)** found that the presence of inflammation products like cytokines also contributes to the development of anemia. He explained that cytokines directly affect erythropoiesis by affecting the growth of erythroid progenitor cells. He also states that rapidly growing cells like cancer cell have an increased demand for iron and may contribute to the lowered level of iron in the serum. In the present study, the prevalence of anemia was24% (12/50). This could be attributed to the fact that most of the tumors were detected and operated early for resection, which might have not given enough time for the anemia to set in. Also,the blood was taken on the day of the surgery and the dogs were kept starving before the surgery, it could have led to dehydration and hemoconcentration resulting in misleading values of PCV and TEC.

Total Leucocyte Count (TLC):

The mean values of Total leucocyte counts (TLC) were 15.17±1.79 and 22.36±4.57 for benign and malignant groups, respectively.

TLC values of group 2 were significantly higher than group 1. This could be due to increased necrosis and secondary infections, ulcerative parts eliciting the inflammatory response in highly malignant growths as compared to their benign counter parts. Leukocytosis is mainly encountered in malignant tumors which has been well described. **Priyadarshani *et al.*,(2021)** had performed the

studies on haematology in case of tumor and found the leucocytosis was the prominent feature. Even **Kumar *et al.*,(2018)** had noticed the similar change which included leucocytosis as a prominant feature. Also **Milijasevic *et al.*,(2014)** had performed the haematological study in the cases of fibrosarcoma and recorded the leucocytosis as a feature. **Ramani *et al.*,(2014)** had study the haematology for the case of benign tumor, the adenoma and found no change in the haematological profile. **Ramsey *et al.*,(1969)** had studied hematology for the cases of benign tumor lipoma and found no significant difference from the reference range. The **Sawyers *et al.*,(1992)** tested the hypothesis that the increase in total leucocyte count is due to the production of a colony-stimulating factor by the tumor. They demonstrated the colony-stimulating factor *in vitro*, in the pleural fluid in cancer patients that contained malignant cells and biologically active granulocyte-macrophage colony-stimulating factor.

Differential Leucocyte Count(DLC):

The mean values of Neutrophils were 76.36±2.42 and 79.52±2.93, Lymphocytes as 19.25±2.28 and 16.02±2.46, Monocytes as 2.12±0.18 and 2.17±0.29, Eosinophils as 2.02±0.20 and 1.96±0.16 and Basophils as 0.21±0.09 and 0.41±0.21 respectively for benign and malignant. There were no significant difference found in the values of Neutrophils, lymphocytes, monocytes and eosinophils between the two groups.

Kumar *et al., (2018)* noticed the granulocytosis and leucocytosis in the tumor cases through the studies conducted. Also according to **Gupta *et al.*,(2014)** there is no alteration in the blood profile performed during the experiment. Even **Naeini(1997)** and **Ramsey *et al.*,(1969)** had recorded the

similar findings with no significant difference in the reading. **Freeman *et al.*,(1995)** opined that peripheral lymphocytosis occurs in cancerconditions and plays a significant role in secreting soluble molecules that regulate intercellular signaling and lymphokines that recruit and activate other inflammatory cells like monocytes. In the tumor microenvironment they secrete epidermal growth factor and angiogenic factors. **Teramukai *et al*(2009)** described the effects of peripheral blood neutrophils , lymphocytes and monocytes on survival of cancer patients. In their study they found that elevated neutrophil count was the most statistically significant for prognosis whereas no association was found between prognosis and lymphocyte or monocyte count. **Fidlender and Albelda (2012)** state that neutrophilia in cancer is not only linked to inflammation due to secondary bacterial infection but also to the tumor itself. The mechanism by which neutrophilia occurs is linked to the colony stimulating factor by the tumor. Several additional cytokines secreted from tumors and stroma cells have been suggested to contribute to neutrophilia. When peripheral neutrophils are associated with tumors, they are known as Tumor Associated Neutrophils.

In this study it is recorded that 50% of the cases have neutrophilia. The findings in these cases can be attributed to the secondary infection in the tumors, which were most often large and showed suppurative and necrotic changes.

Serumbiochemistry findings:

The serum biochemistry values were also analyzed based on the Benign and malignant nature of neoplasm. These values are represented in the **Table 4** and **Table 5.**

Total protein, Albumin, Globulin and A G Ratio:

Total protein as 6.78±0.18 and 6.55±0.16 , Albumin as 3.22±0.14 and 3.07±0.14, Globulin as 3.55±0.09 and 3.47±0.03 and Albumin globulin ratio as 0.91±0.04 and 0.89±0.03 for benign and malignant respectively.

There wasn't any significant change in the values of Total protein, serum albumin and Serum globulin between the two groups. **Priyadarshani *et al.*,(2021)** noticed hypoprotenemia, hypoalbunemia and hypoglobulinemia throughout the studies of tumor conducted. **Kumar *et al.*,(2018)** had recorded no significant difference in total protein, albumin, globulin and A G ratio. **Pawar (2009)** recorded that the value of total protein doesn't differ in benign or malignant growths and serum albumin is reduced in malignant tumors as compared to benign tumors. She also stated that serum globulin level is increased due to the body's immunological reaction against the cancer cells. **Macmillin *et al.*,*(2001)*** explained that previously, it was believed that low circulating albumin concentrations were due to reduced synthesis or increased trans-capillary escape rates in neoplastic patients. However, they recorded that the rate of albumin synthesis is similar to that of non-cancer patients and that trans-capillary escape rates are within the normal range. This suggests that albumin degradation or usage plays an important role in the hypoalbuminemia of the neoplastic patient. **Kumar *et al.*,(2018)**, and **Mohapatra(2016)** had recorded similar findings with no significant difference between the groups.

C-reactive protein:

The serum C-reactive protein levels were 4.73±1.22 for benign and 6.44±2.55 for malignant.

Hansen(2004) explained that the CRP response doesn't seem to depend on whether the inflammatory stimulus is of i.e. aseptic, bacterial or viral nature, but rather on how destructive and pro-inflammatory the stimulus is. He also reported the mean value of CRP in canine cancers to be 3.2mg/lit. The present study shows an average of 4.36±0.75 mg/lit for benign and 5.13±0.93 for malignant of CRP level out of all the tumors recorded.

Heikkila *et al.*,(2007) deduced that there are several reasons why C-reactive protein increases in cancer conditions. First, tumor growth can cause tissue inflammation and hence increase CRP levels. Second, CRP could indicate an immune response to tumor antigens. Third, there is evidence that cancer cells can increase the production of inflammatory proteins, which could explain the high CRP concentrations in patients with cancer. Some cancerous cells have been shown to express CRP and cancer cell lines have been shown to secrete IL6 and IL8,which in turn induce the production of CRP. Finally, CRP is an important marker of chronic inflammation might have an etiological role in cancer.

Allin *et al.*,(2009) reported that an elevated level of C-reactive protein is associated with cancer and affects the overall survival of the patient. They also stated increasing evidence that chronic inflammation, of which CRP is a marker, is a causal factor in several malignancies. Similar findings were made by **Ahamad *et al.*,(2018), Nivy *et al.*,(2014), Watanabe *et al.*,(2013), Pastore *et al.*,(2013), Leitch *et al.*,(2007), Marsik *et al.*,(2008), Proctor *et al.*,(2010) and Wysocki *et al.*,(2013).**

Ionic Calcium, Total Calcium and Vitamin D

The mean values of Ionic Calcium were 1.27±0.03 and 1.28±0.01, total Calcium were 10.50±0.26 and 10.53±0.56 and that of Vitamin D were 31.16±7.35 and 13.37±2.04 for both the groups of benign and malignant respectively.

Hirschfeld *et al.*,(2017) had studied the case of malignant tumor in which they had recorded the total calcium to be elevated and Vitamin D to be reduced or to be on the lower side. **Kwatampora *et al.*,(2016)** had also recorded similar observations concerning with the Incline in Calcium levels indicating Hypercalcemia. He had also studied the vitamin D estimation in which he noted reduction in Vitamin D levels. **Qureshi(2006)** had studied the ionic ca and serum calcium in malignant disorders. In which he noticed that patients with hypercalcemia related with ionic Calcium malignances were more as compared to that of total calcium. **Messinger *et al.*,(2009)** had concluded that Serum-ionized hypercalcemia was most commonly associated with neoplasia, specifically lymphosarcoma. Although dogs with lymphosarcoma and anal sac adenocarcinoma had higher serum ionic calcium concentrations than dogs with other diseases, the magnitude of the serum ionic Ca concentration could not be used to predict the cause of hypercalcemia. Total serum calcium and corrected calcium concentrations did not accurately reflect the calcium status of the dogs in this study.

Individual tumors and their outcomes:

On the basis of gross and histopathological observations made under microscope of H & E stained sections, these 50 cases were categorized as malignant and

benign. These are as follows:

Fibrosarcoma:

The pets with average age of 8yr were found to be affected with this tumor. Out of the study most of the cases were of male dogs. The largest size of tumor collected was 15cm * 9cm. The smallest size collected during this procedure was 7cm * 3cm. It was generally round in shape and hard in consistency. Cut section showed diffusely spread white coloured area throughout the tumorous mass. **(Plate1)**

Histopathologically the section revealed diffused multidirectional proliferation of fibrous connective tissue leading to whorling pattern. Mitotic figures were noticed. Also pleomorphism of cells was present. Focally there were mature collagen fibers with pinkish amorphous collagen.**(Plate1).**

Munday *et al.*,(2017) stated that less cellular differentiation and the presence of more frequent mitotic figures and necrosis, together with an infiltrative growth pattern, allow differentiation from fibroma. The distinction from odontogenic tumors is usually straight forward, unless odontogenic epithelium is not present; in this case, the location of the mass away from the dental arcade may help in the diagnosis. Oral osteosarcoma can be diagnosed when osteoid deposition, recognized as homogeneous eosinophilic extracellular material within the neoplasm, is evident. Similar observations were made by **Soujanya and Madhuri(2019)** and **Subhapriya *et al.*,(2018)**.

Adenocarcinoma of mammarygland:

<u>Mammary adenocarcinomas:</u>

The pets with average age of 8.7yr were found to be affected with this tumor. All of them were female, having

majority of the inguinal glands being affected.The average size of the tumor was 5cm *3cm to 23cm* 8.5cm. These tumors were found to be round in shape and nodular in consistency. On cut section it was found to posses cystic cavities with white colour diffusely spread throughout the area. **(Plate2,3,4)**

Histopathologically the section revealed to posses multifocal areas of glandular epithelium in acini, leading to formation of solid mass of proliferating cells, possessed large number of proliferating ductules. There was severe multifocal areas of multidirectional whorls along with mitotic figures, vesicular nuclei, solid duct were found. There was proliferation of fibrous connective tissue. Also severe multifocal infiltration of polymorph-mononuclear cells was noticed. Few areas also showed multifocal necrosis. **(Plate2,3,4)**

These findings are in coordination with the findings by **Weijer *et al.*,(1972)**, which state that in simple tubular mammary gland adenocarcinomas, pleomorphism and necrosis are common. They also stated that these neoplasm grow in an invasive way and may grow in an expansive nodular way seen in the gross findings of this study. Similar observations were made by **Kumar *et al.*,(2020), Cardiff *et al* (1977), HellmÉn,(1992)** and **Destexhe *et al.* (1993).**

Transmissible venereal tumor

These growths were collected either from female or on the male dogs. Especially the genital area. The canines of average age around 6.7 yrs were found to be affected with this tumor. Both male and female were found to be affected in equal

proportion. The average size of the tumor range from 2cm *1cm to 15cm* 10cm. All of these tumors were multinodular in nature. The consistency was found to be ranging from soft to hard with colour ranging from red to white. **(Plate 5)**

Histopathologically the section revealed the sheets of round individual cells containing round and vesicular nuclei. Single and distinct and centrally placed nucleolus and chromatin was present. Stroma was scanty and which possessed light proliferating fibrous connective tissue. Mitotic figures were seen dispersed throughout the sections. **(Plate 5)**

These neoplastic growths were predominantly present in the genital area in both male and female. Cut surface of growth was pale white to red in colour gross findings along with the location where indicator of CTVT similar findings are reported by **Marcos *et al.,(*2006)** and **Strakova and Murchison (2014).**

Birhan and Chanie(2015) had reported the histopathological features which exhibited Round to polyhedral shaped cells arranged or grouped in strings inter spread with delicate conjunctival stroma when stained with hematoxylin and eosin tumor cells were usually arranged radially around blood and lymphatic vessels and had a high nucleus to cytoplasm ratio with around nucleus and chromatin ranging from delicate to course and prominent nucleoli and cytoplasmic vacuoles the cells contain a large amount of cytoplasm that is highly acidophilic with poorly defined limits. Also there is also frequent infiltration of lymphocytes plasma cells and macrophages which suggest role of immune mediated control.

Epulis

This particular tumor was found in the oral cavity of the animal with its attachment to the gum or tooth. The canine

of average 8.75yr were found to be affected with this type of tumor. Male dogs were predominantly found to be affected. The average size of tumor was ranging from 2cm*2cm to 3cm*2cm. Colour was ranging from white to pink and was hard in consistency. **(Plate 6)**

Histopathologically section revealed expanding subepithelial connective tissue, leading to elevation of the overlying hyperplastic mucosa, and extending cut borders is an unencapsulated neoplasm composed of loosely arranged streams of evenly spaced spindle to stellate cells separated by an abundant collagen matrix. Neoplastic cells had indistinct borders with moderate amounts of eosinophilic fibrillar cytoplasm. Nuclei were irregularly oval to elongate with finely stippled to hyperchromatic chromatin and an indistinct nucleolus. The mitotic figures were less than 1 per 10 high power fields. Focally within the neoplasm is an island of osseous metaplasia composed of immature woven bone. Multifocally there were also few aggregates of homogenous, eosinophilic material (dental hard substance). Also multiple small subepithelial and perivascular accumulations of plasma cells, fewer lymphocytes and occasional neutrophils was noticed. The overlying epithelium is moderately hyperplastic forming anastomosing rete ridges up to 2 mm in length with moderate acanthosis, spongiosis, multifocal epithelial intracellular edema, multifocal hyperkeratosis, neutrophilic exocytosis, and a focal area of erosion. **(Plate 6)**

Desoutter *et al.*,(2012) had studied Clinical and histological features of fibromatous epulis of periodontal ligament origin. It was noticed that in the 16 dogs for which the outcome was known, 2 peripheral giant cell granulomas recurred after excision. No age or sex predilection was

evident; however, lesions were more common in maxillary than in mandibular gingiva. In contrast to cats, peripheral giant cell granulomas in dogs behave like fibromatous epulides of periodontal ligament origin and seldom recur

Gardner and Baker (1993) had studied and compared the microscopic features and clinical behaviour of the acanthomatous epulis in canines with those of ameloblastoma in human beings. It was finally concluded that the acanthomatous epulis is an ameloblastoma, arises from the gingival epithelium in some cases, but may also arise intraosseously and then break out of bone and hence they recommend the term canine acanthomatous ameloblastoma as being appropriate for this particular lesion.

Adenoma

This tumor was found on the skin surface of the affected canine. The average age of affected canines was noticed to be 4.9yr. More number of females were affected with tumour. The average size of the tumor was 2cm*0.5cm. It was moderately hard in consistency and white in colour in cut section. **(Plate 7,8,9)**

Histopathologically it was noticed that there were proliferating cells formed packets which were separated by thin collagen septa. The proliferating cells were found out to be invasive and anaplastic in nature. They were present in group of cells. The section revealed to have little tendency to form vacuoles. Only few mitotic figures were noticed. **(Plate 7,8,9)**

Pereira *et al.*,(2013) found that the adenomas were characterized by the presence of epithelial cells with abundant and eosinophilic cytoplasm, low pleomorphism, and basal

cells with small and hyperchromatic nuclei. The cells were organized in islands separated by well-vascularized connective tissue. The presence of basaloid cells with large nucleus, loose chromatin, evident nucleolus, and occasional mitosis was noted. Cell islands separated by connective tissue were also present. In some samples, focal areas of squamous metaplasia were noted, and also areas with high-grade anaplasia, suggesting malignant transition. In carcinomas, the noticed proliferation pattern was cribriform. The cells presented a large and clear nucleus, loose chromatin, evident nucleolus, cytoplasm with poorly defined borders, and frequent mitosis.

Transitional Cell Carcinoma

The age of affected dog was belonging to Labrador breed and was male. The age of the dog was 4yrs. The size of the tumor was 9cm*5cm. It was found to be hard in consistency and highly nodular in appearance. The cut section showed it to be pinkish white in colour.**(Plate 10)**

Histopathologically it was noticed to be arising from transitional urothelium, infiltrating the propria-submucosa and muscularis, with extension into the adventitia and adjacent peritoneal adipose tissue, non-papillary, infiltrative and unencapsulated. Neoplastic cells were composed of cuboidal-to-columnar epithelial cells arranged in acini, tubules, and trabeculae, which is supported by a moderate-to-dense fibrovascular stroma (desmoplasic/scirrhous response). Neoplastic cells have variably distinct cellular borders, a moderate amount of granular eosinophilic cytoplasm, round to oval nuclei with finely stippled chromatin, and 1-2 prominent centrally located magenta nucleoli. Anisocytosis and

anisokaryosis are moderate, with 20 mitotic figures per 10 high powered fields. Large areas of mural necrosis are represented by lakes of amorphous hypereosinophilic cellular debris and admixed with foci of basophilic mineralization (dystrophic). **(Plate 10)**

Knapp *et al.*,(2014) had performed the studies on Urinary Bladder Cancer in Dogs, a naturally occurring model for cancer biology and drug development. The histopathology revealed High-grade, invasive transitional cell carcinoma (urothelial carcinoma) of urinary bladder. The microscopic examination revealed ivasion of the lamina propria by a disorganized mass of atypical urothelial epithelium. The overlying urothelium was eroded. Detail of the neoplastic growth was marked anisocytosis and anisokaryosis are observed. Note several mitotic figures.

Rhabdomyoma

The age of affected canine was 8 yrs belonging to non descript category and was male. This growth was noticed at the stifle joint of the dog. The size of the growth was 5cm*2cm. It was soft in consistency. Cut section showed it to be pink in colour. **(Plate 11)**

Histopathologically it revealed to posses well circumscribed, non encapsulated sheets of skeletal muscles. Cells were polygonal with abundant eosinophilic fibrillar or granular cytoplasm with frequent cross striation and intracytoplasmic rod like inclusion. Nuclei are small, round and vesicular, have prominent nucleoli. Vacuolated cytoplasm was noticed and mitotic figures were absent. **(Plate 11)**

Fenoglio *et al.*,(1976) had studied the case of

Rhabdomyoma he had performed clinicopathological and electron microscopic Study. In this histopathological examination was also performed which revealed the tumors were circumscribed but not encapsulated and were easily distinguished from the surrounding mayofibers. They ranged in diameter from several microns to several centimeters. The cells constituting these tumors tended to be larger (up to 80 p in diameter) than the surrounding myocardial fibers and appeared vacuolated. Occasional cells were smaller and had an eosinophilic granular cytoplasm. Glycogen was present in all of the rhabdomyoma cells but was abundant only in tissues fixed in alcohol. Classic "spider cells" were characterized by a centrally located mass of finely granular cytoplasm with thin, elongated projections and slender myofibiils extending to the periphery ; although rare, they were found in every case. More frequently the nucleus was displaced to the periphery of the cell and cross striations were identified around the periphery of the cell. Stromal collagen was usually scant, although in several tumors there was abundant collagen. In two cases there were microscopic foci of calcification within rhabdomyoma cells. Foci of extramedullary hematopoiesis were identified in the majority of tumors from the newborn group.

Fibroma

The average age of affected canines was 7.7 yrs. One case was of Germen shepherd breed and other was mixed. This growth was noticed to be circumscribed in the muscles of the left hind limb of the dog. The size of the growth was 12cm*5cm. It was filled with the fluid in the encapsulated part. Within the encapsulated part was the nodular growth which was hard in

consistency. Cut section showed it to be white in colour. **(Plate 12)**

Histopathology revealed the well-circumscribed, unencapsulated, sparsely cellular neoplasm composed of spindle cells arranged in long, interlacing streams and bundles, supported by an abundant, dense collagenous matrix. Neoplastic cells had indistinct cell borders and cytoplasm. An elongate nucleus with finely stippled chromatin and an indistinct nucleolus was noticed.Very few mitotic figures were present. Multifocally within the neoplasm low numbers of perivascular lymphocytes and plasma cells were found. Collagen fibers are mildly separated by amphophilic, beaded to fibrillar mucin; and apocrine glands are mildly ectactic and lined by attenuated epithelium. **(Plate 12)**

Pinker and Daniel(2019) had performed histopathology of soft tissue fibroma. The microscopic description indicated that the lesion was formed by bundles of intersecting collagen with scattered spindle cells as well as rounded cells contained within. No giant cells or mitotic figures were seen. Histological features included cytoplasmic reactivity for smooth muscle actin.

Histiocytoma

The age of affected canine was 5 yrs belonging to non descript breed and was male. This growth was noticed beside the preputial cavity of the dog. The size of the growth was 12cm*5cm. It was filled with the fluid in the encapsulated part. Within the encapsulated part was the nodular growth which was hard in consistency. Cut section showed it to be white in colour. **(Plate 13)**

Histopathologically the section revealed to posses round cells placed in the pattern of sheets in the dermis and epidermis. Also a wedge shaped appearance was noted under low power, which is characteristic of histiocytoma. The cytoplasm was eosinophilic with eccentrically placed nuclei. The size and shape of cells were large and round respectively. Few areas showed infiltration of mononuclear cells and lymphocytes.**(Plate 13)**

Taylor *et al.*,(1969) explained that this tumor has a classical alopecic appearance and is usually a smooth ,pink ,raised mass. The tumor has a predilection to the head and pinnae. It also has a tendency to ulcerate. Histologically, there is dermal infiltration of round cells arranged in sheets. The cells appear histiocytic due to the bean shaped nucleus and eosinophilic cytoplasm. Mitotic figures are numerous and there may be dense populations of plasma cells and lymphocytes. **Duncan and Prasse(1979)** and **Afolter and Moore (2002)** made similar findings. This is accordance to the gross and microscopic findings of this study including areas of predilection of the tumor.

Lipoma:

The average age of the dogs affected with lipoma was 6.5yrs. This particular growth was noticed irrespective of gender. The average size raged from 3cm*2cm to 18cm*9cm. It was soft and flabby in consistency. On cut section it appeared to be white in colour. **(Plate 14)**

Histopathologically the section revealed proliferation of adipocytes. Paucicellular fibrous septa were present. Few necrotic foci were also observed in the tumors which were larger in size. **(Plate 14)**

Manor *et al*(2011) had studied 58 cases of Oral lipoma. In

this they had performed histopathological examination which revealed classic lipoma comprised 28 cases (48%), followed by 19 cases of fibrolipoma (33%), 4 cases of intramuscular lipoma (7%), 2 cases of minor salivary gland lipoma (3.5%), 2 cases of angiolipoma (3.5%), and 3 cases of spindle cell lipoma (5%) (Fig. 1). In the cases diagnosed as spindle cell lipoma, immunohistochemical analysis showed positivity for vimentin and CD34 protein and negativity for S-100 protein and human muscle actin in the spindle cells. In one case diagnosed as spindle cell lipoma, the karyotype was normal.

Pilomatrixoma

The average age of the dogs affected was 6.3yrs. This particular growth was noticed irrespective of gender. The average size ranged from 3cm*2cm. It was soft in consistency. On cut section it appeared to be reddish pink in colour.**(Plate 15)**

Histopathologically it was found to posses solid nests of basaloid cells undergoing keratinisation. Also transeipdermal perforation was noticed. **(Plate 15)**

Levy *et al*(2008) had studied the case of pilomatrixoma and performed the histopathological examination which featured each case of pilomatrixoma depend on the stage of its development. They have also reported that earlier the stage of the lesion, the more numerous the basophilic cells; as the lesion progresses, an increasing number of shadow cells and amorphous debris are seen. In advanced stages, the tumor contains large masses of shadow cells with varying degrees of calcification. Finally, the tumor cells can be almost totally replaced by compact bone, leaving only small numbers of calcified shadow cells to identify the nature of the lesion. The proposed terms for these four chronological and morphological stages of pilomatrixoma are early stage,

fully developed stage, early regressive stage, and late regressive stage, reflecting the life of a pilomatrixoma, which begins as an infundibular matrix cyst and ends up as a calcified and ossified nodule with no visible epithelial component.

Hamartoma

The average age of the canine affected with this tumor was 7.5yrs. The average size noticed was found to be 5cm*4cm. It was hard in consistency and cut section revealed to be pinkish white in colour. **(Plate 16)**

Histopathologically it was found to posses circumscribed mass of ducts and lobules. These ducts were dilated and accompanied by fibrosis. **(Plate 16)**

Misago *et al.*,(2010) had performed the studies on hamartoma and recorded the histopathological observations**.** They had noticed all lesions were characterized by intradermal infundibular cystic structures with or without connection to the epidermis, and the cystic structures attached the sebaceous ducts and sebaceous lobules. These structures with sebaceous differentiation were surrounded by a characteristic stroma of fibrillary bundles of collagen, in which proliferating adipocytes and increased number of capillaries and small venules were often associated to various degrees. Few lesions focally showed differentiation toward the inferior segment of hair follicles

Squamous cell carcinoma

The average size of the growth noticed was found to be 6cm * 4cm. The average age was 7yrs. This growth was nodular and hard inconsistency. On cut section, it revealed to be white in colour. **(Plate 17)**

Histopathologically the infiltration of tumor cells into the dermis was noticed. Nucleus was large and ovoid. Nucleus to cytoplasm ratio was also increased.The centrally placed nucleolus was observed prominantly. Keratinisation was present along with the presence of keratin pearls. There was also the infiltration of mononuclear cells and lymphocytes. **(Plate 17)**

Hargis *et al.*,(1992) and **Moulton (1978)** stated that the peak incidence of squamous cell carcinoma was between 6 to 10 years in dogs and the preferred sites are head, abdomen, forelimb and digits. This is in accordance to the findings of this study. They further stated that the tumor consists of cords of epidermal cells or masses of cells that invade the dermis or sub cutis by downward proliferation. Keratin pearls is a feature of well differentiated cells in which there are concentric layers of squamous cells with increased keratinization in the centre. The gross and histological observation of squamous cell carcinoma in the present study is in accordance with the observations made by **Hargis *et al.*,(1992)**. Similar findings were made by **Almeida *et al.*,(2001), Alam and Ratner(2001)** and **Chandrashekariah *et al.*,(2011).**

Mast Cell Tumour

These were measured 1 cm x 0.4 cm to 4.5cm x 2.5cm. Also these were round in shape and soft in consistency. **(Plate 18)**

Histopathologically oval shaped cells were present and anisokaryosis was noticed. Nuclei were spherical and vesicular with one or two distinct nucleoli. The cytoplasm was sparse and eosinophilic. Some cells had faintly eosinophilic to baso-eosionophilic cytoplasmic inclusion. Stroma was moderate and highly vascular. Similar findings were also found by **Deborah *et al.*, (1986), Bostock (1986)** and **Lemarie *et al.*, (1995). (Plate 18)**

Table1: CLASSIFICATION OF NEOPLASTIC CONDITION AND CASE DESCRIPTION

Fibrosarcoma cases.

Sr.no	Breed	Age	Sex
1.	Mixed	7.5 year	Male
2.	Mixed	9.0 year	Female
3.	Mixed	7.0 year	Male
4.	Germen shepherd	8.0 year	Female
5.	Germen shepherd	8.5 year	Male

Adenocarcinoma cases

Sr.no	Breed	Age	Sex
1.	Labrador	8.0 year	Female
2.	Germen shepherd	8.5 year	Female
3.	Mixed	9.0 year	Female
4.	Mixed	7.5 yeas	Female
5.	Labrador	9.0 year	Female
6.	Poodle	9.5 year	Female
7.	Germen shepherd	12.0 year	Female
8.	Golden retriever	8.0 year	Female
9.	Mixed	7.0 year	Female
10.	Golden retriever	6.5 year	Female
11.	Poodle	11.0 year	Female
12.	Germen shepherd	9.5 year	Female

Adenoma cases

Sr.no	Breed	Age	Sex
1.	Golden retriever	4.0 year	Female
2.	Mixed	6.0 year	Male
3.	Doberman	8.0 year	Female
4.	Mixed	4.0 year	Male
5.	Mixed	5.0 year	Female
6.	Pug	3.0 year	Male
7.	Mixed	4.5 year	Female

Transmissible Venereal tumour

Sr. no	Breed	Age	Sex
1.	Mixed	5.0 year	Female
2.	Pug	7.0 year	Female
3.	Mixed	8.0 year	Female
4.	Doberman	7.0 year	Male

Epulis

Sr. no	Breed	Age	Sex
1.	Cocker spainiel	9.5 year	Female
2.	Mixed	8.0 year	Male

Histiocytoma

Sr.no	Breed	Age	Sex
1.	Mixed	5.0 year	Male

Rhabdomyoma

Sr.no	Breed	Age	Sex
1.	Mixed	8.0 year	M

Fibroma

Sr.no	Breed	Age	Sex
1.	Germen shepherd	7.5 year	Male
2.	Mixed	8.0 year	Female

Lipoma

Sr.no	Breed	Age	Sex
1.	Labrador	7.0 year	Female
2.	Mixed	5.0 year	Female
3.	Mixed	10.0 year	Female
4.	Germen shepherd	9.0 year	Female
5.	Mixed	6.0 year	Male

Pilomatrixoma

Sr.no	Breed	Age	Sex
1.	Pug	3.0 year	Male
2.	Mixed	8.5 year	Female
3.	Mixed	7.5 year	Male

Hamartoma

Sr.no	Breed	Age	Sex
1.	Germen shepherd	8.0 year	Female
2.	Golden retriever	7.0 year	Male

Round cell tumour

Sr.no	Breed	Age	Sex
1.	Mixed	7.0 year	Female
2.	Mixed	8.0 year	Male
3.	Mixed	8.5 year	Female

Mast cell tumour

Sr.no	Breed	Age	Sex
1.	Mixed	8.0 year	Male

Transitional cell carcinoma

Sr.no	Breed	Age	Sex
1.	Labrador	4.0 year	Male

Table 2: HAEMATOLOGICAL DATA OF MALIGNANT TUMOUR CASES

Sr. no.	**Histological description**	**Hb** (gm%)	**PCV (%)**	**TEC** (10^6/ mm^3)	**TLC** (10^3/ mm^3)	**DLC**(%)				
						N	**L**	**M**	**E**	**B**
1.	Fibrosarcoma	9.48	29.5	5.14	34.46	82.6	14.2	1.6	1.6	0.4
2.	Mammary gland Adenocarcinoma	12.64	39.5	5.82	20.11	76.5	18.91	2.08	2.25	0.25
3.	Transitional cell carcinoma	10.2	35.3	5.1	22.5	86	10	3	1	0
4.	Cutaneous squamous cell carcinoma	12.1	38.1	5.57	12.4	73	21	2	3	1
	Average	11.10	35.6	5.40	22.36	79.52	16.02	2.17	1.96	0.41
	Standard Deviation	1.50	4.42	0.34	9.14	5.86	4.92	0.59	0.85	0.42
	Standard error	0.75	2.21	0.17	4.57	2.93	2.46	0.29	0.42	0.21

Table 3: HAEMATOLOGICAL DATA OF BENIGN TUMOUR CASES

Sr. no.	**Histological description**	**Hb** (gm%)	**PCV (%)**	**TEC** (10^6/ mm^3)	**TLC** (10^3/ mm^3)	**DLC**(%)				
						N	**L**	**M**	**E**	**B**
1.	Histiocytoma TVT	10.95	34.65	6.4	24.2	86	10	2.25	1.5	0
2.	Epulis	9.565	39.3	6.07	15.5	72.5	23.5	2	1.5	0.5
3.	Adenoma of sebaceous gland	10.34	31.6	5.07	21.81	81.85	14	1.71	2	0.57
4.	Rhabdomyoma	12.4	36.8	6.24	17.8	84	12	3	1	0
5.	Fibroma	9.15	29.9	4.58	22.4	89	8.5	1	1.5	0
6.	Histiocytoma	10.6	31.5	5.11	6.8	70	25	2	3	0
7.	Lipoma	12.88	38.58	6.22	7.62	69	25.8	2.6	2.6	0
8.	Pilomatrixoma	12.06	36.8	5.58	10	69.33	25	2.33	2.66	0.66
9.	Haemartoma	14.725	44.7	5.91	13	67	30	1.5	1.5	0
10.	Round cell tumor	11.46	34.63	5.43	11.76	70.33	24	3	2	0.66
11.	Mast cell tumor	12	38.1	5.84	16	81	14	2	3	0
	Average	11.46	36.05	5.67	15.17	76.36	19.25	2.12	2.02	0.21
	standard deviation	1.59	4.23	0.57	5.96	8.03	7.57	0.60	0.69	0.30
	Standard error	0.48	1.27	0.17	1.79	2.42	2.28	0.18	0.20	0.09

Table 4: BIOCHEMICAL DATA OF MALIGNANT TUMOUR CASES

Sr.no	**Histological description**	**T P** (gm/dl)	**ALB** (gm/dl)	**GLOB** (gm/dl)	**A/G**	**CRP** (mg/l)	**Ca** (mg/dl)
1.	Fibrosarcoma	6.75	3.19	3.56	0.93	7.70	10.37
2.	Mammary gland Adenocarcinoma	6.37	2.97	3.40	0.87	3.73	9.71
3.	Transitional cell carcinoma	6.17	2.74	3.43	0.79	13.01	9.88
4.	Cutaneous squamous cell carcinoma	6.91	3.41	3.5	0.97	1.32	12.18
	Average	6.55	3.08	3.47	0.89	6.44	10.53
	Standard Devation	0.33	0.28	0.07	0.07	5.10	1.13
	Standard Error	0.16	0.14	0.03	0.03	2.55	0.56

Table 5: BIOCHEMICAL DATA OF BENIGN TUMOUR CASES

Sr.no.	**Histological description**	**T P** (gm/dl)	**ALB** (gm/dl)	**GLOB** (gm/dl)	**A/G**	**CRP** (mg/l)	**Ca** (mg/dl)
1.	Histiocytoma TVT	6.15	2.70	3.44	0.81	9.60	9.48
2.	Epulis	6.9	3.06	3.83	0.81	1.05	10.57
3.	Adenoma of sebaceous gland	6.72	3.19	3.52	0.90	1.83	10.50
4.	Rhabdomyoma	5.51	2.21	3.3	0.66	0.78	12.0.1
5.	Fibroma	6.77	3.61	3.16	1.14	8.29	10.41
6.	Histiocytoma	7.81	3.91	3.9	1.01	2.34	11.91
7.	Lipoma	6.86	3.53	3.334	1.09	3.03	10.28
8.	Pilomatrixoma	6.83	3.24	3.59	0.90	1.29	11.99
9.	Haemartoma	6.49	2.88	3.61	0.80	12.46	9.34
10.	Round cell tumor	7.54	3.41	4.13	0.82	3.48	10.75
11.	Mast cell tumor	7.01	3.75	3.26	1.15	7.98	9.81
	Average	6.78	3.22	3.55	0.91	4.73	10.50
	Standard deviation	0.61	0.49	0.30	0.15	4.07	0.89
	Standard error	0.18	0.14	0.09	0.04	1.22	0.26

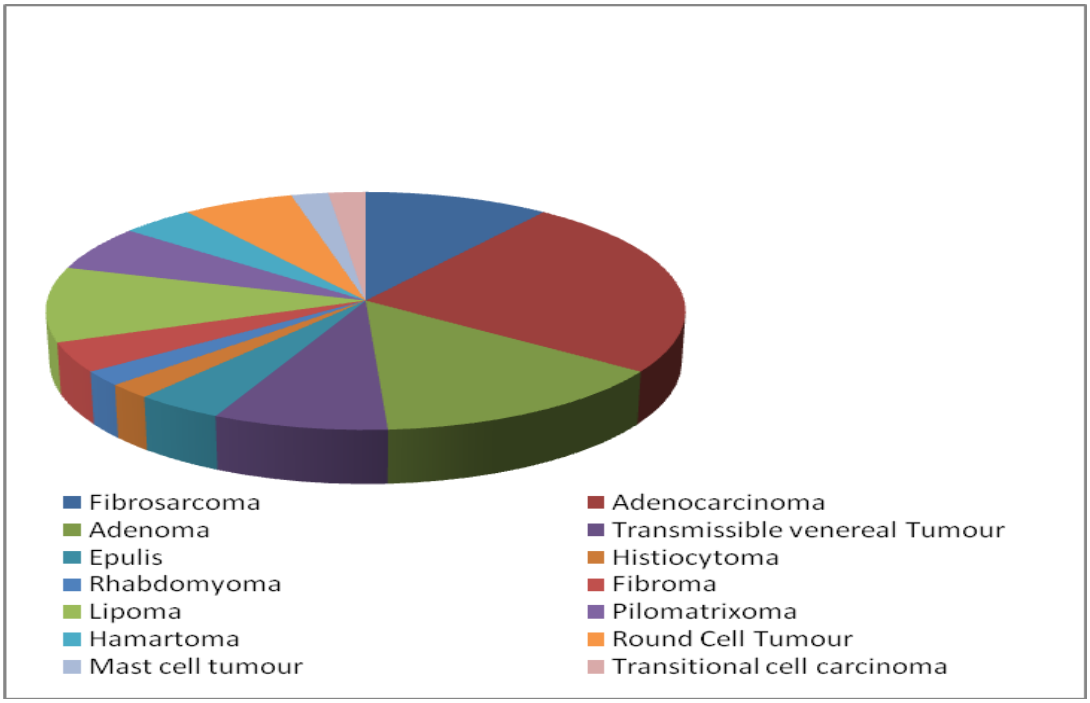
Table 6: TOTAL CALCIUM, IONIC CALCIUM AND VITAMIN D OF MALIGNANT TUMOUR

Sr. No	**Histological description**	**Total Calcium** (mg/dl)	**Ionic Calcium** (mmol/L)	**Vitamin D** (ng/ml)
1.	Fibrosarcoma	10.37	1.31	17.7
2.	Mammary gland Adenocarcinoma	9.71	1.24	8.2
3.	Transitional cell carcinoma	9.88	1.27	15.3
4.	Cutaneous squamous cell carcinoma	12.18	1.29	12.3
	Average	10.53	1.28	13.37
	Standard Deviation	1.13	0.02	4.09
	Standard Error	0.56	0.01	2.04

Table 7: TOTAL CALCIUM, IONIC CALCIUM AND VITAMIN D OF BENIGN TUMOUR

Sr. No	**Histological description**	**Total Calcium** (mg/dl)	**Ionic Calcium** (mmol/L)	**Vitamin D** (ng/ml)
1.	Histiocytoma TVT	9.485	1.22	10.53
2.	Epulis	10.57	1.16	55.5
3.	Adenoma of sebaceous gland	10.50	1.32	24.5
4.	Rhabdomyoma	12.0.1	1.57	90
5.	Fibroma	10.41	1.27	21.5
6.	Histiocytoma	11.91	1.37	44
7.	Lipoma	10.28	1.3	50.46
8.	Pilomatrixoma	11.99	1.27	23.2
9.	Haemartoma	9.34	1.16	15.5
10.	Round cell tumor	10.75	1.20	14.3
11.	Mast cell tumor	9.81	1.17	15.3
	Average	10.50	1.27	33.16
	Standard Deviation	0.89	0.11	24.40
	Standard error	0.26	0.03	7.35

Figure 1: CLASSIFICATION BASED ON HISTOLOGICAL DISCRIPTION OF TUMOUR



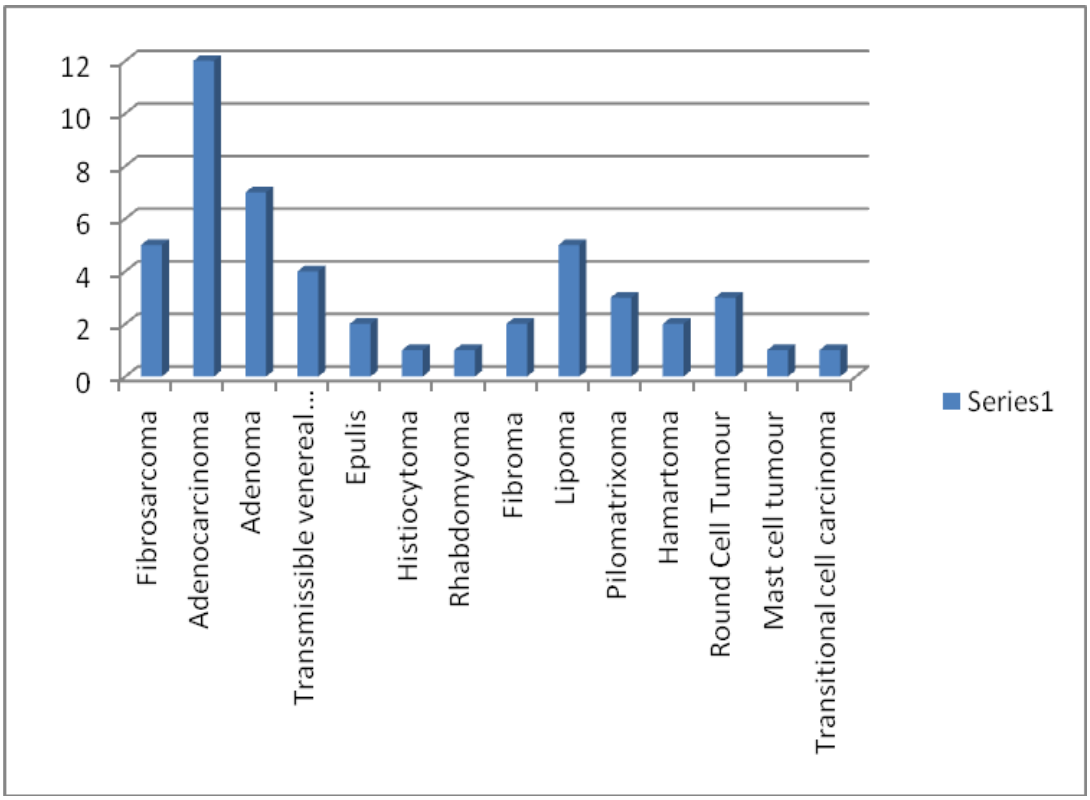
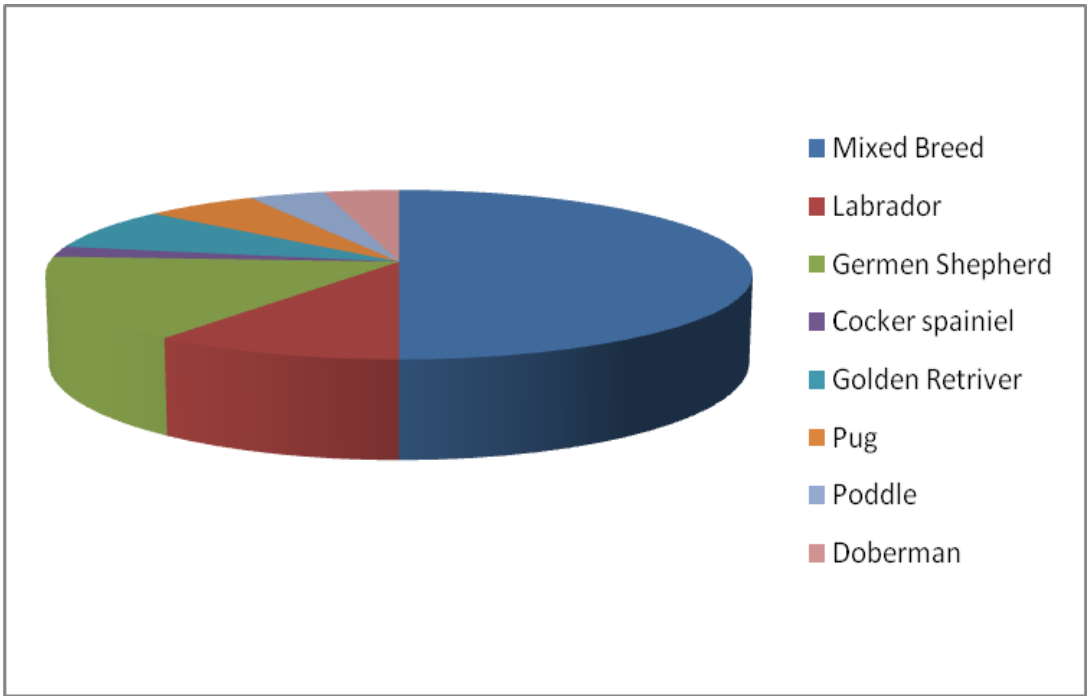


Figure 2: CLASSIFICATION BASED ON BREEDS OF CANINES AFFECTED WITH TUMOUR.



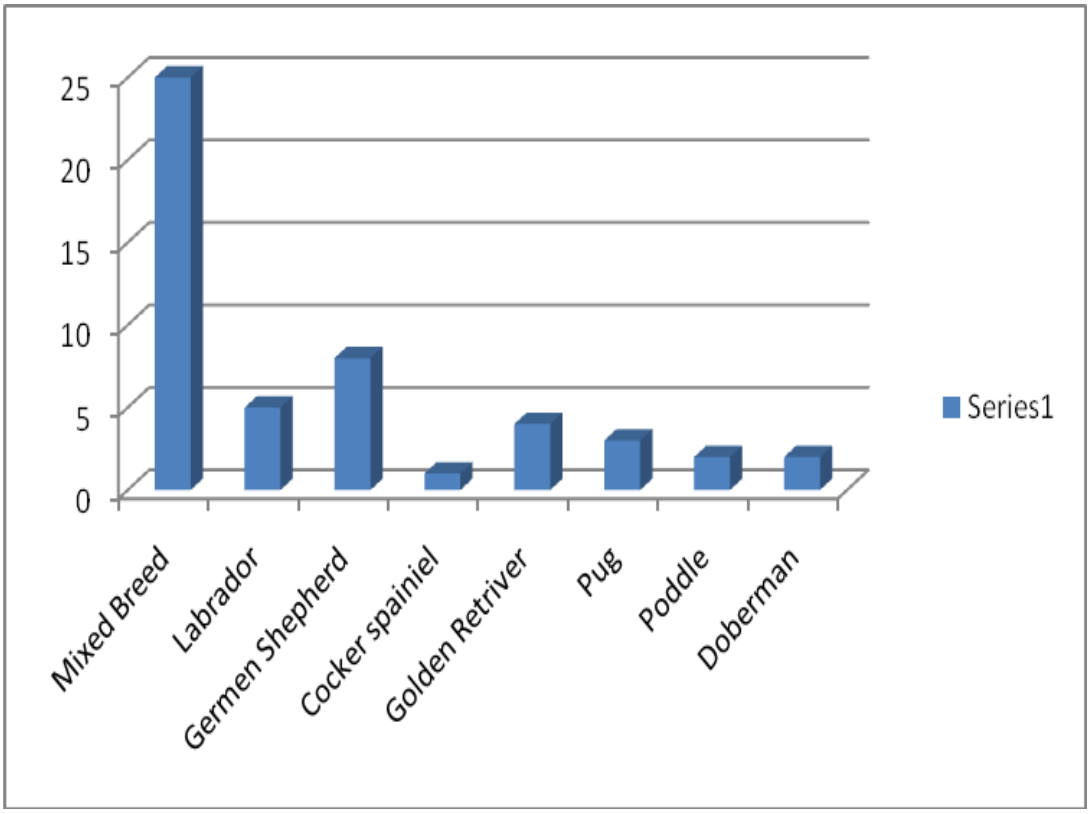
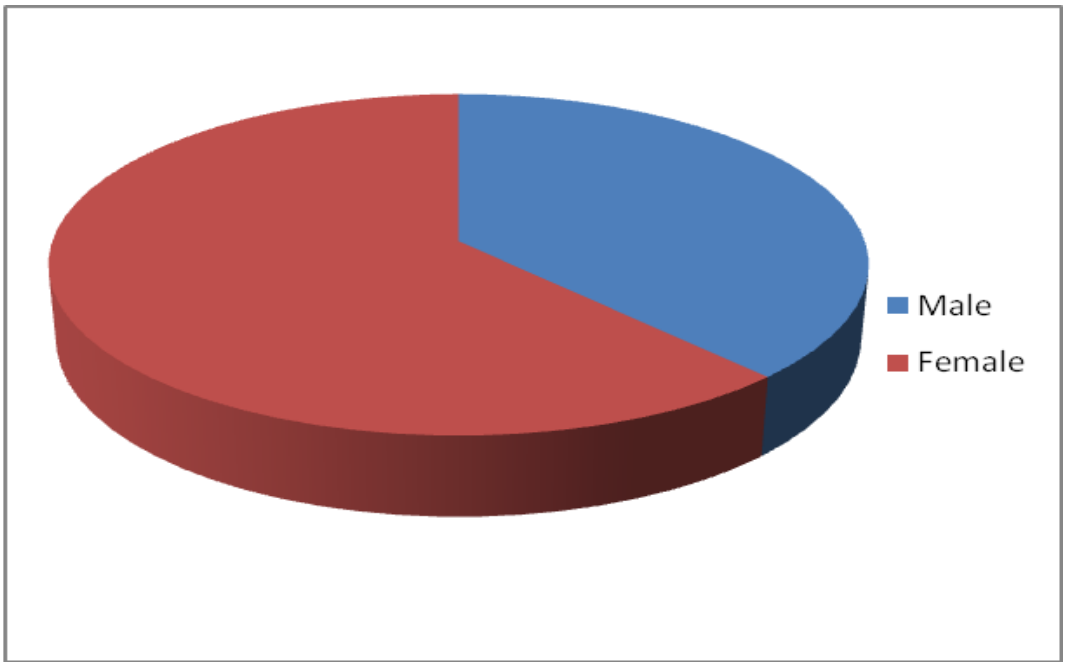
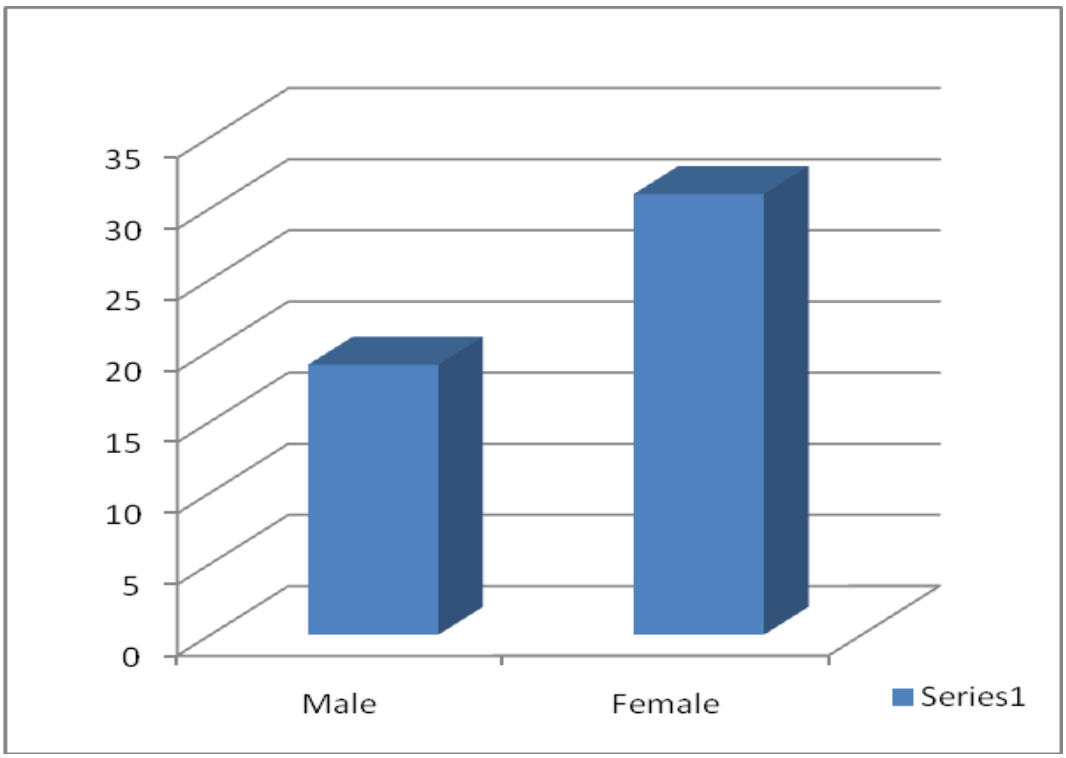
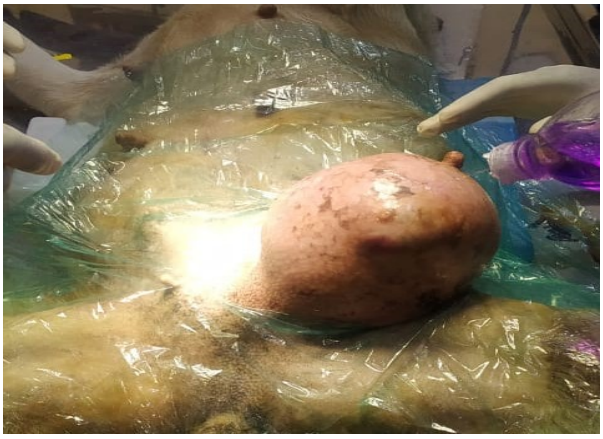


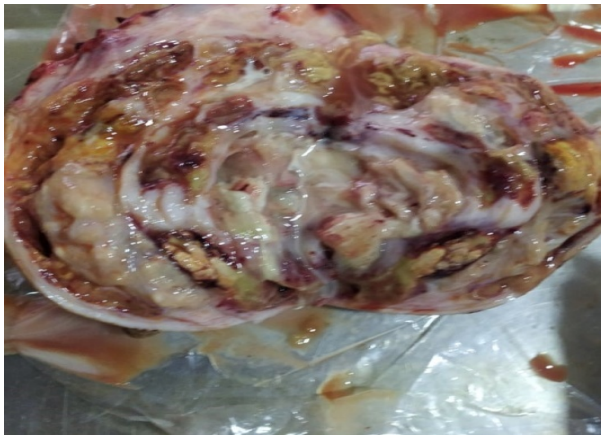
Figure 3: BASED ON GENDER



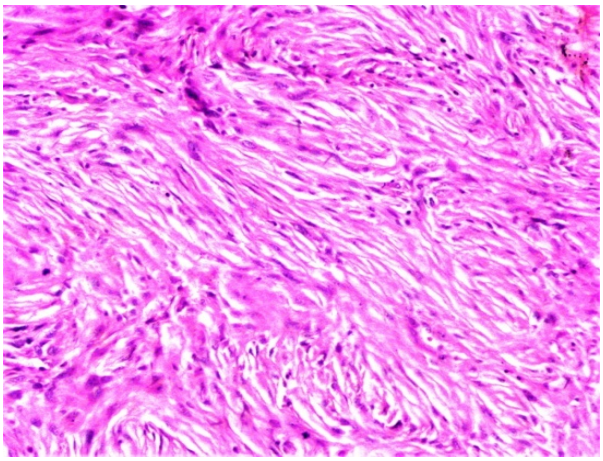




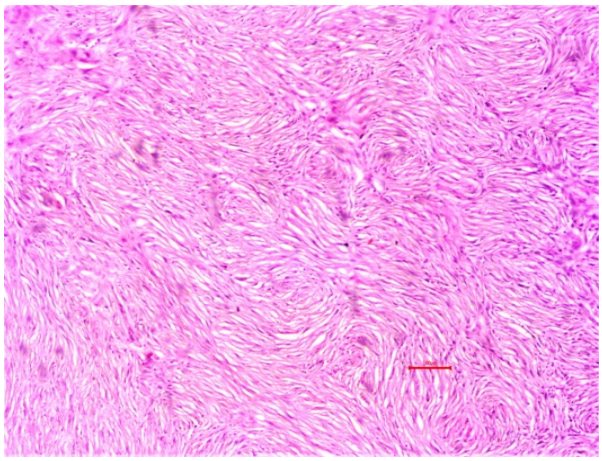
Size of tumor collected was 15cm * 9cm



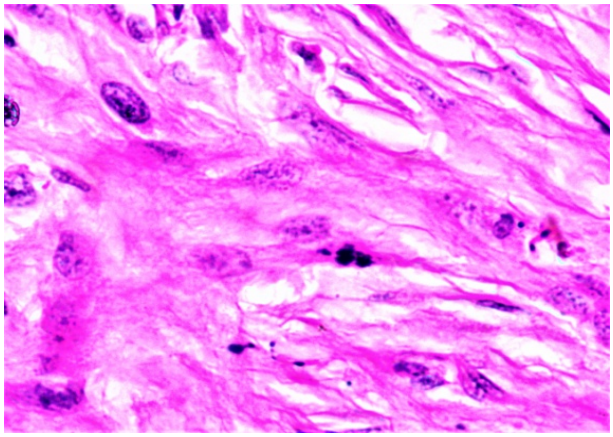
Cut Section of the growth



Diffused multidirectional proliferation of fibrous connective tissue, 100 X
Fibrosarcoma H&E Stain



leading to worling pattern.,40 X
Fibrosarcoma, H&E Stain



400 X Fibrosarcoma H&E Stain

PLATE 01: Fibrosarcoma

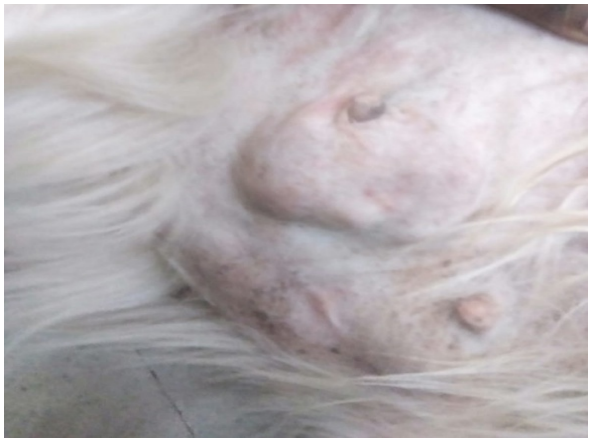
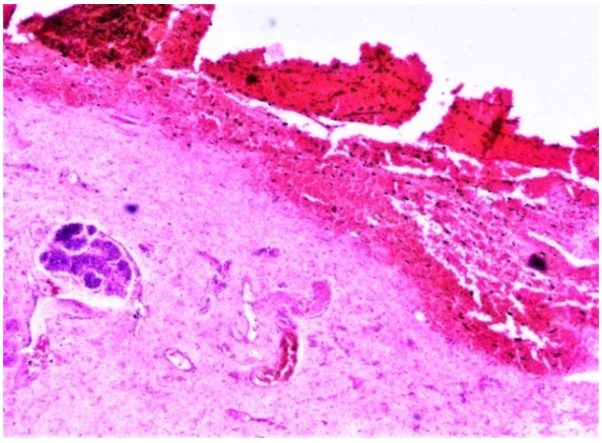
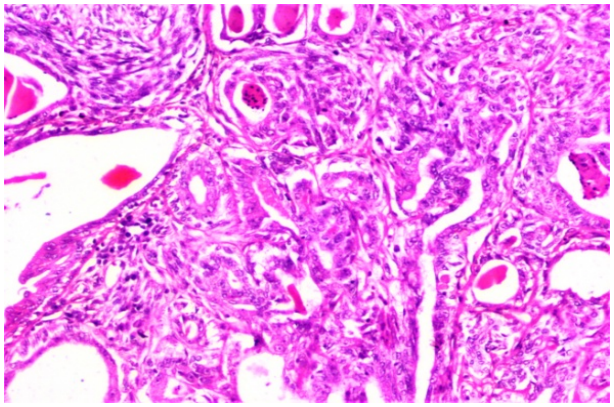


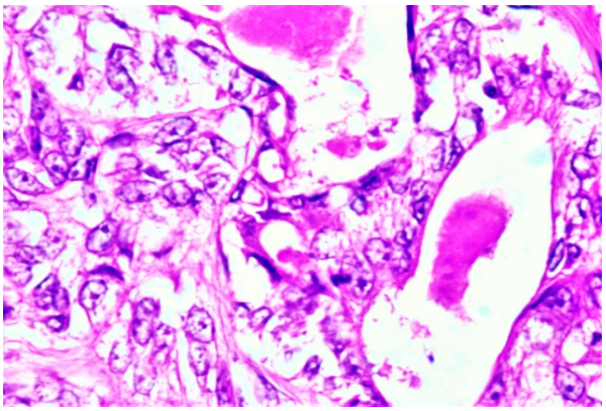
Image indicating affected ingual glands



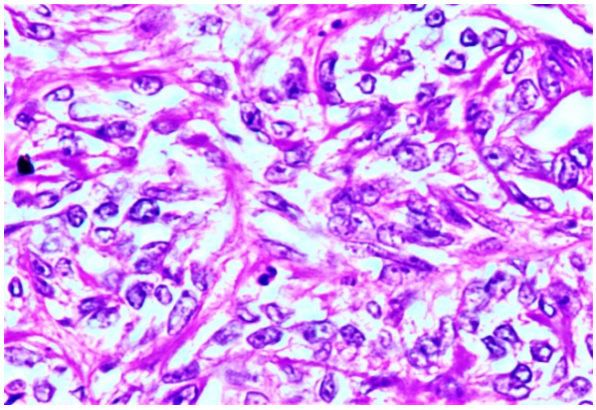
Granulation tissue, H&E stain, 40X



Multifocal areas of glandular epithelium in acini,H&E stain, 100X Adenocarcinoma

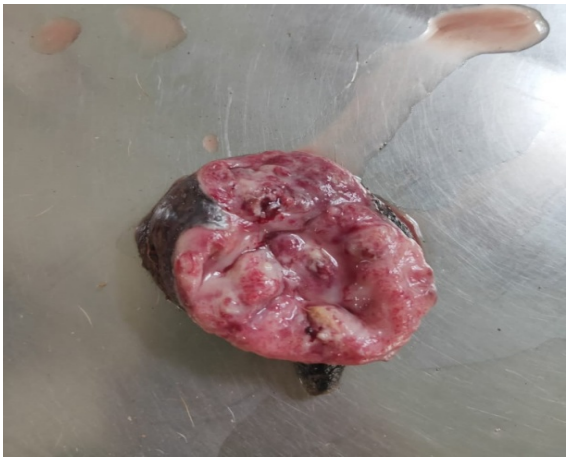


Solid Adenocarcinoma, H&E stain,400X

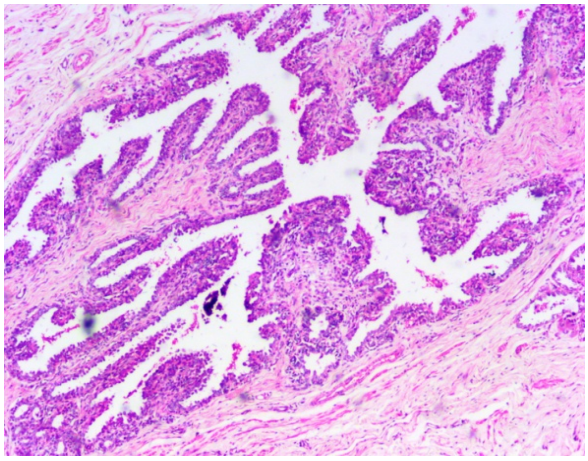


Mitotic figures, Solid Adenocarcinoma, H&E stain, 400X,

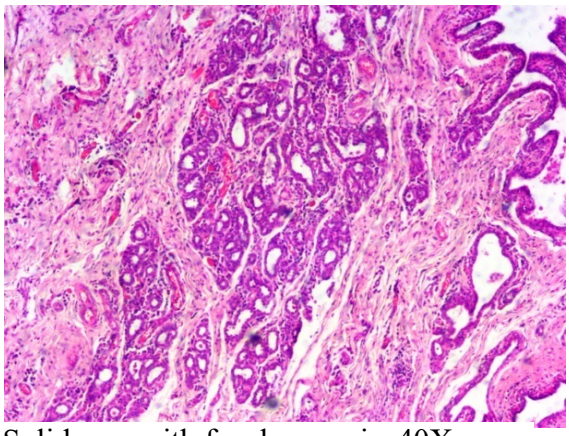
PLATE 0 2 : Adenocarcinoma of mammary gland



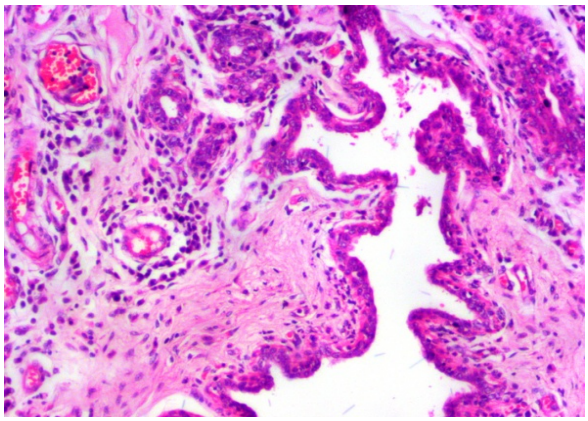
Cut section, it was found to posses cystic cavities with white colour diffusely spread throughout.



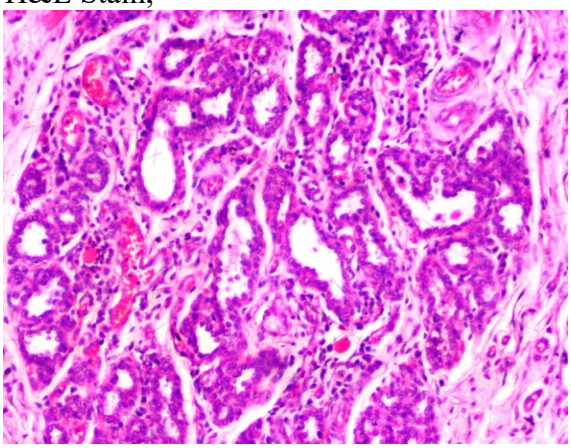
Fused glands,40X, H&E Stain



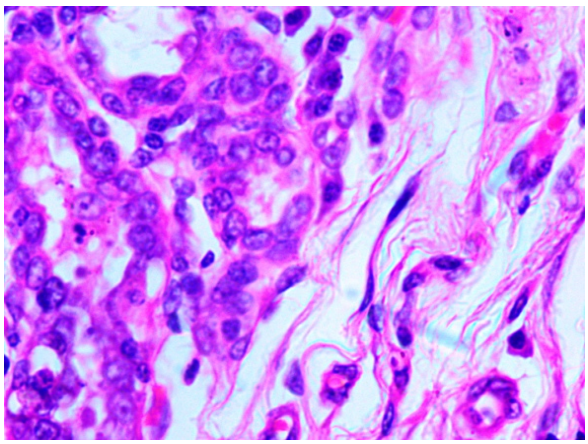
Solid area with focal necrosis, 40X, H&E Stain,



100X Papillary adenocarcinoma

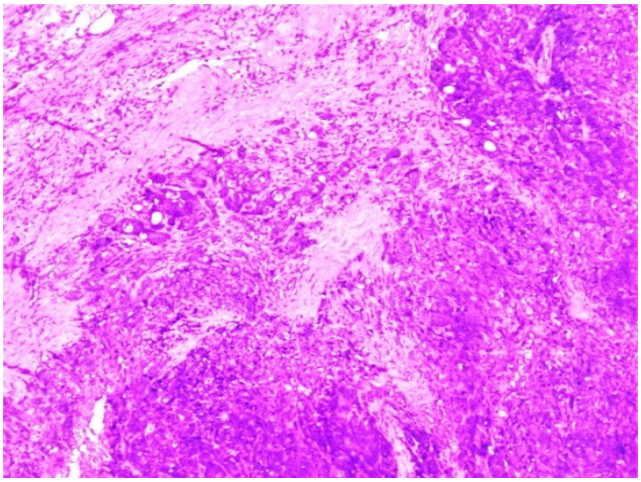


Small nest and lymphatic invasion, 100X, H&E Stain

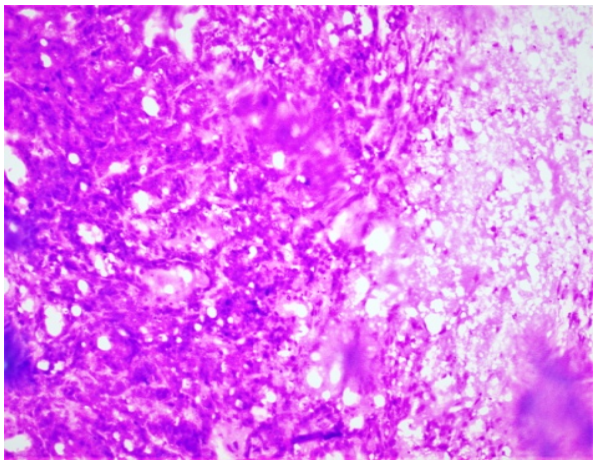


Small nest and lymphatic invasion, 400X, H&E Stain

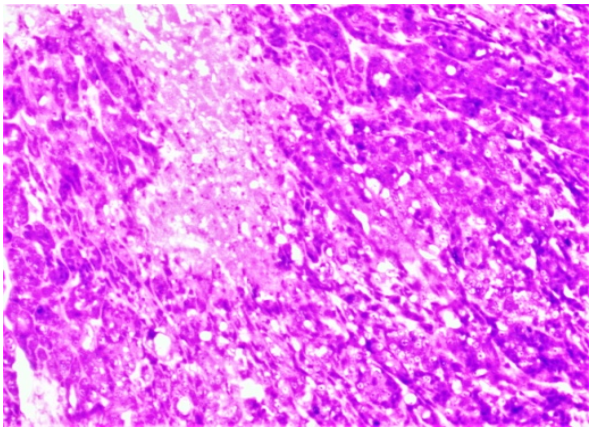
PLATE 03: Papillary adenocarcinoma



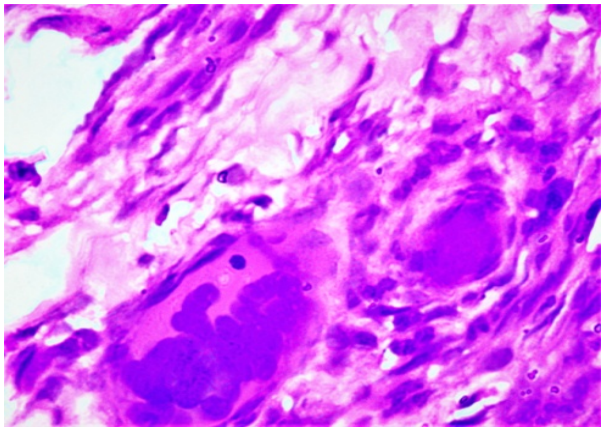
Irregular and diffused branching 40X, H&E Stain



100X, H&E Stain

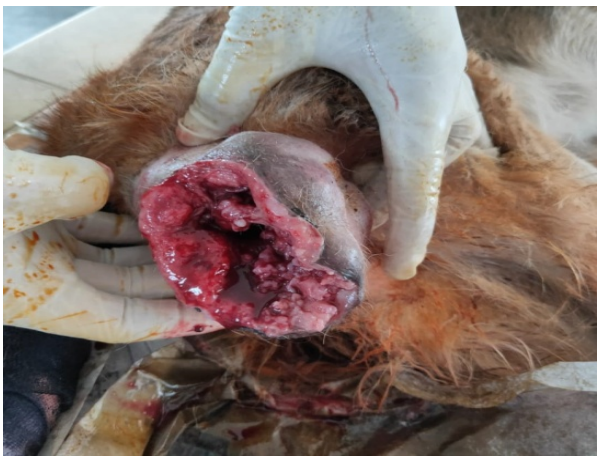


Dense cribriform, loose cribriform, solid and micropapillary patterns, 100X, H&E Stain

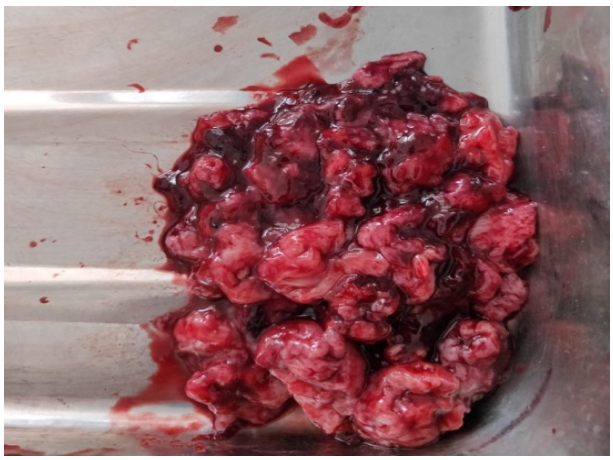


400X Intraductal Carcinoma,
100X, H&E Stain

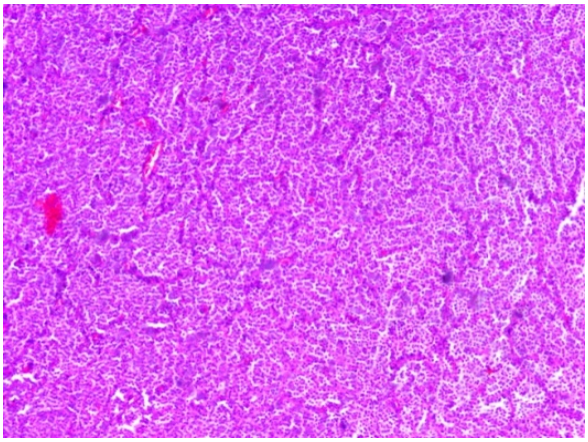
PLATE 04: Intraductal Carcinoma



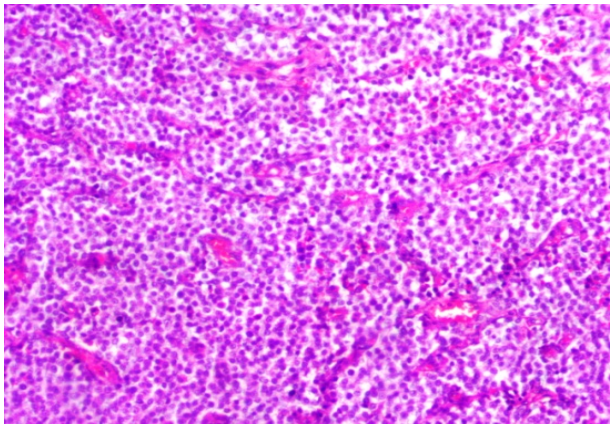
Multinodular in nature



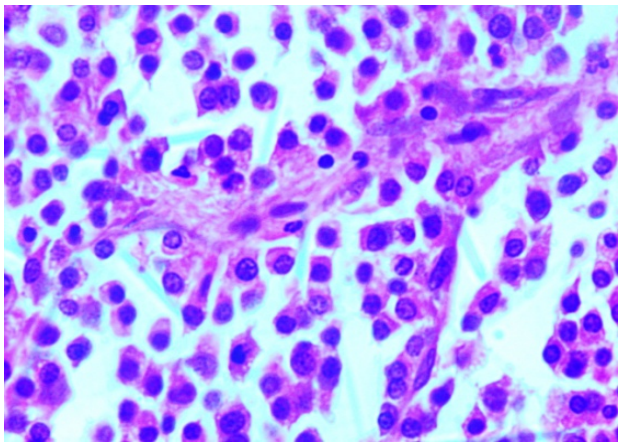
Consistency was found to be ranging from soft to hard



Single and distinct and centrally placed nucleolus and chromatin was present,40X, H&E Stain

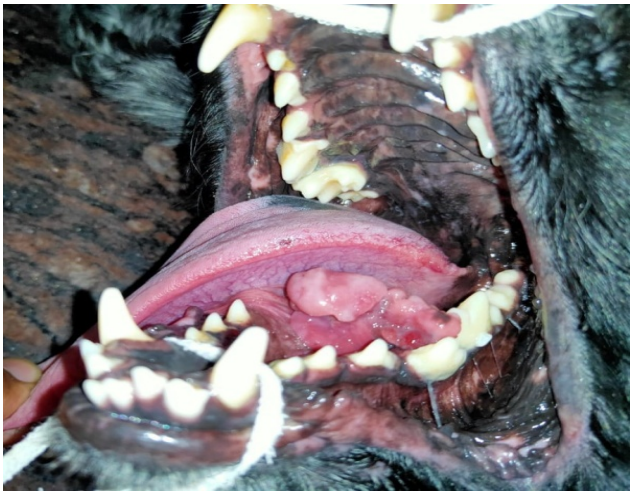


100X TVT H&E Stain

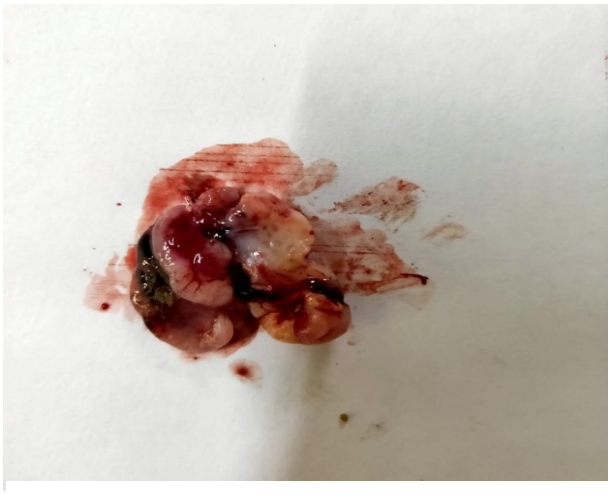


Round individual cells containing round and vesicular nuclei. ,400X, H&E Stain

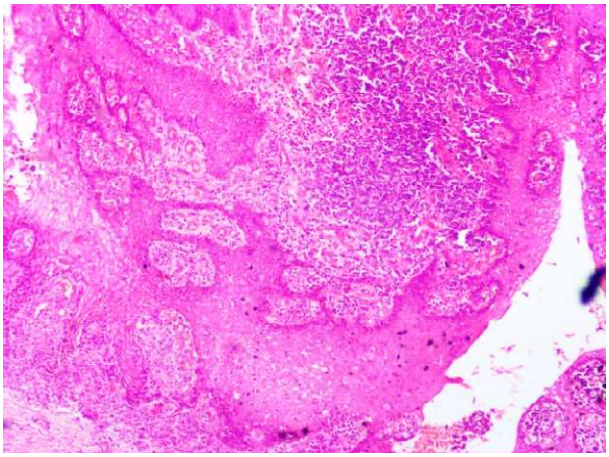
PLATE 05: Transmissible venereal Tumour



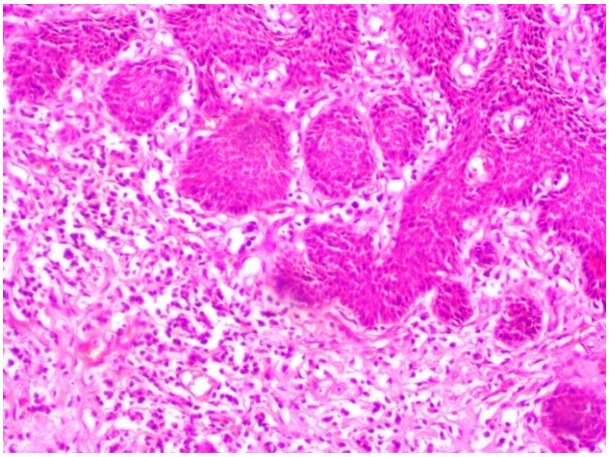
Colour was ranging from white to pink



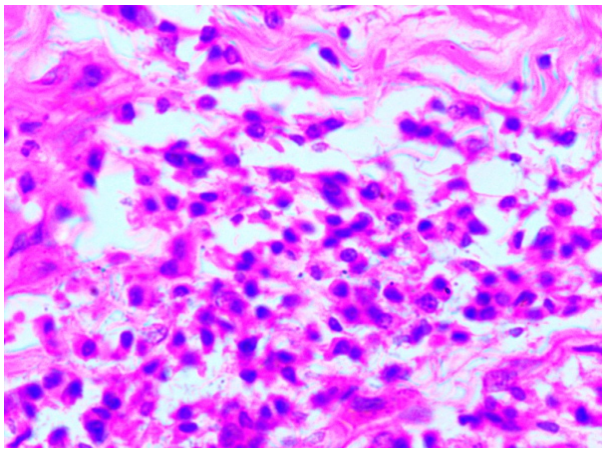
The growth was hard in consistency.



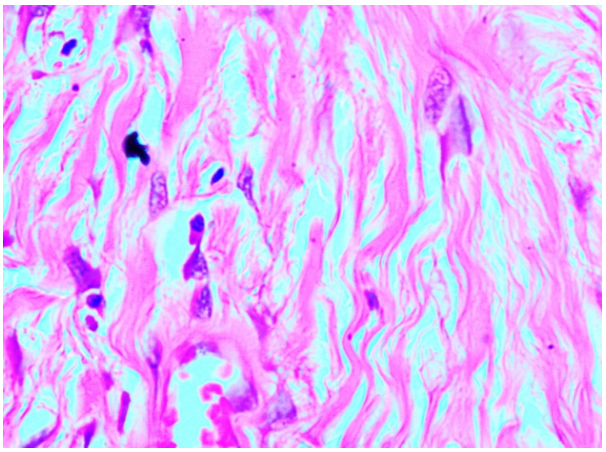
Expanding subepithelial connective tissue, 40X, H&E Stain.



Elevation of the overlying hyperplastic mucosa,100X, H&E Stain.

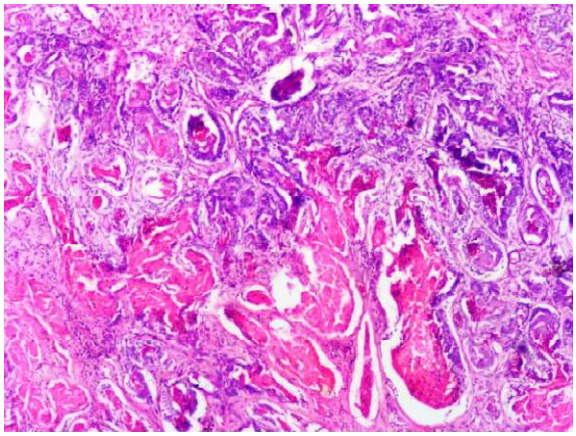


400X, H&E Stain.

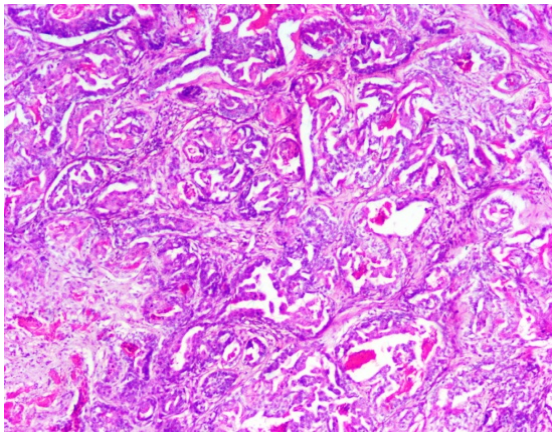


Loosely arranged streams of evenly spaced spindle to stellate cells separated by an abundant collagen matrix. H&E Stain

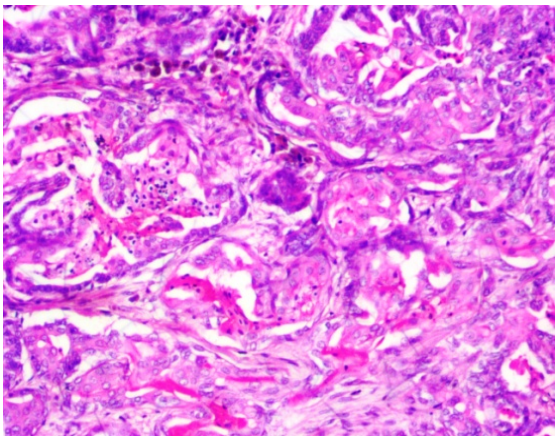
PLATE 06: Epulis



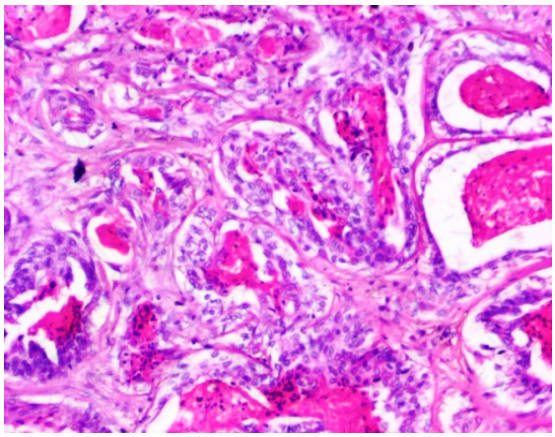
Proliferating cells formed packets, 40X, H&E stain.



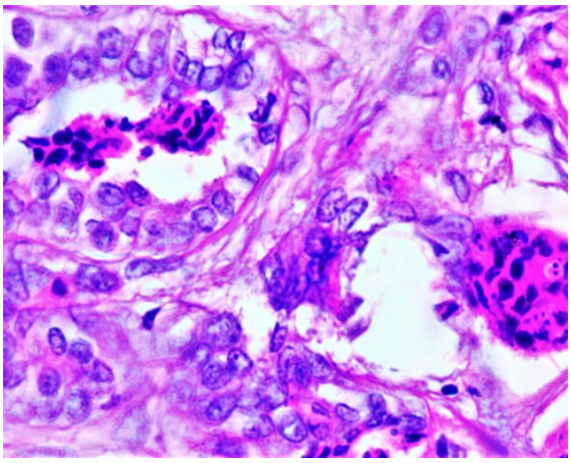
Adenoma 40X



Anaplastic nature, 100X, H&E Stain



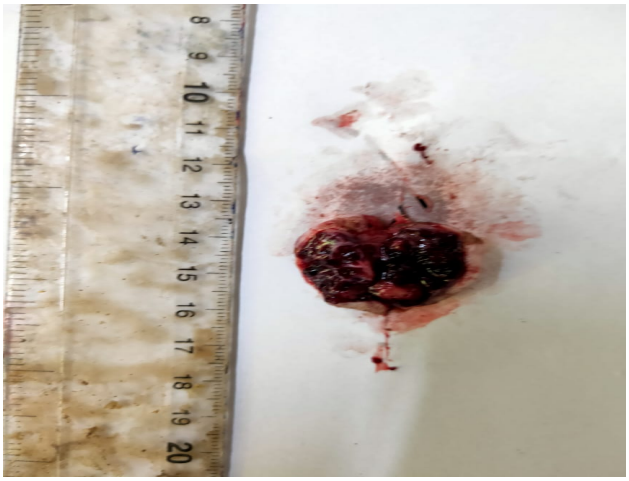
Adenoma 100X, H&E Stain



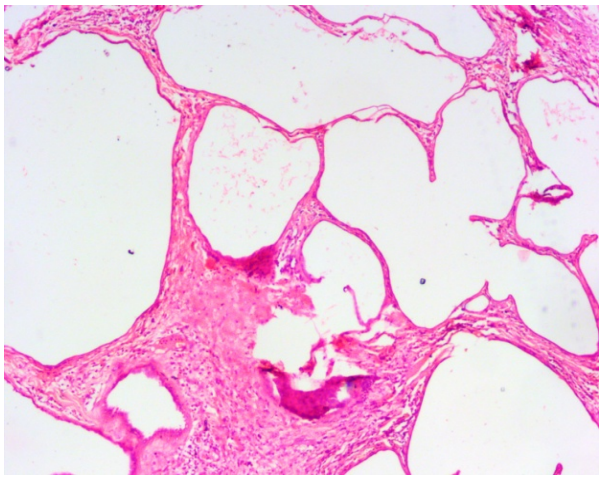
Adenoma 400X H&E Stain

PLATE 07: Adenoma

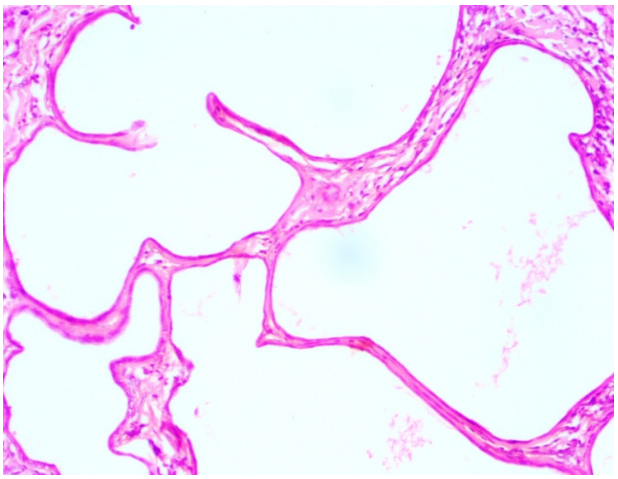
Gross Pre Surgery



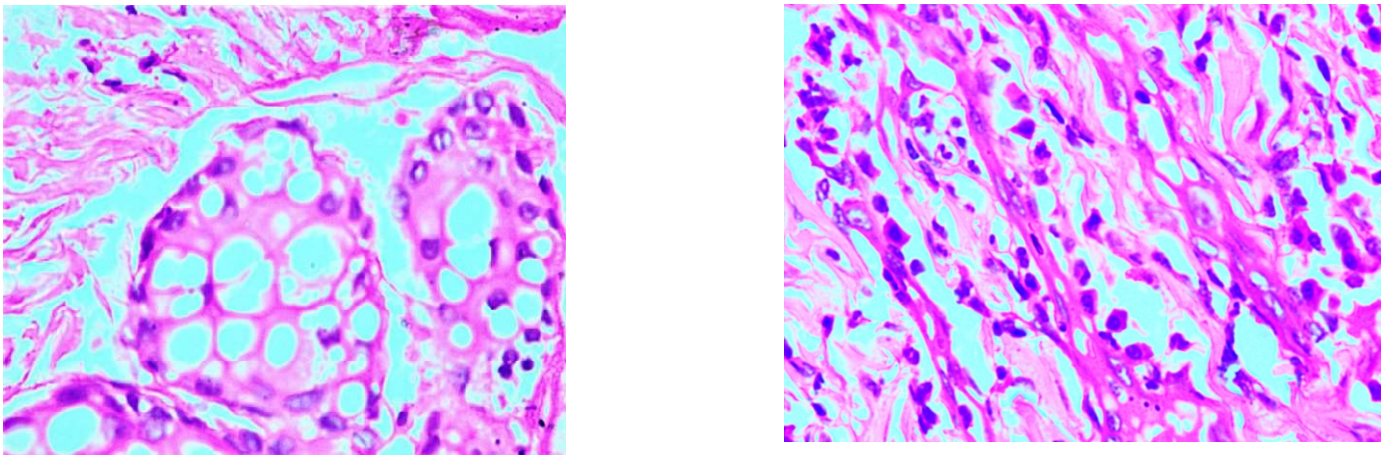
Gross Post Surgery after having cut section



Overlying hyperplastic mucosa, 40X H&E Stain.

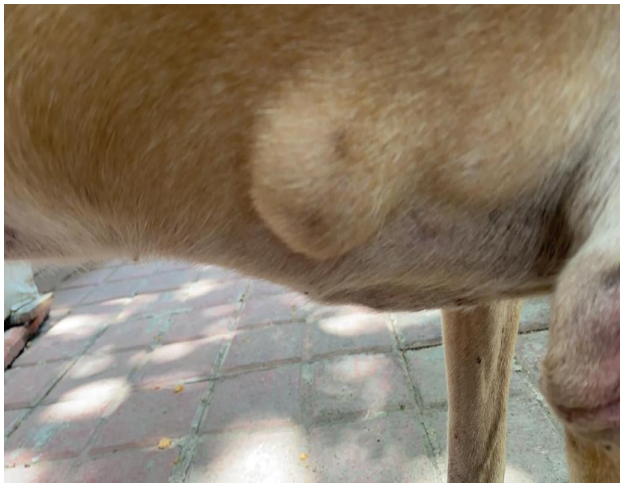


100X Adenoma, H&E Stain.

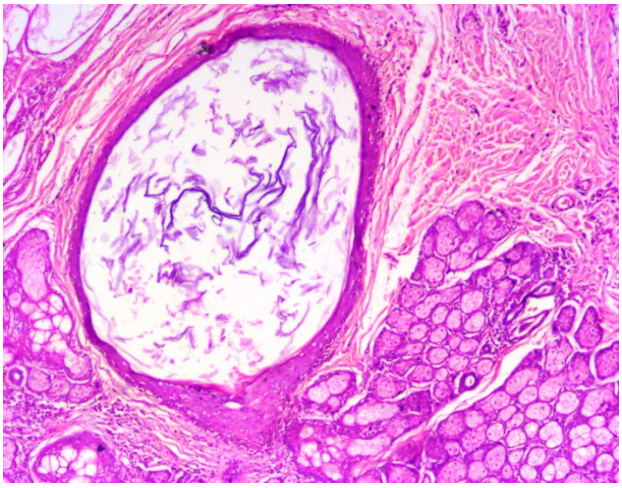


Loosely arranged streams of evenly spaced spindle to stellate cells separated by an abundant collagen matrix, 400X, H&E Stain.

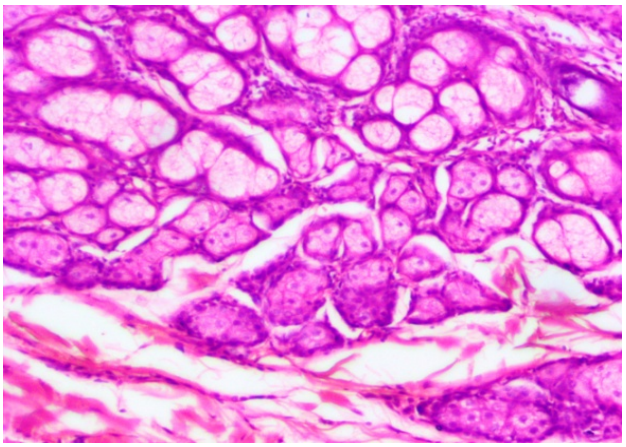
PLATE 08: Adenoma



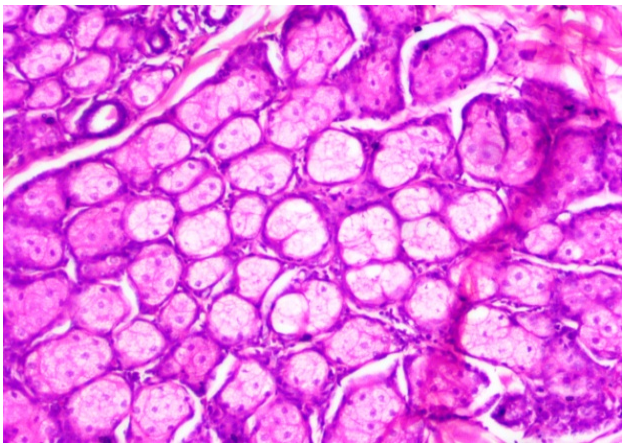
Growth noticed the lateral aspect of abdomen.



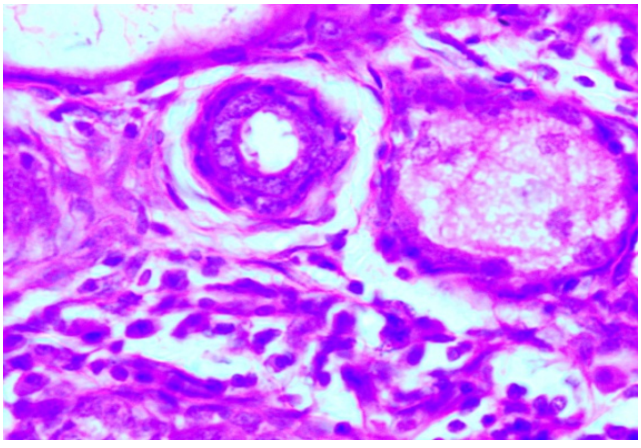
40X, H&E stain.



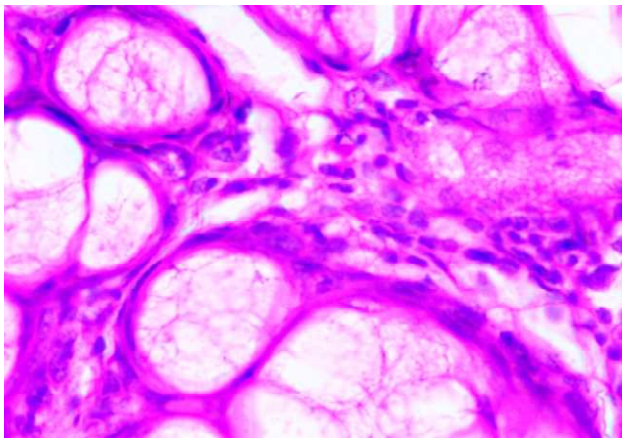
100X, H&E stain.



Overlying hyperplastic mucosa, 100X, H&E Stain.

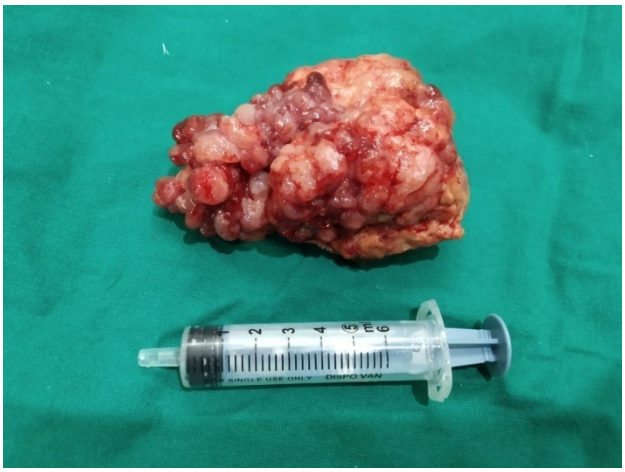


Streams of evenly spaced spindle to stellate cells separated by an abundant collagen, 400X, H&E stain.

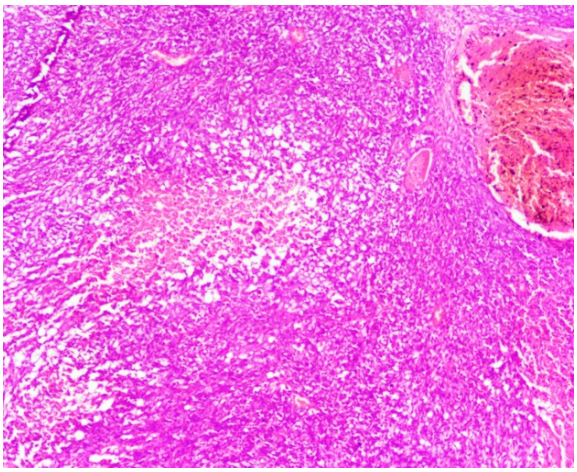


400X, H&E stain.

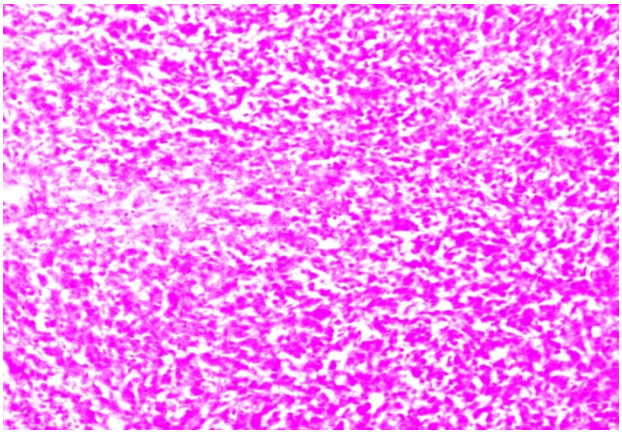
PLATE 09: Adenoma

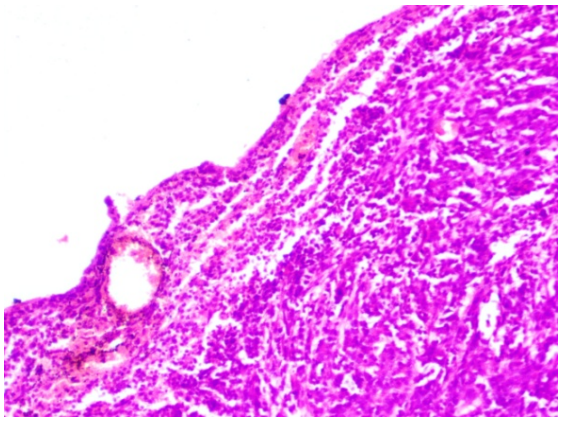


Size of the tumour was 9cm*5cm

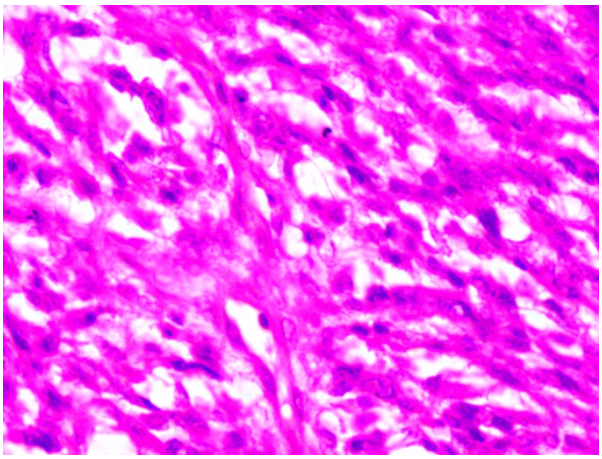


40X, H&E Stain

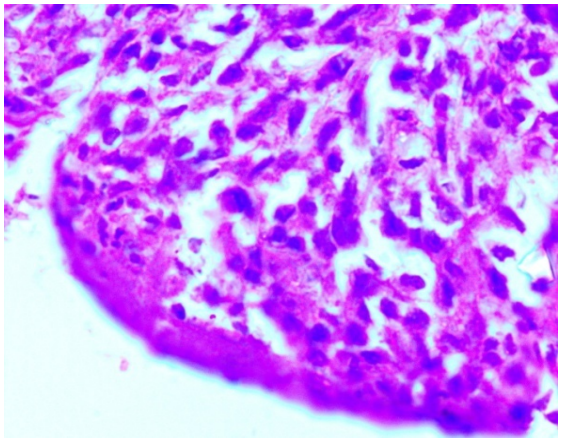




Arising from transitional urothelium, infiltrating the propria-submucosa and muscularis, with extension into the adventitia and adjacent peritoneal adipose tissue, non-papillary, infiltrative and unencapsulated.,100X Transistional cell carcinoma.

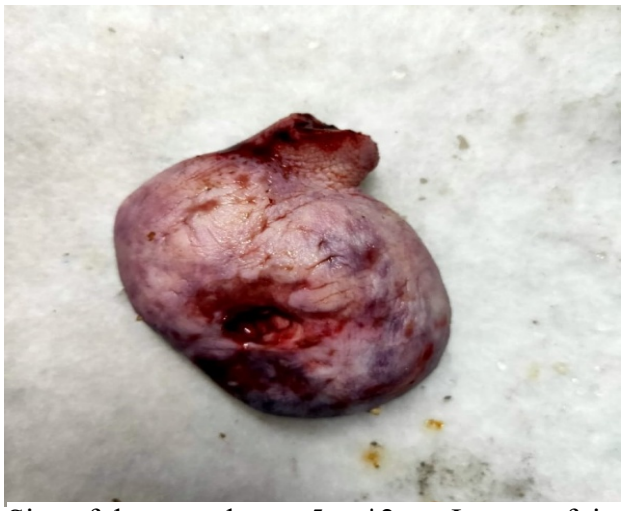


Cells are composed of cuboidal-to-columnar epithelial cells arranged in acini, tubules, and trabeculae, H&E Stain



Transistional Cell Carcinoma 400X, H&E Stain.

PLATE 10: Transistional cell carcinoma



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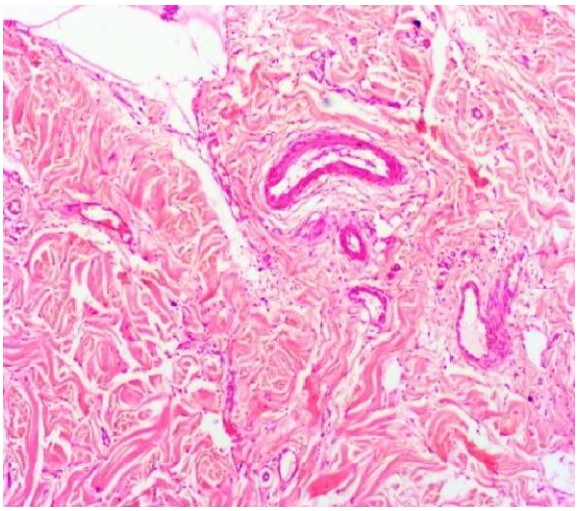
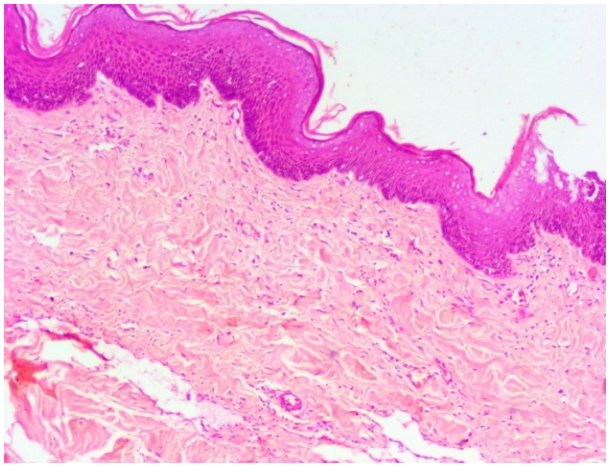
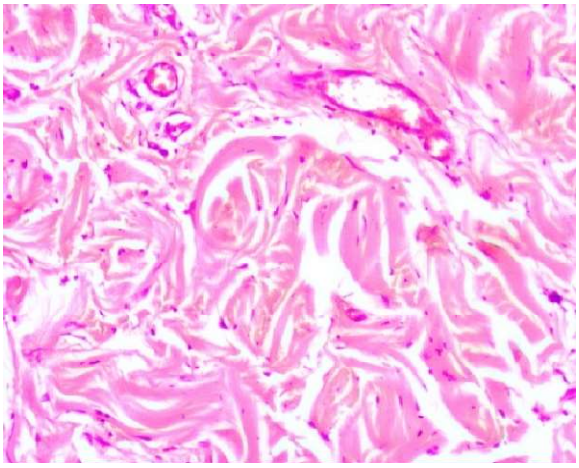
Size of the growth was 5cm*2cm. It was soft in consistency. Cut section showed it to be pink in colour.



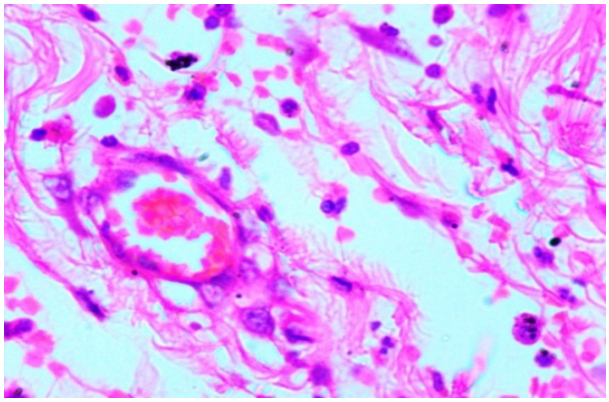
40X Rhabdomyoma

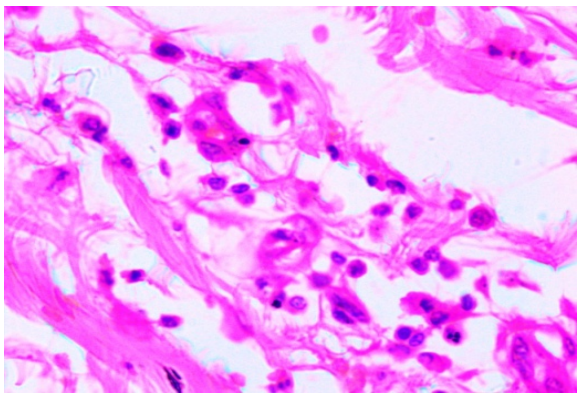


100X Rhabdomyoma



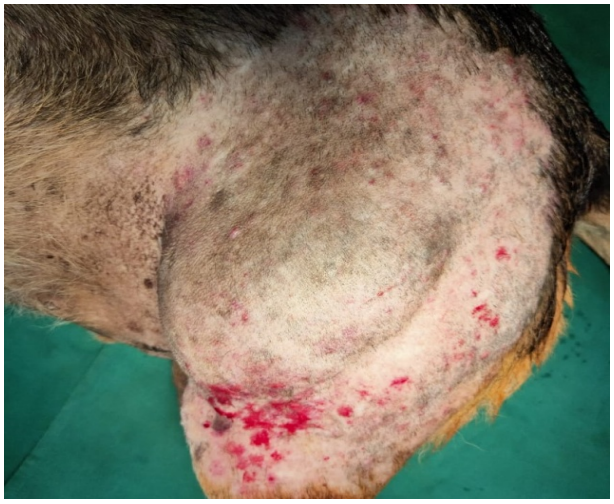
Well circumscribed, non encapsulated sheets of skeletal muscles. 100X, H&E Stain.



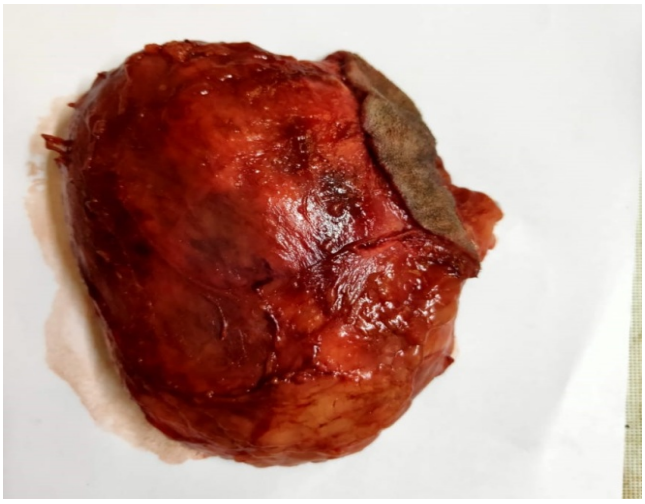


Cells are polygonal, round with abundant eosinophilic fibrillar cytoplasm with frequent cross striation and intracytoplasmic rod like inclusion. 400X, H&E Stain.

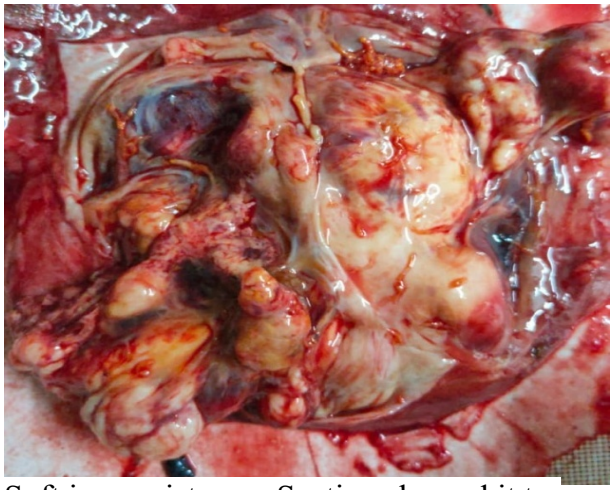
PLATE 11: Rhabdomayoma



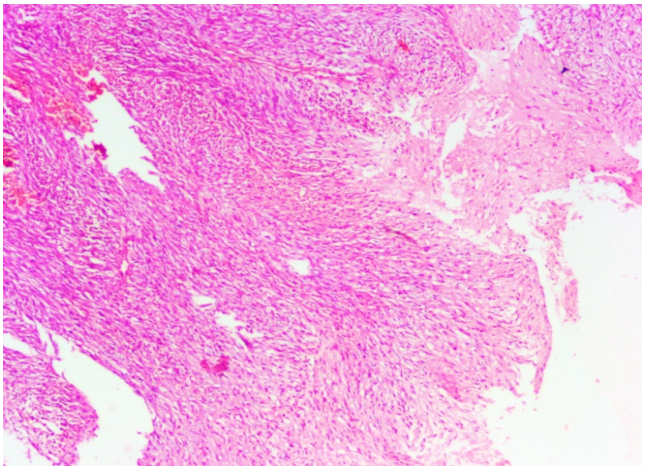
Circumscribed in the muscles of the left hind limb of the dog



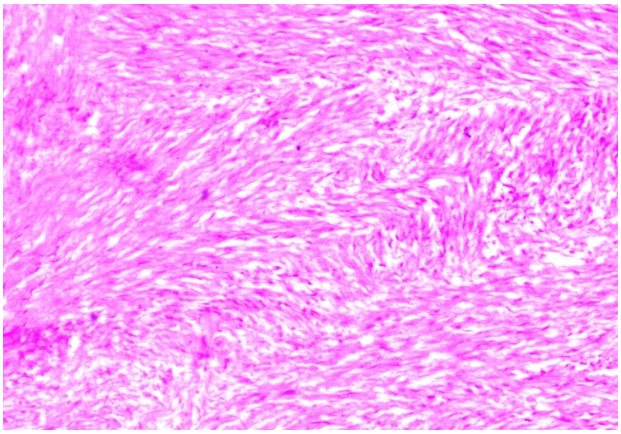
Cut section

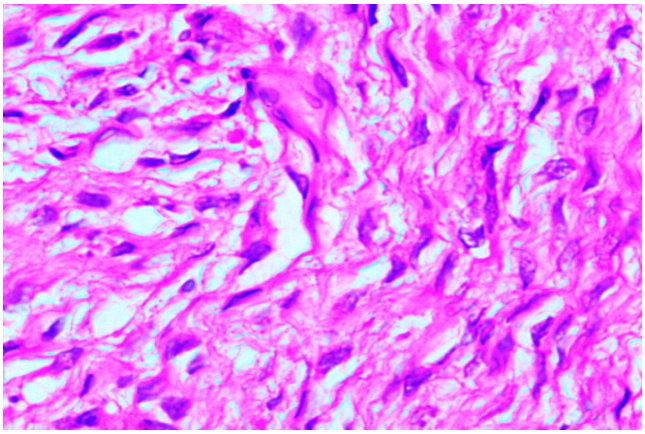


Soft in consistency. Section showed it to be pink in colour.



Unencapsulated, sparsely cellular neoplasm composed of spindle cells. 40X, H&E Stain.

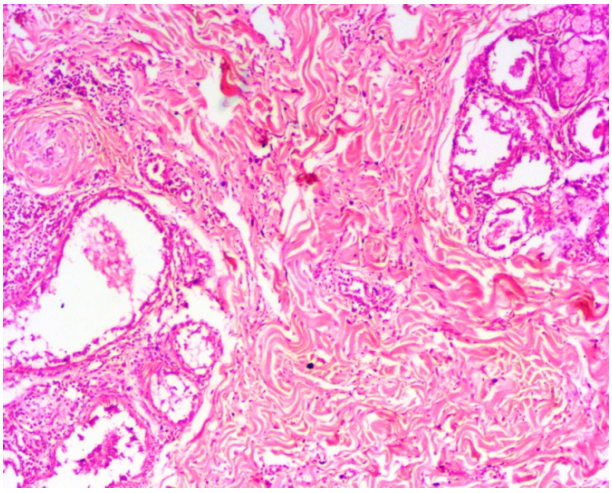




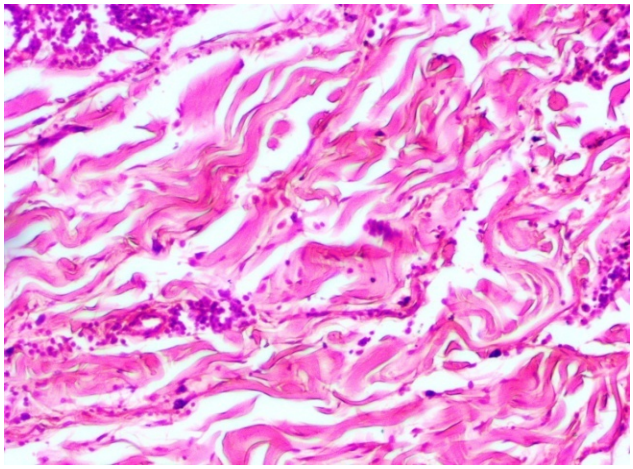
Interlacing streams and bundles, supported by an abundant, dense collagenous matrix. H&E Stain.

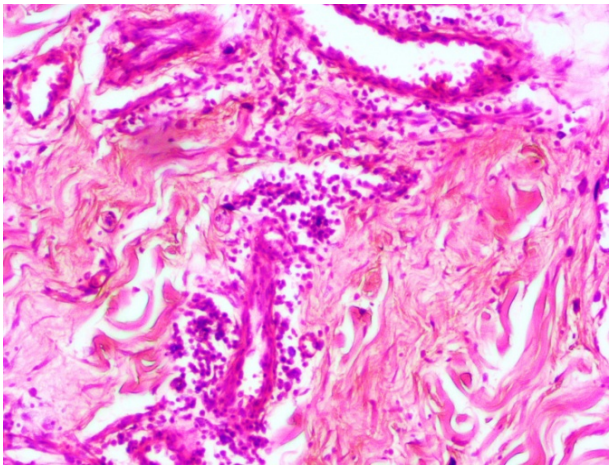
PLATE 12: Fibroma

Beside the preputial cavity of the dog.

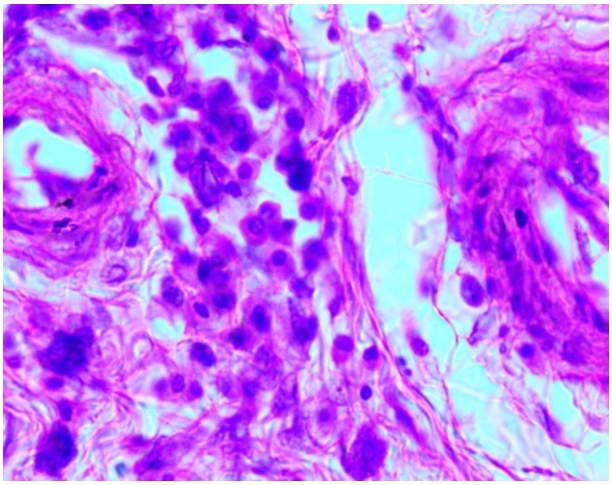


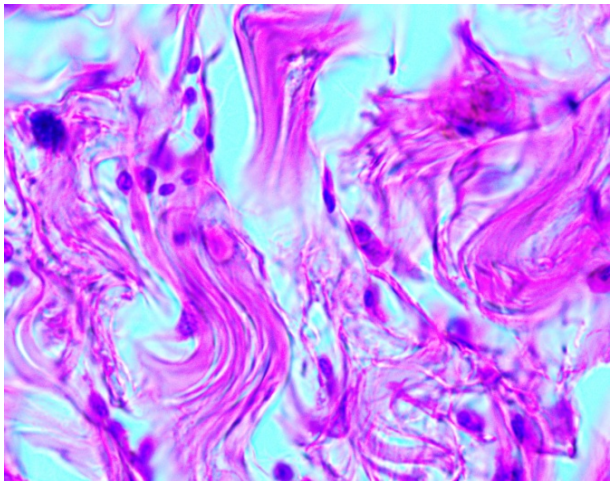
40X Histiocytoma, 40X, H&E Stain.





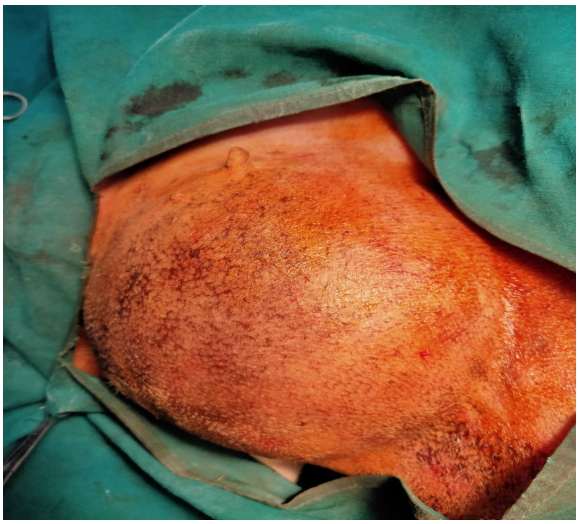
Wedge shaped appearance, 100X, H&E Stain.



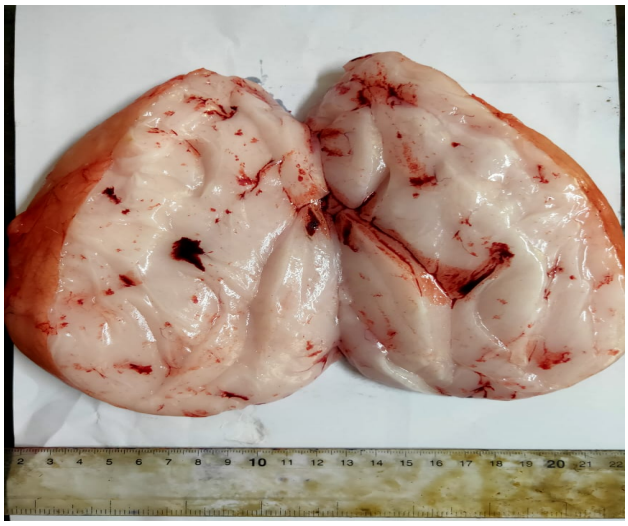


Round cells placed in the pattern of sheets in the dermis and epidermis. 400X, H&E Stain.

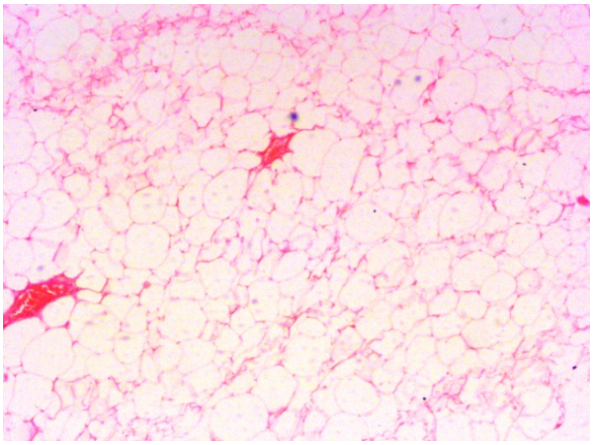
PLATE 13: Histiocytoma



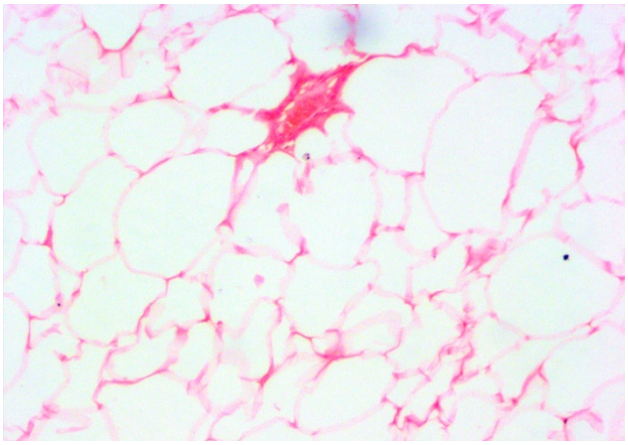
Gross : Pre Surgery



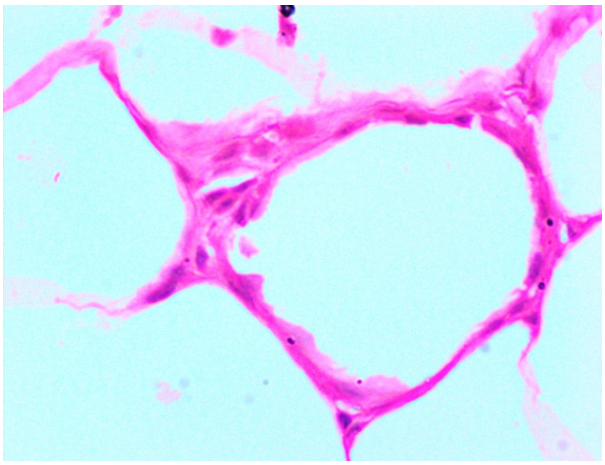
Gross: Cross Section



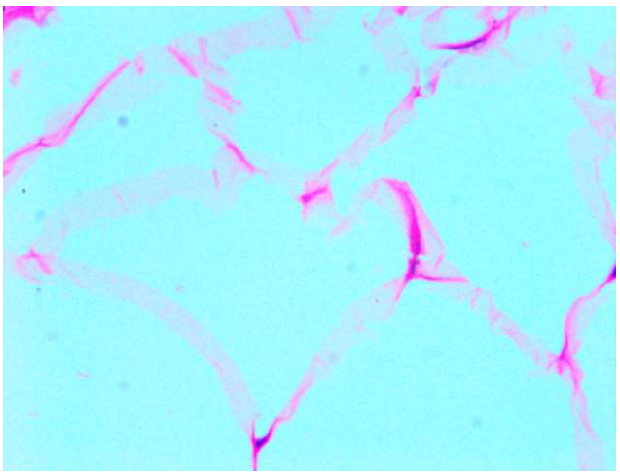
40X Lipoma, Proliferation of adipocytes, H&E Stain.



100X Lipoma, H&E Stain.

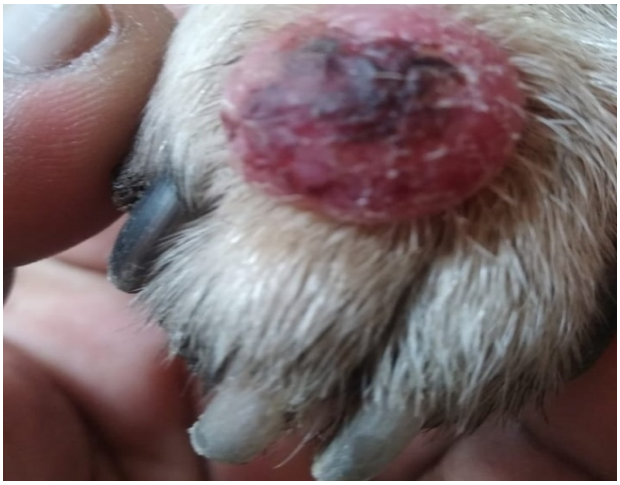


Paucicellular fibrous septa were present.,400 X Lipoma, H&E Stain.

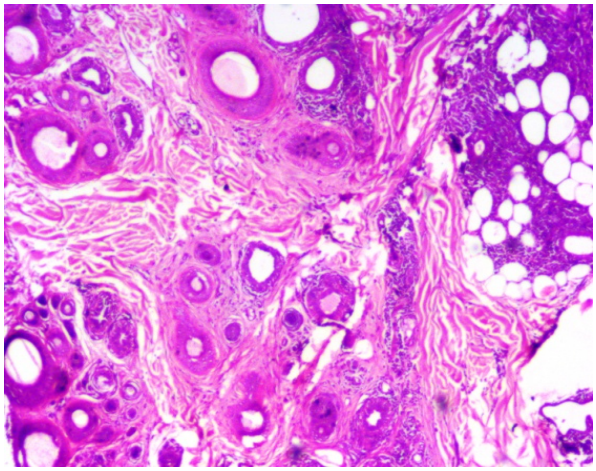


400 X Lipoma, H&E Stain.

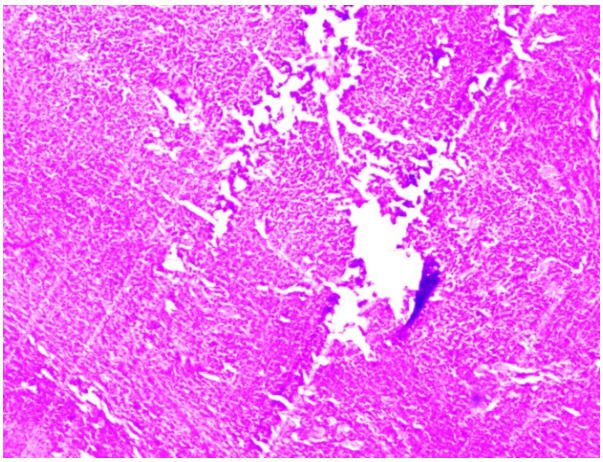
PLATE 14: Lipoma



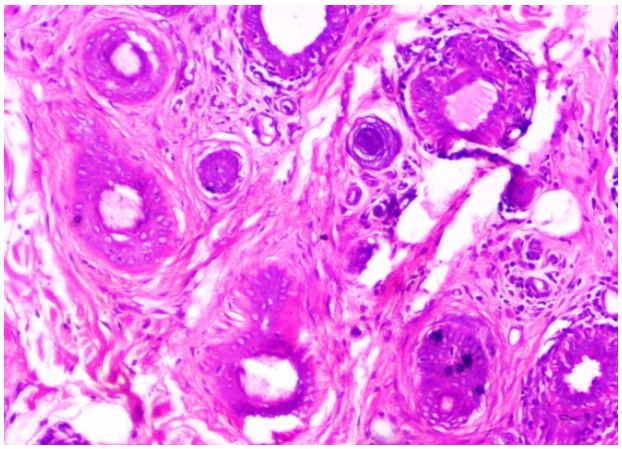
The growth was 3*2cm in size.



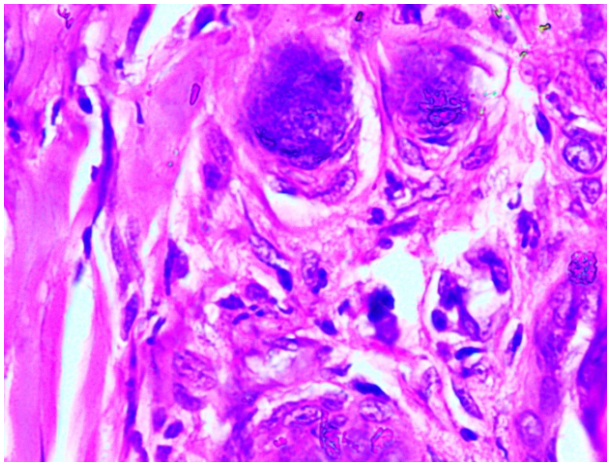
Solid nests of basaloid cells, 40X,
H&E Stain



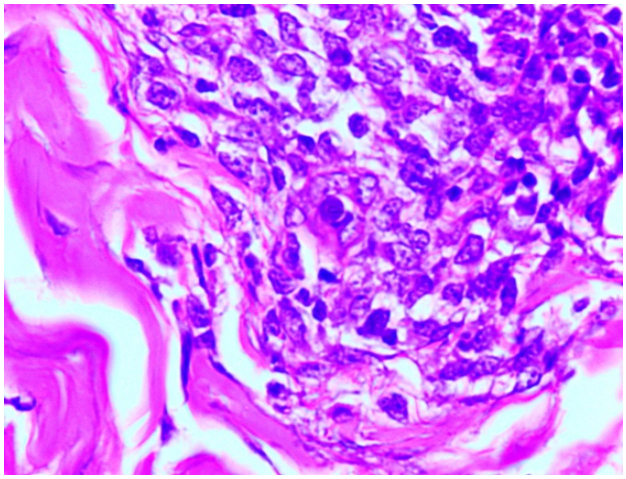
40X Pilomatrixoma



Transeipdermal peforation , 100X,
H&E Stain.

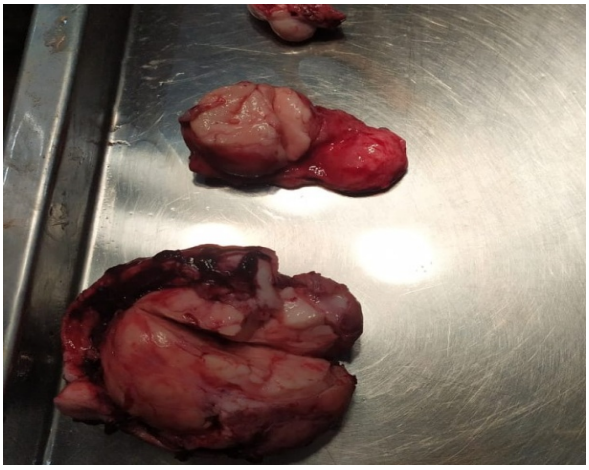


400X Pilomatrixoma

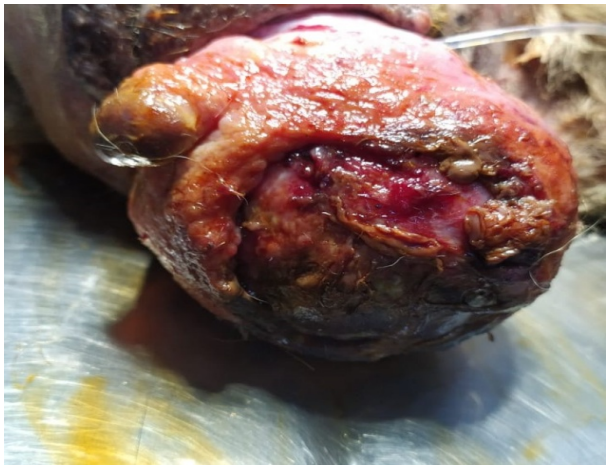


400X Pilomatrixoma

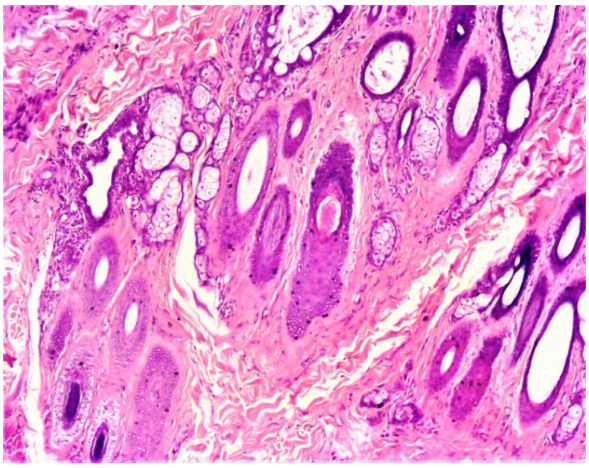
PLATE 15: Pilomatrixoma



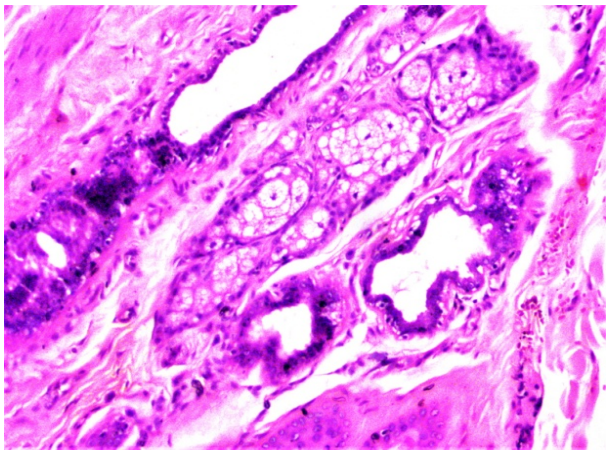
Tissue collected after surgery



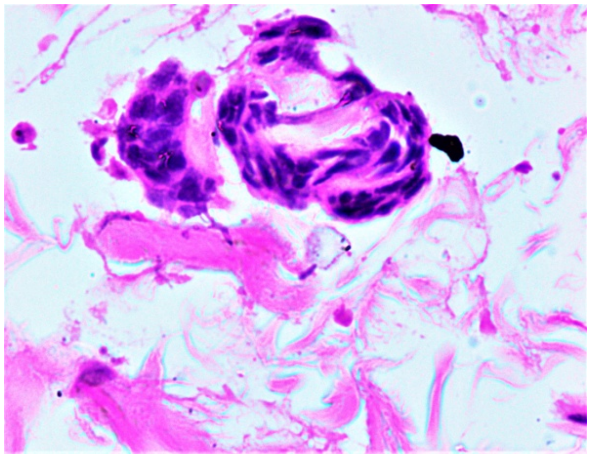
Ulcerative Growth noticed while clinical examination



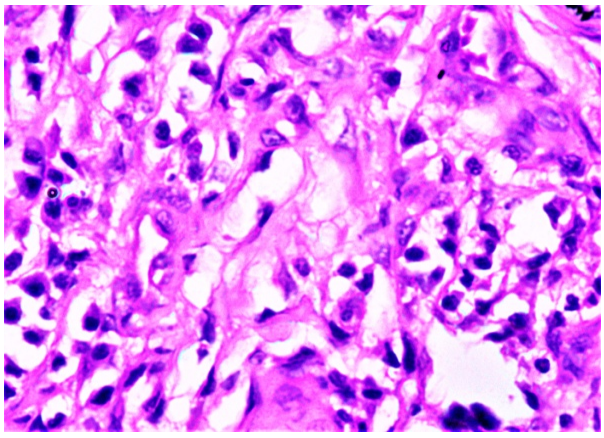
Circumscribed mass of ducts and lobules.40X, H&E Stain.



Ducts were dilated and accompanied by fibrosis.100X, H&E Stain

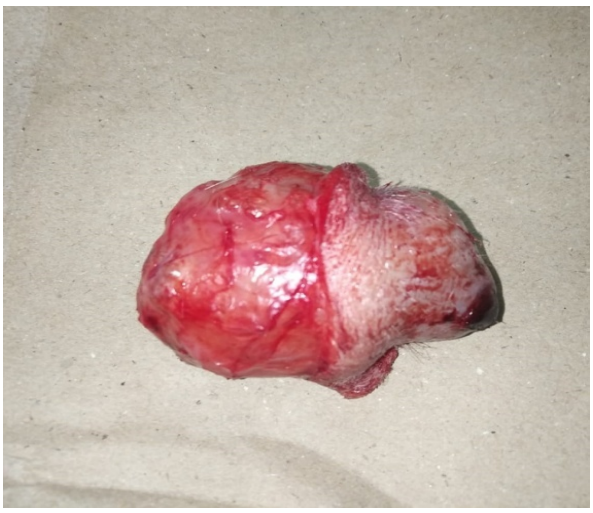


400X Hamartoma

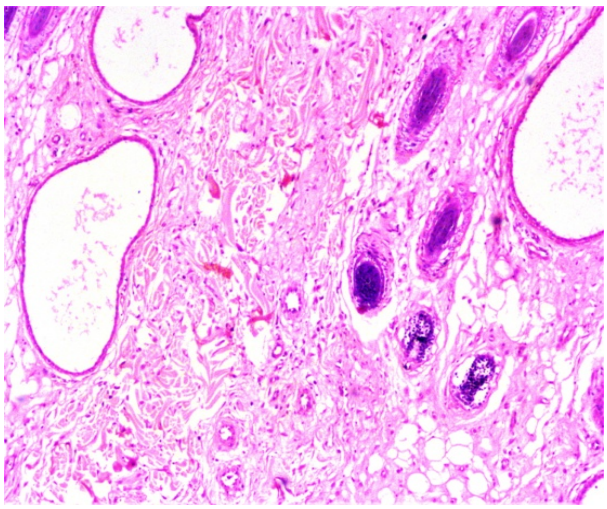


400X Hamartoma

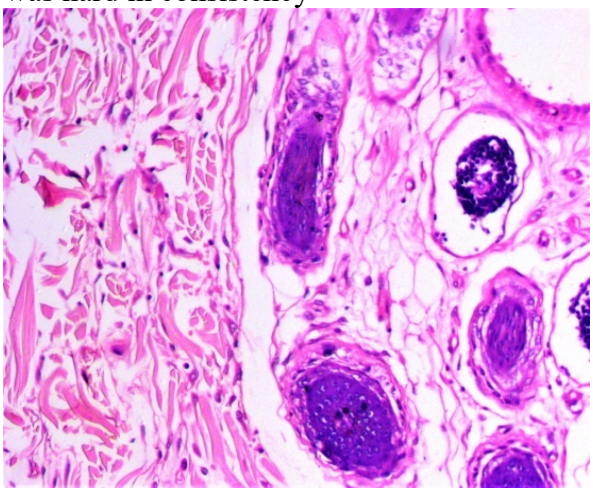
PLATE 16: Hamartoma



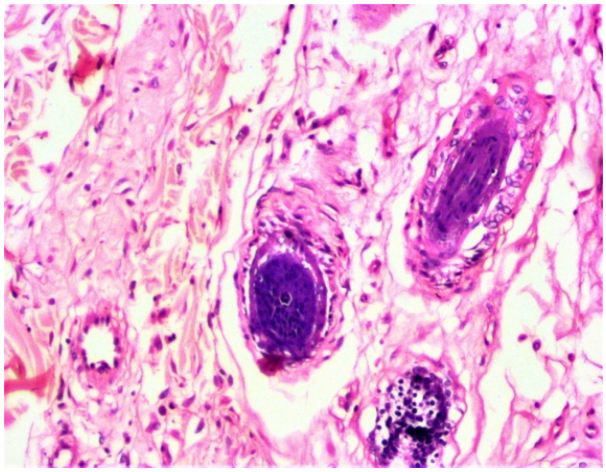
Gross image after collection of tissue post Surgery, The growth was hard in consistency



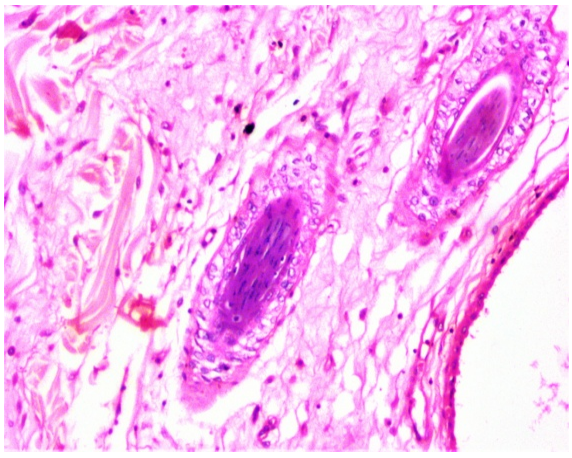
40 X Squamous cell carcinoma



Keratinisation was present along with the presence of keratin pearls.100X H&E Stain.

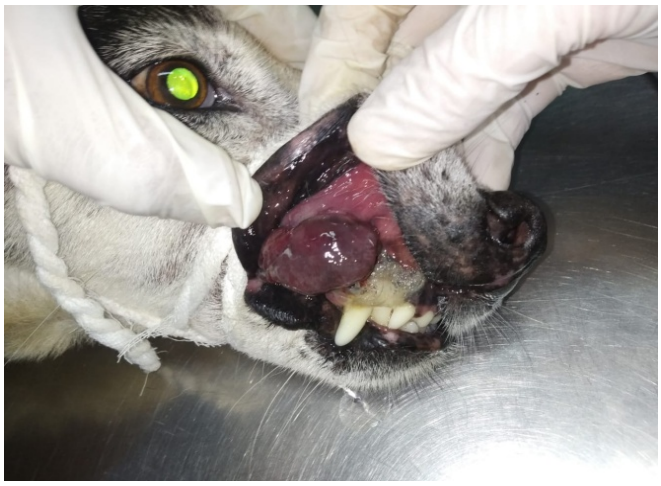


100 X Squamous cell Carcinoma

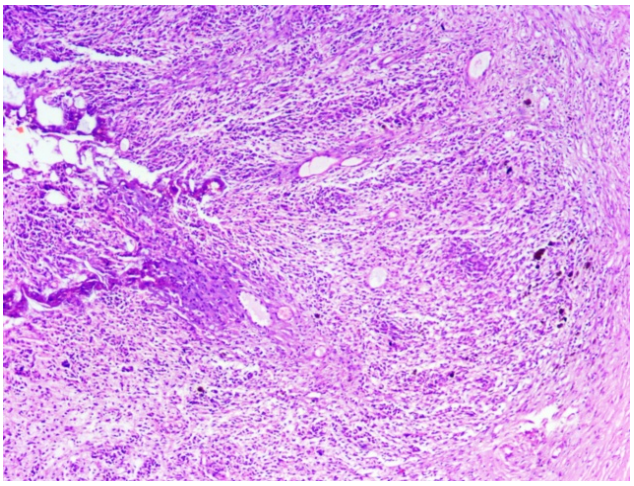


400 X Squamous cell Carcinoma

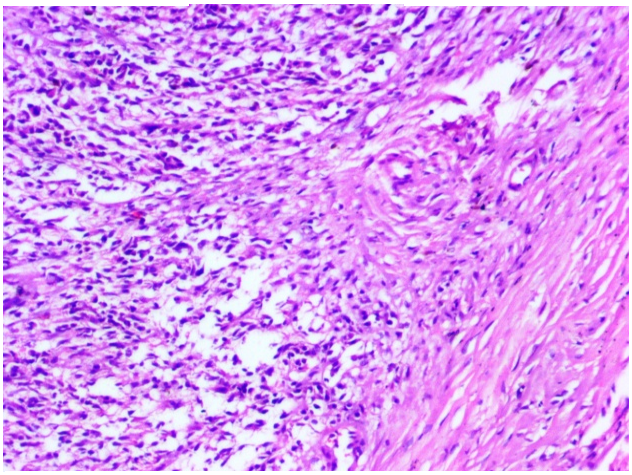
PLATE 17: Squamous Cell Carcinoma



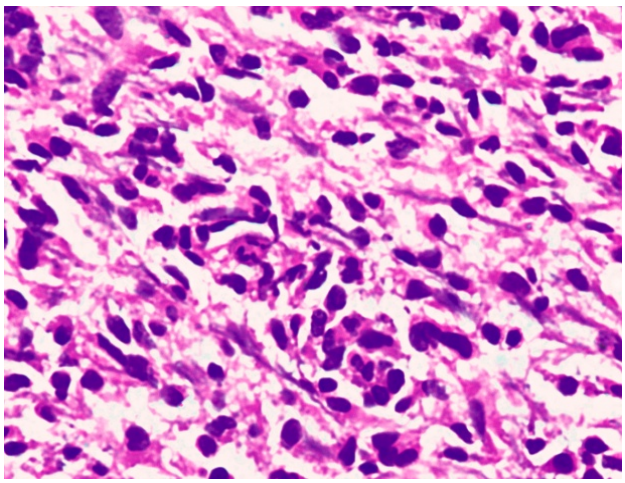
Growth was noticed to be 3*2.5cm



40X Mast cell tumour



Roughly spherical to oval cells present and anisokaryosis.100X H&E Stain



Nuclei spherical and vesicular with one or two distinct nucleoli.400X, H&E Stain.

PLATE 18: Mast Cell Tumour

CHAPTER 5

SUMMARY AND CONCLUSIONS

The present study was carried at the Department of Veterinary Pathology, Mumbai Veterinary College, Mumbai, Maharashtra, India to investigate the occurrence of neoplasms in Mumbai, to study clinical presentation and histopathological features of neoplastic lesion in dogs, to study the biochemical profile of canines with neoplasm and to study the correlation between serum calcium level and neoplastic conditions. Fifty neoplasms were collected along with the blood and serum. Gross examination and histopathology was done. The present study revealed that 38% malignant neoplasm as compared to 62% benign neoplasm.

It was evident that Females are more commonly affected with neoplasms than males since 62% tumors were found in Female dogs as compared to 38% in males dogs. The age of tumor bearing animals ranged from 3 Years to 12 Years old. The highest occurrence was observed between 5 to 8 years (58%) followed by 9 to 12 years (30%) of age and then 1-4 years (12%). Non descript breeds showed the highest occurrence of neoplasm with 52%(26 cases), Germen Shepherd 14% (7 cases), Labrador 10%(5 cases), Golden retriever 8% (4 cases), pug 4%(2 cases), Pomerenian and doberman with 4%(2 cases) each and lastly cocker spaniels with 2%(1 case)

Hematology revealed no major alteration in the values as considered the mean values and compared between benign and

malignant. Total leukocyte count was noticed to be increased in case of malignant neoplasm as compared to benign. Serum biochemistry did not show significant difference between the groups. Also CRP levels were elevated individually in case of inflammatory response.

The highest occurrence found was of mammary gland tumour with 24%(12) followed by adenoma of skin associated glands 14% (7), Fibrosarcoma 10%(5), Lipoma 10%(5), Transmissible veneral tumour 8%(4), Pilomatrixoma 6%(3),Round cell tumor6%(3), Fibroma 4%(2), Epulis 4%(2), Hemartoma 4%(2), Histiocytoma 2%(1), Rhabdomayoma 2%(1), Transistional cell Carcinoma 2%(1), Squamous cell carcinomas 2%(1) and mast cell tumour 2%(1).

Cases were grouped according to their classification as per histological description that is Malignant and Benign.

The mean values of Ionic Calcium were 1.27±0.03 and 1.28±0.01, total Calcium were 10.50±0.26 and 10.53±0.56 and that of Vitamin D were 33.16±7.35 and 13.37±2.04 for both the groups of benign and malignant respectively. All the calcium values of the samples collected were within the physiological reference range, indication no deviation or alteration.

CONCLUSIONS:

From the present study, the following conclusions could be drawn

1. Occurrence of benign neoplasms was more in dogs as compared to malignant neoplasms.
2. Non-descript breed of dogs was found to be more susceptible to neoplasms followed by Germen shepherd.
3. Occurrence of Neoplasm was more in females than in males.
4. Highest occurrence of neoplasm was noticed n the age group of 5 to 8 Years.
5. C-reactive protein levels may not always be elevated in dogs affected with tumors.
6. The serum calcium and vitamin D levels are independent of neoplastic condition in canines.

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THESIS ABSTRACT

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11)	Signature of the Associate Dean		

ABSTRACT

CLINICOPATHOLOGICAL STUDIES OF NEOPLASM IN CANINES.

Neoplasia is the uncontrolled, abnormal growth of cells or tissues in the body, and the abnormal growth itself is called a neoplasm or tumour. It can be benign or malignant. Benign neoplasms do not grow aggressively, do not invade the surrounding body tissues, and do not spread throughout the body. On the other hand, malignant neoplasm tends to proliferate rapidly, invade the tissues around them, and spread or metastasize to other body parts.

Fifty cases of neoplastic growth were enrolled and collected in the study. For these cases the blood samples were collected in EDTA and Plain Vials. The blood samples were processed for Hemoglobin, Haematocrit, Total erythrocyte count, Total Leucocyte count and Differential leucocyte count. Subsequently the serum was processed for biochemical test like Total protein, Albumin, Globulin, C- Reative Protein and also Vitamin D estimation by Radio immune assay and ionic calcium estimation. Finally the tissue of the growth was also collected and processed for histopathological examination.

It was found that the occurrence of Mammary gland tumour was highest with 24%(12). In the present study 62% (31/50) tumours were found in female. The average age of tumour bearing animals recorded was 7.28 years. As per the study, Non descript being 52% was recorded.

In haematological and biochemical data no significant difference was noticed and the mean values of Ionic Calcium were 1.27±0.03 and 1.28±0.01, total Calcium were 10.50±0.26 and 10.53±0.56 and that of Vitamin D were 31.16±7.35 and 13.37±2.04 for both the groups of benign and malignant respectively.

प्रबंध-सारांश

1. प्रबंधाचेशीर्षक	:	कॅनिन्समधील निओप्लाझमचा क्लिनिकोपॅथॉलॉजिकल अभ्यास.
2. विद्यार्थ्यांचे पूर्ण नाव.	:	गुंजाटे आदित्य बाबासाहेब
3. मार्गदर्शकाचे नाव व पत्ता	:	डॉ. डी. पी. कदम. I/c प्राध्यापक व विभाग-प्रमुख, पशुवैद्यकीय विकृतीशास्त्र विभाग, मुंबई पशुवैद्यकीय महाविद्यालय, परळ, मुंबई- ४०००१२.
4. प्रदान करण्यात येणारी पदवी	:	एम व्ही एस सी
5. पदवी प्रदान करण्याचे वर्ष	:	2022
6. मुख्यविषय	:	पशुवैद्यकीय विकृतीशास्त्र विभाग
7. प्रबंधाची एकूण पाने	:	
8. सारांशचे एकूण शब्द .	:	
9. विद्यार्थ्यांची सही	:	
10. प्रबंध पाठविणाऱ्या अधिकाऱ्याची सही, पूर्ण नाव आणि पत्ता	:	डॉ. डी. पी. कदम. I/c प्राध्यापक व विभाग-प्रमुख, पशुवैद्यकीय विकृतीशास्त्र विभाग, मुंबई पशुवैद्यकीय महाविद्यालय, परळ, मुंबई- ४०००१२.
11. सहयोगी अधिष्ठाता, मुंबई पशुवैद्यकीय महाविद्यालय, परळ, मुंबई- ४०००१२.	:	

कॅनिन्समधील निओप्लाझमचा क्लिनिकोपॅथॉलॉजिकल अभ्यास.

निओप्लाझिया म्हणजे शरीरातील पेशी किंवा ऊतींची अनियंत्रित, असामान्य वाढ आणि असामान्य वाढीलाच निओप्लाझम किंवा ट्यूमर म्हणतात. हे बेनाइन किंवा मैलीगनंट असू शकते. बेनाइन निओप्लाझम आक्रमकपणे वाढत नाहीत, शरीराच्या आसपासच्या ऊतींवर आक्रमण करत नाहीत आणि संपूर्ण शरीरात पसरत नाहीत. दुसरीकडे, मैलीगनंट निओप्लाझम वेगाने वाढतात, त्यांच्या सभोवतालच्या ऊतींवर आक्रमण करतात आणि शरीराच्या इतर भागांमध्ये पसरतात किंवा मेटास्टेसाइज करतात.

अभ्यासात निओप्लास्टिक वाढीची पन्नास प्रकरणे नोंदवली गेली आणि गोळा केली गेली. या प्रकरणांसाठी रक्ताचे नमुने ईडीटीए आणि प्लेन वायल्समध्ये गोळा करण्यात आले. हिमोग्लोबिन, हेमॅटोक्रिट, टोटल एरिथ्रोसाइट काऊंट, टोटलल्युकोसाइट काऊंट आणि विभेदक ल्युकोसाइट काऊंटसाठी रक्त नमुन्यांची प्रक्रिया केली गेली. त्यानंतर संपूर्ण प्रथिने सीरमची प्रक्रिया केली गेली, अल्ब्युमिन, ग्लोब्युलिन, सी-रिएटिव्ह प्रोटीन आणि आयनिक कॅल्शियम आणि रेडिओ इम्यून असे द्वारे व्हिटॅमिन डीच्या जैवरासायनिक चाचणीसाठी सीरमची प्रक्रिया केली गेली. शेवटी गाठीचा टिश्यू देखील गोळा केले गेले आणि हिस्टोपॅथॉलॉजिकल तपासणीसाठी प्रक्रिया केली गेली.

असे आढळून आले की मेमरी ट्यूमरची घटना 24% (12) सह सर्वाधिक आहे. सध्याच्या अभ्यासात 62% (31/50) ट्यूमर मादी कुत्रांमध्ये आढळून आले. ट्यूमर असलेल्या प्राण्यांचे सरासरी वय 7.28 वर्षे नोंदवले गेले. अभ्यासानुसार, 52% नॉन डिस्क्रिप्ट नोंदवले गेले.

हेमॅटोलॉजिकल आणि बायोकेमिकल डेटामध्ये कोणताही महत्त्वपूर्ण फरक लक्षात आला नाही आणि आयनिक कॅल्शियमची सरासरी मूल्ये 1.27±0.03 आणि 1.28±0.01 होती, टोटलकॅल्शियम 10.50±0.26 आणि 10.53±0.56 होते आणि व्हिटॅमिन डी 31.16±16±7.34± 7.35.35. अनुक्रमे बेनाइनआणि मैलीगनंट दोन्ही गट.

VITA

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