Research Article

Canine Mammary Tumors: A Study on 12 Clinical Cases

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A R T I C L E   I N F O

A B S T R A C T

Introduction: Canine mammary tumors (CMTs) are the most prevalent neoplasms in female dogs, posing a substantial threat to their overall health and quality of life. The present study aimed to investigate the incidence, characteristics, and staging of canine mammary tumors in bitches presented to the Veterinary Teaching Hospital, University of Jos, Nigeria.

Materials and methods: Data from 12 dogs with CMTs presented to the Veterinary Teaching Hospitals, University of Jos, Nigeria, from 2022 to 2023, including age and breed of the bitches, affected gland(s), size, weight, consistency, external appearance of the tumor, and staging were obtained. Data were categorized using the modified World Health Organization's tumor-nodal involvement-metastasis (TNM) Classification.

Results: Among the 12 CMT cases studied, the findings revealed a high incidence (50%) in elderly dogs (8 years and older), with the Russian Shepherd breed being the most susceptible (50%). The CMTs were predominantly hard, encapsulated masses, measuring 4 to 20 centimeters and weighing 90 to 1000.6 grams. Six cases had a solitary (single) mass within a single gland, and the other half (6) had multiple (more than one) masses located either in a single mammary gland (multifocal) or in multiple (more than one) mammary glands (multicentric). Most of the tumors (67%) were located in the right mammary gland chain, and the inguinal mammary glands were highly susceptible (58%). Stage III tumors were the most prevalent and accounted for 42% of the cases.

Conclusion: The present study highlighted the importance of timely detection and diagnosis of CMTs, with a high prevalence of early-stage tumors (75%). Notably, 50% incidence of CMTs in Russian Shepherds suggested a potential breed predisposition and warrants further investigation.

1. Introduction

Canine mammary tumors (CMTs) are the most prevalent neoplasms in female dogs. These tumors account for approximately 46% of all tumors in intact bitches[1]. Canine mammary tumors are composed of diverse neoplasms. About 50% of CMTs are benign (including adenoma, fibroadenoma, and ductal papilloma), while 50% are malignant (including carcinoma, sarcoma, and carcinosarcoma)[1,2]. These CMTs show similarities with human breast cancer in aspects such as histology, molecular, clinical, and treatment protocols. Additionally, these female dogs develop spontaneous neoplasms with biological and environmental features similar to those of humans[1,3]. The risk factors for CMTs are multifaceted. These risk factors include hormonal, age, genetic, dietary, and environmental factors[4]. The timing of spaying significantly impacts the CMT risk. Spaying before the first heat cycle reduces the risk of

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CMT in female dogs to 0.5%, while delaying spaying until after the first or second heat cycle increases the risk to 8% and 26%, respectively[4]. Canine mammary tumors are commonly seen in middle-aged (5-7 years) and elderly (8-12 years) bitches. The lesions can present as a single or multiple nodules or masses within the glandular tissue or nipple[1,5,6]. The benign tumors are typically small and well-circumscribed, compared with the malignant tumors, which exhibit rapid growth with ill-defined borders and, in some instances, ulceration[1]. About 70% of intact female dogs develop multiple masses in multiple mammary glands (multicentric CMTs) and multiple masses in a single mammary gland (multifocal CMTs), often located in the caudal abdominal and inguinal mammary glands[1,3]. Canine mammary tumors can be diagnosed through a comprehensive approach that includes medical history, clinical examination, and diagnostic tools such as a complete blood profile, radiographs, ultrasonography, fine-needle aspirate, and surgical biopsy with histopathological staining[7]. A modified tumor-nodal involvement-metastasis (TNM) staging system is used to assess metastasis risk and inform treatment decisions for CMTs. This system categorizes the CMTs into stages based on tumor size (T), nodal involvement (N), and metastasis (M). The stages based on the TNM are categorized as Stage I (< 3 cm), Stage II (3-5 cm), Stage III (> 5 cm), Stage IV (lymph node involvement regardless of tumor size), and Stage V (distant metastasis)[7]. Treatment options for CMTs depend on the size, location, stage, and characteristics of the tumor involved. These options include surgery, radiation therapy, chemotherapy, hormone therapy, and palliative care or a combined therapy[8]. Surgical excision (mastectomy) with complete tumor removal is the recommended treatment option. Surgical techniques ranging from lumpectomy to simple mastectomy, regional mastectomy, and radical mastectomy can be employed depending on the size, location, and the number of tumor[1,9,10]. The present study aimed to indicate the incidence, characteristics, and staging of CMTs diagnosed in bitches of different ages and breeds at the Veterinary Teaching Hospital, University of Jos, Nigeria.

2. Materials and methods

2.1. Ethical approval

Ethical approval for the present study was obtained from the Ethics Committee on Animal Use and Experimentation of the University of Jos, Nigeria. Consent from each client was obtained while collecting information about the case's history, and prior to mammary tumor management.

2.2. Animals

The present study involved 12 female dogs, aged 3 to 10 years and weighing 15 to 40 kg, representing six breeds, including Russian Shepherd, Bull Mastiff, Boar Boel, Lhasa, Neapolitan Mastiff, and Mongrel. Dogs were diagnosed with mammary gland tumors at the Veterinary Teaching Hospital, University of Jos (VTH-UJ), Nigeria, during 2022-2023. Data on tumor incidence, including age, breed, affected gland(s), tumor size and weight, consistency, external appearance, and association with skin and underlying tissues, were collected and analyzed. Additionally, tumor staging was indicated using the modified World Health Organization's Tumor-Node-Metastasis (TNM) Classification[7].

2.3. Data analysis

The present data were presented descriptively to characterize the study population and identify clinical trends. Categorical variables, including breed, tumor location (gland position), tumor consistency, attachment type (sessile or encapsulated), number of masses (solitary, multifocal, multicentric), and TNM stage, were reported as frequencies and percentages. Continuous variables, including age, tumor dimensions (length, width, and height), and tumor weight, were summarized with measures of central tendency and dispersion. Means and standard deviations were used for normally distributed data, while medians and ranges were applied to non-normally distributed data.

3. Results

A total of 12 cases with CMTs were presented to the VTH-UJ, Nigeria, and the results of the study are presented as follows.

3.1. Incidence of age

The highest incidence of CMTs was recorded in bitches of eight years and above (n = 6, 50%). Bitches between 5-7 years old, followed by a 33% incidence (n = 4), and the lowest CMT incidence (17%) was found in two bitches under 5 years old. This age distribution highlighted the importance of regular check-ups for older dogs.

3.2. Incidence of breed

Six distinct dog breeds were recorded with CMTs in the present study. Notably, Russian Shepherds had the highest incidence, accounting for 50% of cases (n = 6), followed by Bull Mastiffs at 17% (n = 2). Other breeds, including Neapolitan Mastiff, Boerboel, Lhasa Apso, and Mongrel, had an incidence of 8% (n = 1) each. These findings suggested a potential breed predisposition for CMTs in the Russian Shepherds.

3.3. Tumors' sizes and weights

A significant variation in tumor size was observed among the 12 reported cases, ranging from 4×5×3 cm (smallest) to 20×7×4 cm (largest). Tumor weight varied widely, with solitary tumors ranging from 90 g to 121.5 g, whereas multifocal and multicentric tumors ranged from 138.5 g to 1000.6 g. These findings highlighted the importance of early detection.

3.4. Tumors' morphology and adherence

All tumors in the current study presented as palpable masses, with most (n = 9, 75%) being hard and a few (n = 3, 25%) firm in consistency. Based on their attachment and skin integrity, the tumors were categorized into two types; sessile and ulcerated[11] (found in four dogs, 33%), and encapsulated with intact overlying skin (n = 8, 67%). These characteristics were crucial for diagnosis and treatment[6,7].

3.5. Tumors' number and location

Six cases (50%) had a solitary mass in a single gland, while the other half (50%) had multiple masses, which were either multifocal (n = 3, 25%) or multicentric (n = 3, 25%). In the multicentric cases, 17% of dogs (n = 2) had involvement of two glands, and 8% (n = 1) had involvement in three glands. The inguinal mammary glands were the most commonly affected (n = 7, 58%), followed by the caudal abdominal glands (n = 4, 33%), cranial abdominal glands (n = 2, 16%), and right caudal thoracic gland (n = 1, 8%). These findings have implications for the choice of surgical technique and presurgical preparations. Understanding the patterns of tumor distribution and gland involvement can help veterinarians develop more effective treatment plans and improve surgical outcomes for dogs with CMTs.

3.6. Tumors' stage

The staging of the CMTs in this study was carried out using the modified World Health Organization's TNM classification system[7]. Based on this classification system, the present results demonstrated a range of stages II to V of the CMTs. Stage III was the most common (42%, n = 5), followed by stage II (33%, n = 4), stage IV (16%, n = 2), and stage V with the least incidence (8%, n = 1). Notably, stage I was not represented in the present study. The high number of stage III indicated that many tumors were large but without metastasis to the lymph nodes.

4. Discussion

The present study found that mammary gland tumors in bitches varied in age, with a higher incidence in elderly dogs (8-12 years) than in middle-aged (5-7 years) or younger dogs (3 years), with a median age of approximately 8.3 years. These findings aligned with those of Zheng et al.[1], who reported a higher incidence in elderly female dogs, followed by middle-aged dogs, and the lowest in younger dogs. The Russian Shepherd breed had the highest incidence of CMTs in the present study, accounting for 50% of cases. Notably, this 50% incidence was the highest ever recorded worldwide for CMTs in Russian Shepherd breeds. This novel finding strongly indicates a potential breed predisposition, representing a noteworthy advance in veterinary oncology. However, other studies have reported higher incidence in different breeds, including Spitz[12], Boxers[13,] and poodles[6]. Compared with other studies, the present findings revealed notable trends in tumor size, number, characteristics, and

location along the mammary chain, consistent with previous findings[1,14]. Solitary and multiple masses were observed in the present study, with a 50:50 incidence rate, which contrasted with the findings of Ariyarathna et al.[15], who reported a higher incidence of solitary masses (71.6%) than multiple masses (28.3%). The present study observed a wide variation in tumor sizes and excised tumor weights, consistent with the findings of Pastor et al.[5]. During the present study, 33% of dogs presented with sessile (non-pedunculated) and ulcerated tumors, whereas 67% of dogs had encapsulated tumors with intact overlying skin. In comparison, Bindu et al.[12] reported a 100% incidence of non-pedunculated CMTs with a similar incidence of ulceration (40%), whereas Mello et al.[16] found that 94.7% of ulcerated mammary tumors were malignant; however, only 18.7% of malignant tumors presented with ulceration. The distribution of tumors in the present study indicated that the inguinal mammary glands were most commonly affected, followed by the caudal abdominal, cranial abdominal, and caudal thoracic glands. These findings are consistent with findings of Zheng et al.[1], Vazquez et al.[3], and Ferreira et al.[17], who reported a higher frequency of CMTs in the inguinal and caudal abdominal glands. The present study found stage III tumors to be the most prevalent, followed by stage II, stage IV, and stage V, respectively. Notably, 75% of cases presented with early-stage tumors (stage II and III), while 25% had advanced-stage tumors (stage IV and V). The present findings supported the findings of Sruthi et al.[18], which reported a higher incidence of early clinical stages (I-III) and no advanced stages. However, the present results contrast with those of Bindu et al.[12], who found a higher incidence of advanced-stage (V) malignancies in dogs.

5. Conclusion

The present study provided valuable insights into the incidence, characteristics, and staging of mammary tumors in female dogs with CMTs at study area. Key findings included the high incidence of CMTs in dogs aged 8 years and above, with stage III tumors being the most common. Notably, the incidence of CMTs in Russian Shepherds (50%) suggested a potential breed predisposition. These findings warrant further investigation into the genetic and environmental factors that contribute to CMT in female dogs, as well as the development of effective screening strategies for early detection and prevention.

Declarations

Ethical considerations

The authors declared that the present study is unpublished and has not been submitted elsewhere for publication. The manuscript has undergone rigorous review, including plagiarism checks and screening for data fabrication and falsification, prior to publication. No AI tool was used during the present study or in preparing this manuscript.

Authors' contributions

Iliya Paul Sambo conceptualized the study and wrote the manuscript. Iliya Paul Sambo, Japhet Joel Kalang, Daniel Onimisi Avazi, and Andrew Ababa James conducted morphological descriptions and management of canine mammary tumors. Emmanuel Vandi Tizhe, Tanko Polycarp, Gurumyen Yilzem George, and Deborah Maigawu Buba performed the diagnosis and staging of canine mammary tumors using the WHO's TNM classification system. All authors read and approved the final edition of the manuscript prior to publication

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