

Cytopathology and Occurrence of Round Cell Tumours in Dogs in and around Meerut, Uttar Pradesh

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ABSTRACT

Five types of round cell tumors found in dogs are mast cell tumors (MCT), lymphoma, plasma cell tumors, histiocytoma, and transmissible venereal tumors (TVT). This study focuses on the occurrence and cytopathology of these tumors in dogs of Meerut, Uttar Pradesh (India), spanning the period from 2018 to 2022. A total of 147 samples were gathered from different sites of dogs, notably 95 samples from vaginal specimens, 24 from nodular skin swellings, 7 samples from penile growths, 5 from lymph nodes, and 16 were from various skin lesions. The analysis of these samples revealed 4 cases of lymphoma, 3 cases of MCT, and 28 cases of TVT. In lymphoma, one case was identified as cutaneous lymphoma, while three cases were associated with lymph nodes. Cutaneous lymphoma exhibited numerous small and medium-sized lymphocytes. Lymph node samples exhibited a substantial presence of large-sized and medium-sized lymphocytes. TVT emerged as the most prevalent round cell tumor, observed in both genital and extragenital forms. Extragenital TVT predominantly affected the skin. In mast cell tumors, cells demonstrated round characteristics, with a notable granules in the cytoplasm and infiltration of eosinophils. Minimal anisocytosis and anisokaryosis, coupled with a high nuclear-to-cytoplasmic ratio, were evident in these tumors.

Key words: Cytology, Dogs, MCT, Round cells, TVT.

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INTRODUCTION

Round cell tumors constitute a significant and diverse group of neoplasms in dogs, encompassing five entities such as mast cell tumors (MCT), lymphoma, plasma cell tumors, histiocytoma, and transmissible venereal tumors (TVT) (Meuten, 2017). Some researchers include melanoma, basal cell carcinoma, and histiocytic sarcoma also in round cell tumors (Fisher, 2014; Meuten, 2017). The prevalence of these tumors is noteworthy, with mast cell tumors alone accounting for approximately 25% of all skin tumors in dogs (Misdorp, 2004). The gravity of the issue is underscored by the fact that tumors, in general, stand as a leading cause of mortality in canine populations (Pang and Argyle, 2016). The majority of round cell tumors appear in the skin or subcutaneously, even though they can be noticed in many other locations. Dogs are considered as an animal model for studying the pathogenesis of cancers in humans due to the similarity in the behaviour of tumors (Pang and Argyle, 2016).

In the pursuit of effective diagnostic methodologies, cytology has emerged as a cornerstone in the identification and characterization of round cell tumors in dogs. The efficiency of cytological diagnosis is particularly highlighted, with studies demonstrating a 95% accuracy rate compared to traditional histopathological examinations (Guedes *et al.*, 2000). The distinct advantage of cytology lies in its ability to provide a rapid, cost-effective, and reliable means of diagnosing these tumors, as highlighted by the better-defined nature of round cell tumor cells in cytological specimens compared to histopathology (DeNicola, 2014).

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This article aims to explore the various facets of round cell tumors in dogs, emphasizing the importance of cytology in their diagnosis.

MATERIALS AND METHODS

In the present study, we studied the occurrence of different round cell tumors in dogs of Meerut district of Uttar Pradesh (India) from the period October, 2018 to March, 2022. A total of 147 samples were collected from skin nodules, tumors,

skin lesions, penile growths and vagina. Out of these, 95 samples were from vagina, 7 samples were from penile growths, 24 samples were from nodular swelling of the skin, 5 samples from lymph nodes, and the remaining 16 samples from different skin lesions. Samples were collected by different methods such as fine needle aspiration, swab method, impression smear from excisional biopsy and direct impression from cutaneous lesion.

Slides were prepared and were stained by Field (Himedia) staining method. Cytological smears were analyzed and classified according to the characteristics of neoplastic cells, and were further studied for the occurrence of these tumors in the study area.

RESULTS AND DISCUSSION

Out of 147 samples examined, 35(23.80%) samples came out positive for round cell tumors (RCT), in Meerut. Out of 35 RCT, 4 cases were of lymphoma (11.42%), 3 cases were of mast cell tumour (8.58%) and 28 cases were of TVT (80.00%). Notably, TVT emerged as the most common round cell tumor in the study, affecting both genital and extragenital sites. The cytological features of each tumor type were examined in detail, providing a comprehensive understanding of their characteristics in the studied population. Incidence of round cell tumour was 16.5% in a study conducted in Veterinary College, Bengaluru and Hassan (Mathur *et al.*, 2017). High incidence of RCT was reported in many previous studies in India and other countries (Alleman and Bain, 2000).

The most common round cell tumor noticed in present study (28/35) was TVT. We observed both genital (25) and extragenital (3) TVTs. Similar observations were also made by Parikh and Panchal (2023). Extragenital sites included the skin near the perineal region and caudal ventral abdomen; all cases in the skin were primary lesions. In our study, females were more affected than male (21 vs 7 cases), with an age group ranging from 1.5 years to 9 years. All age groups above 1 year were susceptible to TVT. Clinical manifestations included bleeding from the external genitalia and constant licking. The gross appearance revealed soft, haemorrhagic, polyploid growth in the genitalia, while the skin exhibited nodular, ulcerated, and haemorrhagic masses. In both cases, the cells were uniform and characterized by round cells with a round and eccentrically located nucleus, prominent nucleoli, pale blue cytoplasm, and punctate and distinct cytoplasmic vacuolation (Fig. 1). Marked anisocytosis and anisokaryosis were observed, with frequent mitotic figures (Fig. 2). Multinucleation and infiltration of neutrophils were also observed. Cytological examination of tumors after first dose of vincristine (anti-tumour therapy) showed infiltration of large number of lymphocytes indicating anti-tumor immunity and large number of variable sized cytoplasmic vacuoles indicating cell death (Fig. 3).

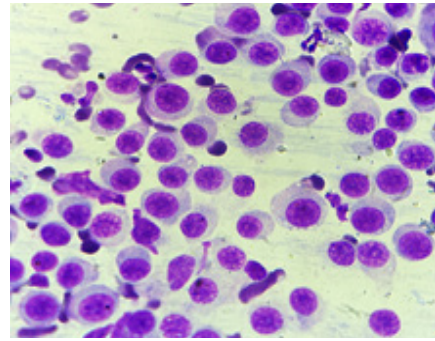


Fig. 1: Cytology of TVT: Characterized by round uniform cells with round and eccentrically located nucleus and prominent nucleoli with pale blue cytoplasm and cytoplasmic vacuolation. Marked anisocytosis and anisokaryosis seen, Field Stain, 1000x

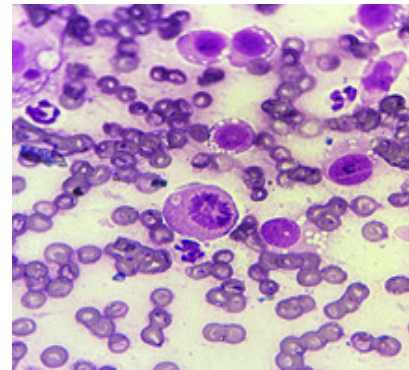


Fig. 2: Cytology of TVT: Cells are characterized by round shape and eccentrically located nucleus and prominent nucleoli with pale blue cytoplasm, cytoplasmic vacuolation, and presence of mitotic figures. Field Stain, 1000x

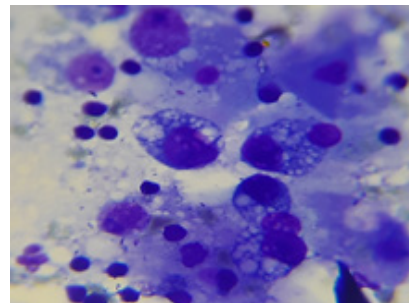


Fig. 3: Cytology of TVT (1 week after anti-tumor therapy): Increase in number of cytoplasmic vacuoles and infiltration of small lymphocytes. Field stain, 1000x

TVT's are very common round cell tumors in dogs. Cytologically, the tumor cells appear as a homogeneous, sheet-like highly cellular population. TVT cells have cytoplasmic vacuolation, prominent nucleoli, marked anisokaryosis and anisocytosis, and coarse to reticulate nuclear chromatin as prominent features (DeNicola, 2014). Mitotic figures are very common in cytology. In this study, similar cytological features were observed. We also studied the changes in cells after anti-tumor therapy. A large number of lymphocytes were seen post-therapy, indicating anti-tumor immunity. Similar findings were also reported in other studies using histopathological examination (Den Otter *et al.*, 2015; Parikh and Panchal,

2023; Parikh *et al.*, 2023). Additionally, a significant presence of variable-sized non-punctate vacuoles in the cytoplasm showed the cytopathic changes indicative of cell death.

In the mast cell tumor (3/35), in 2 cases, cells were well-differentiated, round, with a large number of purple granules in the cytoplasm, along with the moderate infiltration of eosinophils (Fig. 4). Minimal anisocytosis was observed, and a high nuclear to cytoplasmic ratio was noticed. In these cases, a large number of purple-colored granules were observed, and there was also an absence of mitotic figures and multinucleated giant cells. Infiltration of neutrophils was also seen in the slides. Both the cases were from male animals and breeds were Labrador retriever and German Shepherd. In case of Labrador retriever, aged 9 years, we noticed multiple cutaneous nodules on thighs and trunk. Cytological examination revealed presence of large number of poorly granulated mast cells with infiltration of eosinophils and neutrophils (Fig. 5). Moderate anisocytosis and anisokaryosis were noticed. Binucleation/multinucleation was frequent.

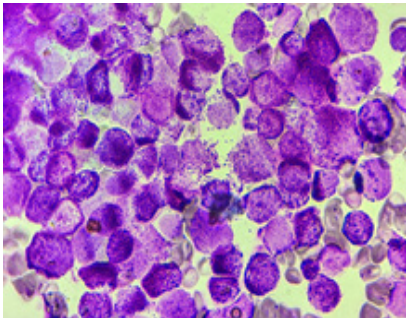


Fig. 4: Cytology of mast cell tumor: Cells were well differentiated, round with round nucleus and large number of purple coloured granules in the cytoplasm. Field stain, 1000x

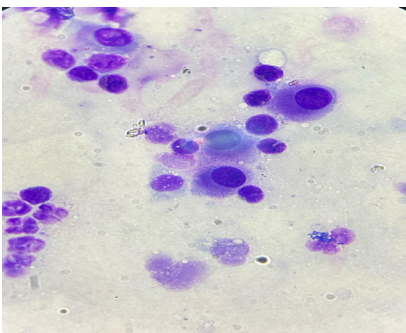


Fig. 5: Cytology of mast cell tumor: Cells were poorly differentiated, round with round nucleus and few/absence of purple coloured granules in the cytoplasm. Field stain, 1000x

MCTs are highly aggressive metastatic and are the most frequent round cell tumors in dogs, comprising 16-21% of all cutaneous tumors diagnosed (Misdorp, 2004). MCTs can be easily diagnosed by cytology by its typical appearance by routine staining method. Grading can also be done by cytology. Camus *et al.* (2016) proposed 2 tier cytologic grading system, high grade MCT should be poorly granulated or have any 2 of the 4 features such as multinucleation/binucleation, high anisokaryosis, nuclear pleomorphism and mitotic figures. In present study, MCT was easily diagnosed

and graded as low grade (well differentiated) in 2 cases which showed well granulated MCT with minimal anisokaryosis with absence of multinucleation and mitotic figures and in one case graded as high grade (poorly differentiated). This helps to determine the prognosis of the case. Dogs diagnosed with histologic high-grade MCTs had a 39-fold higher likelihood of mortality within the 2-year follow-up period compared to dogs with low-grade MCTs. Similarly, those with cytologic high-grade MCTs were 25 times more likely to die within the same period. Additionally, a high tumor grade was correlated with an increased probability of experiencing additional tumors or tumor regrowth (Camus *et al.*, 2016).

Out of the 4 lymphoma cases, 1 was a cutaneous lymphoma, and 3 were affecting lymph nodes. Grossly, multiple erythematous nodular lesions were observed. In cutaneous lymphoma, a large number of small and medium-sized lymphocytes were seen. Many of the lymphocytes exhibited a hand mirror appearance, and a considerable number of RBCs, along with a few neutrophils (Fig. 6). In the other 3 cases, generalized lymphadenopathy of superficial lymph nodes was observed. In cytology, a large number of immature lymphoblasts were seen, characterized by large cells with deeply basophilic cytoplasm and a diffuse and paler chromatin pattern (Fig. 7). Nucleoli were single to multiple, located centrally or peripherally. More than 50% of cells were large and medium-sized lymphocytes. A substantial number of lymphoglandular bodies were observed in the background.

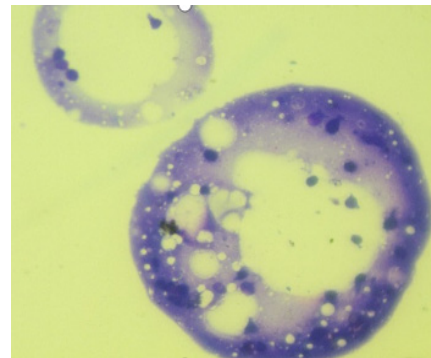


Fig. 6: Cytology of lymphoma: Medium to large sized lymphocytes have a round nucleus, fine chromatin pattern, 2-4 small prominent, generally central to marginally placed nucleoli, and deeply basophilic scant cytoplasm. Field stain, 1000x

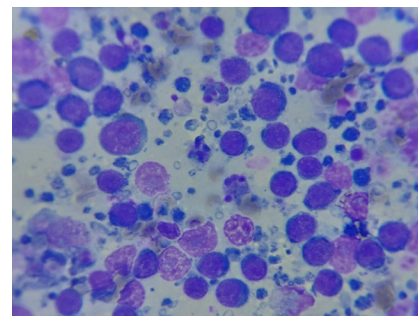


Fig. 7: Cytology of cutaneous lymphoma: Large number of small lymphocytes, some showing mirror handle appearance. Field stain, 1000x

Lymphomas constitute a diverse group of monoclonal neoplasms originating from B, T, or natural killer (NK) lymphocytes at various stages of maturation (Zandvliet, 2016). Canine lymphoma is one of the most common tumors in dogs. Despite the precise cause remaining unknown, there is a belief that environmental factors and genetic susceptibility play crucial roles in its development (Sanchez *et al.*, 2019). In canine lymphomas, predominant cells will be immature lymphoblast, but small cell lymphomas were also reported. Lymphoblasts are large cells with a size that varies from 2 to 5 times the size of erythrocytes with deeply basophilic cytoplasm that is more abundant than that of small or intermediate lymphocytes (Zandvliet, 2016; Sanchez *et al.*, 2019). In this study, cutaneous lymphoma was presented as a case of chronic dermatitis in the clinics, and impression smear and FNAC were performed on the skin lesions, revealing lymphoma. Cytology allows for the diagnosis of lymphoma, but for a more in-depth characterization of cells, additional techniques such as immunophenotyping through flow cytometry, immunohistochemistry, or PCR are recommended.

In conclusion, this study sheds light on the occurrence of different round cell tumors in dogs, emphasizing the importance of cytology as a reliable diagnostic tool. The findings contribute to our understanding of the prevalence and characteristics of these tumors in Meerut district, Uttar Pradesh, offering valuable insights for future research and clinical practice in veterinary oncology.

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