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Thyroid pathology in canine parvoviral infection

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Abstract

The hypothalamic-pituitary-thyroid axis is suppressed by pro-inflammatory mediators in systemic disease, which affects the thyroid hormone level. Canine parvovirus is one of the important infectious diseases which causes profound morbidity as well as mortality in dogs. It is found that canine parvovirus infection can result in non-thyroidal sickness syndrome. The relation between thyroid pathology and canine parvovirus infection will pave the way for therapeutic and preventive measures for this infectious-disease. This study was conducted on 61 dog carcasses brought to the Department of Veterinary Pathology, College of Veterinary and Animal Sciences, Pookode during one year period. Among 61 cases, nine were found to be positive for canine parvovirus which constitutes an incidence of 14.75 per cent. Analysis of gross and histopathological lesions in canine parvovirus positive cases was the goal of this investigation. The gross lesions observed were paleness and nodular growth and histopathological lesions encountered were lymphocytic thyroiditis, colloidal goiter, c cell hyperplasia, severe fibrotic changes and neoplastic lesions. Further research is required to understand the pathophysiology of the euthyroid sick syndrome in canine parvoviral infection.

Keywords: *Thyroid, lymphoplasmacytic infiltration, canine parvovirus, lesions*

Thyroid disorders are rising these days which can adversely affect the quality of life in companion animals. Infectious diseases are a significant source of health issues and canine parvovirus is found to be a deadly disease that causes high mortality in dogs (Deepa and

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Fig. 1. Gel electrophoresis showing 630 bp amplicons of VP2 gene of canine parvo virus.
Lane 1 : 100 bp DNA ladder ; Lane 2 : Positive control; Lane 3 to 6 : Samples; Lane 7 : Negative control

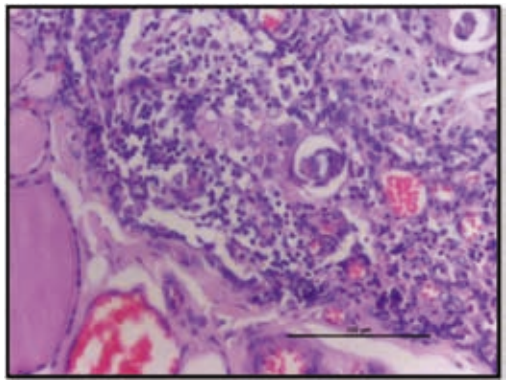

Fig 3. Diffuse sclerosing variant of papillary thyroid carcinoma (H & E, 100 x)

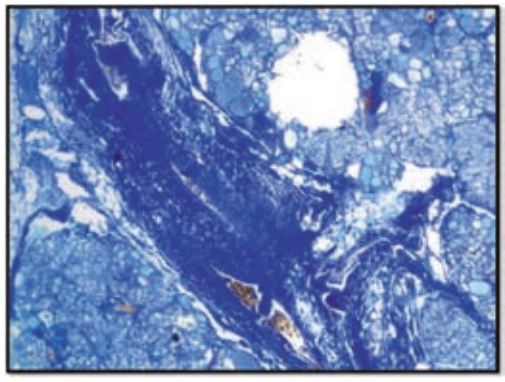

Fig 5 Fibrotic changes in thyroid parenchyma (Mallory's stain, 100 x)

Fig 2. Diffusely pale thyroid glands

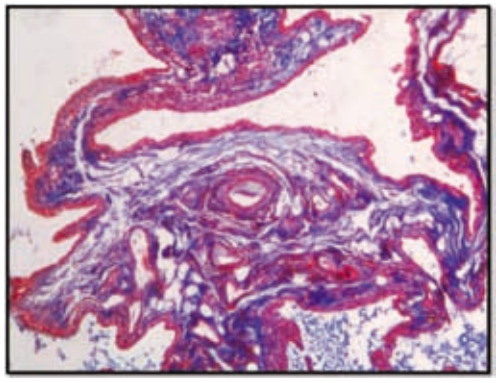

Fig 4. Papillary thyroid carcinoma (Gomori's one step trichrome, 100 x)

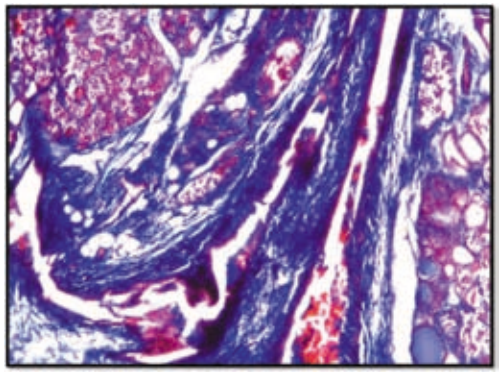

Fig 6. Fibrotic changes in thyroid parenchyma (Gomori's one step trichrome stain, 400 x)

Saseendranath, 2004). There are reports of thyroid affections in human parvovirus B19 which belongs to the same family parvoviridae as that of canine parvo virus. The term "non-thyroidal sickness syndrome" or "euthyroid sick syndrome" refers to the common variations in thyroid profiles that can occur in any acute or chronic disease but are not specifically linked to thyroid function. Oikonomidis *et al.* (2021) have demonstrated the role of canine parvovirus in euthyroid sick syndrome. Archin *et al*. (2021) stated that human parvovirus (PB19) was involved in the pathogenesis of many thyroid diseases like Hashimoto's thyroiditis, grave's disease as well as thyroid cancer. It is found that more than euthyroid sick syndrome, pathology of thyroid gland is clearly evident in systemic diseases like canine parvoviral infection. Owing to the limited studies on thyroid pathology in parvo viral infections in animals, this study was proposed.

Materials and methods

A total of 61 dog carcasses which were brought for post-mortem examination to the Department of Veterinary Pathology, College of Veterinary and Animal Sciences, Pookode, Wayanad, from northern districts of Kerala like Wayanad, Kozhikode, and Malappuram formed the material of study. Detailed history was taken from the owners regarding various symptoms shown by the animals as well as vaccination history. Gross lesions were recorded and thyroid tissue samples were collected in 10 per cent neutral buffered formalin for histopathological examination and processed following standard histopathological procedures (Suvarna *et al.*, 2013). Tissue samples were collected and stored at -20°C for molecular diagnosis of canine parvovirus and Polymerase chain reaction was carried out for its screening, targeting the VP2 gene (Srinivas *et al.,* 2013). The stained sections were examined under a light microscope (Zeiss Axio Scope A1 microscope) and lesions were recorded. Gomori's one-step trichrome and Modified Mallory's staining was performed to examine the extent of connective tissue proliferation.

Results and discussion

Out of 61 dog carcasses screened for canine parvovirus infection, nine were found to be positive, with a prevalence rate of 14.75 per cent. Amplicons of 630 bp generated by PCR were observed on agarose gel electrophoresis (Fig.1). The different clinical signs exhibited in dogs included vomiting, blood mixed diarrhoea, anorexia and weakness. The majority of the affected dogs were Non-Descript and German Shepherds and 55.55 per cent of animals were males (5/9). According to the research findings of Ramadass and Khader (1982), Brady (2012), and Greene and Decaro (2012), the prevalence of CPV infection in dogs was unaffected by gender. All the animals in this study belonged to the age group of below 6 months with an average age of 3.1 months, which was similar to the findings of Srinivas *et al. (*2013). Gross pathological lesions in the thyroid were found in all nine dogs which included paleness of the thyroid (Fig. 2) in 88.8 per cent (8/9), diffuse hyperaemic changes in 11 per cent (1/9) and nodule embedded deeply in the thyroid parenchyma in 11 per cent (1/9) cases. Different histopathological lesions encountered were lymphocytic thyroiditis in 66.6 per cent (6/9), papillary thyroid carcinoma (Fig. 3 & 4) in 22.2 per cent (2/9), ultimobranchial cyst-induced parafollicular cell hyperplasia in 11 per cent (1/9) and severe fibrous tissue proliferation (Fig 5 & 6) in 88.88 per cent (8/9). Table 1 shows detailed observations of gross and histopathological findings in the thyroid gland of canine parvovirus-positive dogs.

According to Kemppainen and Clark, (1994) lymphocytic thyroiditis, which resembles Hashimoto's thyroiditis in humans, is likely an autoimmune disease and patients frequently have thyroid autoantibody titers in their blood. Hypothyroidism in dogs typically results from progressive destruction of the thyroid gland. In the present study immunosuppressive nature of canine parvovirus might have resulted in lymphocytic thyroiditis. Grossly the thyroid gland was found to be pale due to blood loss caused by severe haemorrhagic enteritis in canine parvovirus. According to Etemadi *et al*. (2017), parvovirus B19 infection in humans may significantly contribute to carcinogenesis and the development of thyroid cancer through an inflammatory mechanism. Inflammation might be the cause for rise of cytokines and RONS (Reactive Oxygen and Nitrogen Species) levels, which may or may not contribute to the growth of thyroid cancer.

Conclusion

This study focused on the pathological changes of thyroid gland in canine parvo virus infected dogs. The lesions included moderate to severe type of lymphocytic thyroiditis, focal fibrosis and even neoplastic alterations. Previous studies had related parvo viral infection with euthyroid sick syndrome in which no lesions were observed in the thyroid glands. Hence our findings are unique and highly relevant in formulating a new treatment strategy in case of parvo viral infection in dogs. However further extensive studies are required to understand the pathophysiology of thyroid glands in such conditions.

Table 1. Gross and Histopathological Lesions Observed in the Thyroid Gland of Canine Parvovirus cases

S.No.	Animal details	Gross lesions in the thyroid	Histopathological lesions in the thyroid
1	Labrador 3.5 months Male	Congestion of both the lobes of the thyroid gland with the left thyroid slightly larger than the right	Moderate lymphocytic thyroiditis, severe fibrosis along with desquamation and collapse of follicles.
2	Non-descript 3 months Male	The anterior part of the thyroid gland showed pale discoloration	Severe fibrosis of the thyroid along with a single follicular cyst which is lined by a single layer of flattened squamous epithelium and contained debris in the lumen. Mild congestion, haemorrhage, and perivascular sclerosis. Numerous papillae-like structures are lined by epithelial cells having a round nucleus. Nucleus showed prominent grooving as well as nuclear clearing resembling Orphan annie eye nuclei.
3	German Shepherd 2 months Female	Both the thyroid glands showed diffuse paleness with the left thyroid slightly larger than the right with a soft consistency in both the lobes.	Marked c cell proliferation along with multiple cysts lined by cuboidal epithelium and severe connective tissue proliferation in between follicles. Moderate epithelial hyperplasia.
4	Non-descript 2 months Female	Multifocal pale areas in the left thyroid which is slightly larger than the right	Severe fibrous tissue proliferation in between the follicles along with marked c cell hyperplasia and a well-encapsulated mass containing cells with a vesicular nucleus and anisokaryosis with nuclear grooving and mitotic figures were detected.
5	Non-descript 2 months Female	Both the thyroid lobes showed paleness and the left one was slightly larger than the right	Moderate epithelial hyperplasia with perivascular fibrosis, capsular thickening along with focal lymphocytic infiltration, and moderate desquamation. Severe fibrous tissue proliferation in between the follicles and predominant microfollicular pattern.
6	German Shepherd 6 months Male	The left thyroid gland showed focal white discoloration in the mid-anterior part.	Many of the follicles contain pale coloured colloid along with mild congestion, haemorrhage, and perivascular sclerosis. Encapsulated structure showed pleomorphic population of cells which are present on a fibrovascular core and is infiltrated by lymphocytes suggestive of the diffuse sclerosing variant of papillary thyroid carcinoma. Prominent c cell hyperplasia and fibrous tissue proliferation as well as moderate epithelial hyperplasia. Mild desquamative changes along with lymphoplasmacytic infiltration
7	German shepherd 2 months Male	Diffused paleness of both the thyroid glands Left thyroid lobe was significantly larger with elliptical shape and the right one was smaller with an almond shape	Loss of colloid along with moderate perivascular sclerosis. Prominent epithelial as well as parafollicular cell hyperplasia and multifocal lymphocytic infiltration.
8	German shepherd 4 months Female	Diffuse pallor of both the thyroid glands with mild transparency	Most of the follicles were large in size with moderate epithelial hyperplasia. Mild perivascular sclerosis and congestion. C cell hyperplasia and lymphocytic infiltration were prominent.
9	Non-descript 4 months Male	Diffused paleness of both the thyroid glands which were oval in shape and the left thyroid gland showed a 3 mm sized creamy white nodule embedded in the thyroid parenchyma	Severe fibrous tissue proliferation with the collapse of follicles and multifocal infiltration of lymphocytes along with perivascular sclerosis and colloidal goitre.

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Conflict of interest

The authors declare no conflict of interest.

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