

STUDY ON PATHOMORPHOLOGICAL CHANGES IN 21 CASES OF CANINE DILATED CARDIOMYOPATHY

M. Thangapandian¹, *T. Mohanapriya², C. Balachandran¹, K. Jeyaraja³,
K. Arulanandam² and R. Sridhar¹

¹Department of Veterinary Pathology, ²Post Graduate Research Scholars, Department of Veterinary Pathology, ³Department of Clinics

Madras Veterinary College, TANUVAS, Chennai-7, India

E-mails: sugigold@gmail.com, priya.vet21@gmail.com, cbalachandran2000@yahoo.com,
jeyaraja.k@tanuvas.ac.in, kamalaarul89@gmail.com
sri_ramaswamy@yahoo.com (*Corresponding Author)

Abstract: Twenty one dogs of different breeds admitted to the Madras Veterinary College Teaching Hospital with the clinical history suggestive of heart failure and dilated cardiomyopathy. The incidence of DCM in various age groups, breed and sex were recorded in this study. The electrocardiography revealed atrial fibrillation and sinus tachycardia with right ventricular enlargement. The thoracic radiography showed cardiomegaly with pulmonary edema. Ultrasonography showed mild to moderate enlargement of left ventricle and atrium and pericardial effusion. Postmortem examination was conducted in the dogs died due to DCM and the necropsy findings showed grossly dilated and flabby heart. Histopathologically two distinct forms of DCM (i) ‘attenuated wavy fiber (AWF)’ type and (ii) ‘fatty infiltration – degenerative (FID)’ type.

Keywords: Dogs, Heart, DCM, Clinical signs, Necropsy, Histopathology.

Introduction

Dilated cardiomyopathy (DCM) is a progressive disease of heart muscle, in which heart becomes weakened and cannot pump blood efficiently. DCM is characterized by chamber dilatation, myocardial systolic and diastolic dysfunction, which is one of the most common heart diseases in dogs. DCM is a polyetiological disease, the etiology is not well known for individual cases, it involves several causes, including genetic factors, nutritional deficiencies, metabolic disorders, immunologic abnormalities, infectious diseases and drug-toxin and tachycardia – induced myocardial hypokinesis (Sisson *et al.*, 1995 and Janus *et al.*, 2016). Gross pathology shows dilatation of all four cardiac chambers or predominant dilatation of left cardiac chambers. Histologically two distinct forms of canine DCM are i) Attenuated wavy fiber (AWF) type of DCM in many giant, large and medium – sized breeds and ii) Fatty-infiltration degenerative (FID) type (Janus *et al.*, 2015). Those lesions are mainly encountered in the left ventricular wall (Janus *et al.*, 2016).

Materials and methods

Twenty one dogs of different breeds were admitted to the Madras Veterinary College Teaching Hospital with the clinical history suggestive of heart failure, dilated cardiomyopathy and chronic renal failure. All these dogs were subjected to thorough physical and clinical examination, electrocardiography, ultrasonography and radiography were taken for diagnosis. Animals died during the course of treatment were sent for postmortem examination to the Department of Veterinary Pathology, Madras Veterinary College, Chennai. During necropsy, gross and histopathological changes of heart were recorded. Myocardial sections were obtained from the dilated ventricular wall for histopathologic analysis. Tissues were fixed in 10% formalin, embedded in paraffin blocks, sectioned at 5 µm and stained with haematoxylin – eosin as per standard procedure and Masson's trichrome special staining was applied for the connective tissues and underwent light microscopic evaluation as prescribed by lobo *et al.*, 2010.

Results and discussion

During the period of 2011 - 2013, a total of twenty one dogs of different breeds were presented for the postmortem examination with the clinical history of congestive heart failure, dilated cardiomyopathy and chronic renal failure. The common clinical signs shown by dogs with DCM were inappetance, cough, vomiting, melena, not able to walk properly, exercise intolerance and recumbency. The clinical examination revealed dyspnoea, tachycardia, arrhythmia, feeble femoral pulse and systolic murmur in those dogs.

The electrocardiography of these dogs revealed atrial fibrillation and sinus tachycardia with right ventricular enlargement is in accordance with Vollmar *et al.*, 2003. The thoracic radiography showed cardiomegaly with pulmonary edema is in concordance with Vollmar *et al.*, 2003. Ultrasonography revealed mild to moderate enlargement of left ventricle and atrium and pericardial effusion, ascites, and severe congestion of hepatic blood vessels are in coincidence with Petric *et al.*, 2002 findings.

Breed, Age and Sex-wise incidence

In the breed-wise incidence, the highest prevalence of DCM was recorded by Labrador retriever (12/21; 57.14%), followed by German shepherd (4/21; 19.04%) and two each (9.52%) in Boxer and Great Dane and one (4.76%) in Spitz. The commonly affected medium to large sized breeds by DCM in this study was Labrador retriever, German shepherd, Boxer, Great Dane (O'Grady and O' Sullivan, 2004; Martin *et al.*, 2009 and Janus *et al.*, 2016) and an exception, Spitz a small sized breed also affected by DCM in this study.

The age-wise incidence was 4 (19.05%) dogs in 3-6 years, 11 (52.38%) in 6-9 years, 2 (9.52%) in 9-12 years and 4 (19.05%) in more than 12 years of age were recorded. The highest incidence recorded in the age group between 6-9 years is in accordance with Tidholm and Jonsson, 2001 and Palermo *et al.*, 2011.

On sex wise predilection, males were most commonly affected, 14 (66.66%) dogs were male and 7 (33.33%) were female. The ratio was 2:1 for male: female. This male overrepresentation was recorded by calvert *et al.*, 1997 and Tidholm and Jonsson (2001). Palermo *et al.*, 2011 recorded the similar M: F ratio level of 1.9:1 in their study.

Gross and histopathology findings

In this study the clinical presentation, ECG, and radiographic findings assisted in diagnosis of DCM, where the final diagnosis is based on postmortem findings. Gross pathology of dogs with DCM showed generally enlarged, flabby heart, thin walled with rounded apex (Fig.1) in most cases and double apex was noted in one case. Among all the 21, seventeen dogs showed moderate to severe dilatation of all chambers of heart, two dogs showed marked dilatation of left ventricle with thin wall (Fig.2) and two another showed marked right ventricular dilatation. The gross pathological changes were in accordance with Tidholm and Jonsson, 2001 and Sisson *et al.*, 1995. Sub-endocardial fibrosis noticed in left ventricle of two cases. In most of the cases myocardial eccentric hypertrophy was noticed. Right ventricular dilatation and sub endocardial fibrosis of the left ventricle was recorded by Vollmar *et al.*, 2003.

Histopathologically, two distinct forms of DCM were identified. In two cases both the attenuated wavy fibre type (Fig.4) and fatty infiltration- degenerative type (Fig.5) was recorded. Out of 21, eleven cases attenuated wavy fibre type, in which atrophy or attenuation of myofibres with wavy or thinner than the normal appearance comprising at least half of the thickness of myocardial muscles and among this 11, three had right ventricular dilatation has been recorded. The myocytes were separated by a clear space, which is free from cellular infiltrates with oedematous fluid. In two cases there was a diffuse subendocardial fibrosis of left ventricle was recorded. In Boxer and other four dogs revealed, fatty infiltration-degenerative type of lesions which include myocytolysis, myofiber degeneration, fibrosis, vacuolization of cytoplasm and myocyte atrophy. The histological classification of attenuated wavy fibre, fibrosis, and fatty infiltration-degenerative type was presented by Everett *et al.*, 1999, McEwan *et al.*, 2003 and Tidholm and Jonsson (2005) and Janus *et al.*, 2016.

Extensive interstitial fibrosis, fatty infiltration, vacuolar degeneration and cords of collagen deposition in ‘fatty infiltration - degeneration’ type were also evident in Masson’s trichrome staining (Fig.6). The interstitial and perivascular fibrosis in Masson’s trichrome stain was demonstrated by Janus *et al.*, 2016 and by lobo *et al.*, 2010. Dogs with DCM carries a poor prognosis (Tidholm *et al.*, 2005, Everett *et al.*, 1999 and Vollmar *et al.*, 2003).

Conclusion

The results of this study suggest that Labrador retriever breeds may be predisposed to the development of DCM in Chennai. The breed differences in DCM, both in manifestations and clinical course, make it unlikely that identical criteria apply to all breeds. In canine DCM, there are at least two histologically distinct forms, which reflecting different disease processes. Histologic classification of canine DCM is therefore essential for scientific studies of the disease. This article provides the various clinical presentation, electrocardiographic, radiographic and ultrasonographic characteristics and the gross and histopathological changes of heart with special staining in dogs affected with DCM

References

- [1] Calvert CA, Pickus CW, Jacobs GJ. & Brown, J. 1997. Signalement, survival and prognostic factors in Doberman Pinschers with end-stage cardiomyopathy. *J Vet Int Med* **11**, 323–6.
- [2] Everett RM, McGann J, Wimberly HC and Althoff J. 1999. Dilated cardiomyopathy of Doberman Pinschers: Retrospective Histomorphologic Evaluation of Heart from 32 Cases. *Vet Pathol* **36**: 221-227.
- [3] Janus I, Marcin N and Janus. A. Madej. 2015. pathomorphological chanes of the myocardium in canine dialted cardiomyopathy (DCM). *Bull Vet Inst Pulawy* **59**: 135 - 142.
- [4] Janus I, Nowak AN, Nowak M, Ciaputa R, Gola MK and Paslawka U. 2016. A comparison of the histopathologic pattern of the left atrium in canine dilated cardiomyopathy and chronic mitral valve disease. *BMC Vet Research*. **12**:3
- [5] Lobo L, Carvalheira J, Canada N, Bussadori C, Gomes JL and Faustino AM. 2010. Histologic characterization of dilated cardiomyopathy in Estrela mountain dogs. *Vet Pathol*. **47**:637–642.
- [6] Martin MWS, Stafford MJ and Celona B. 2009. Canine dilated cardiomyopathy: a retrospective study of signalment, presentation and clinical findings in 369 cases. *J Small Anim Pract* **50**: 23–29.

- [7] Palermo V, Michael J. Stafford Johnson, Certsam, Elisabetta Sala, Paola G. Brambilla and Mike W.S. Martin. 2011. Cardiomyopathy in Boxer dogs: A retrospective study of the clinical presentation, diagnostic findings and survival. *J Vet Cardiol*, **13**: 45-55
- [8] Petric AD, Stabej P and Çemva AZ. 2002. Dilated cardiomyopathy in Doberman Pinschers: Survival, Causes of Death and a Pedigree Review in a Related Line. *J Vet Cardiol*, **4**: 17-24
- [9] Sisson DD and Thomas WP. 1995. Myocardial diseases. In: Textbook of Veterinary Internal Medicine. 4th edn. Ed Ettinger, S. J. W. B. Saunders, Philadelphia. pp. 995–1005.
- [10] Tidholm A., Haggstrom J., Borgarelli M and Tarducci A. 2001. canine idiopathic dilated cardiomyopathy. Part I:aetiology, clinical characteristics, epidemiology and pathology. *Vet J*, **162**: 92 – 107.
- [11] Tidholm A and Jonsson L. 2005. Histologic characterization of canine dilated cardiomyopathy. *Vet Pathol* **42**:1-8.
- [12] Vollmar AC, Fox PR, Meurs KM and Liu S-K. 2003. Dilated cardiomyopathy in juvenile Doberman pinscher dogs. *J Vet Cardiol* **5**:23–27.



Fig.1. Dog - DCM - Heart with rounded apex

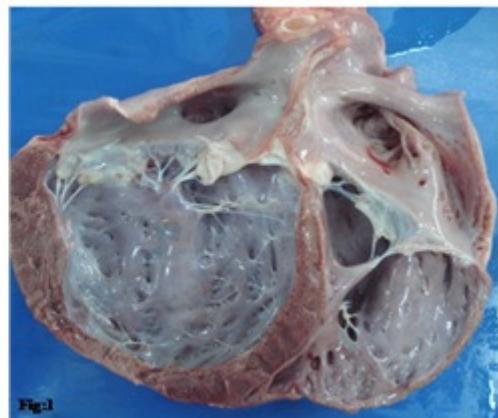


Fig.2. Dog - DCM - Heart - Marked dilatation of left ventricle

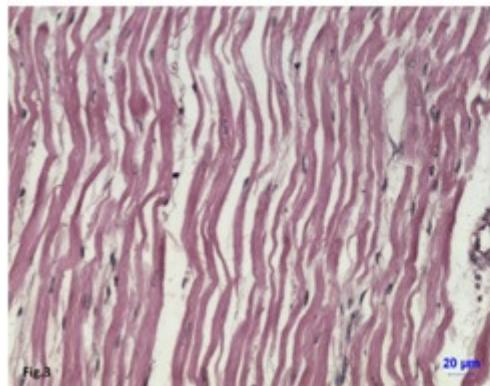


Fig.3. Dog - DCM - Heart - Left ventricular thinned out myocardium with attenuated wavy fibre. H&E, Bar=20μm

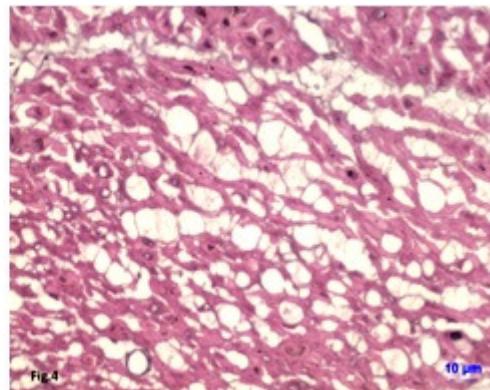


Fig.4. Dog - DCM - Heart -Left ventricular myocardium with fatty infiltration-degenerative type. H&E, Bar=10μm

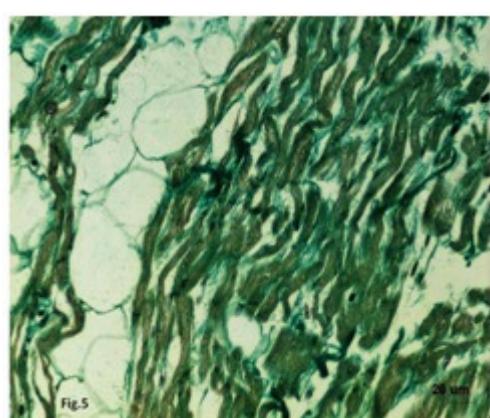


Fig.5. Dog - DCM - Heart - Left ventricular myocardium with fatty infiltration-degenerative type. Vacuolar degeneration and atrophy of myofibers with fat deposits and cords of collagen (green staining). Masson's trichrome. Bar=20μm