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Parth Nanda

Department of Veterinary
Clinical Complex, Veterinary
College, Kamdhenu University,
Navsari, Gujarat, India

Saurabh Parmar

Department of Veterinary
Medicine, Veterinary College,
Kamdhenu University, Navsari,
Gujarat, India

Rajan Kunjadiya

Department of Veterinary
Medicine, Veterinary College,
Kamdhenu University, Navsari,
Gujarat, India

Jignesh Vala

Department of Veterinary
Medicine, Veterinary College,
Kamdhenu University, Navsari,
Gujarat, India

Manish Patel

Department of Veterinary
Medicine, Veterinary College,
Kamdhenu University, Navsari,
Gujarat, India

Sudhir Mehta

Department of Veterinary
Medicine, Veterinary College,
Kamdhenu University, Navsari,
Gujarat, India

Corresponding Author:

Parth Nanda

Department of Veterinary
Clinical Complex, Veterinary
College, Kamdhenu University,
Navsari, Gujarat, India

Use of echocardiography and cardiac biomarkers for the diagnosis and therapeutic management of Mitral Valve Disease (MVD) in dogs

Parth Nanda, Saurabh Parmar, Rajan Kunjadiya, Jignesh Vala, Manish Patel and Sudhir Mehta

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Abstract

This case report describes the clinical presentation, diagnosis, and management of Myxomatous Mitral Valve Disease (MMVD) in an 8-year-old intact male Shih Tzu named Oreo. Oreo presented with chronic coughing, exercise intolerance, and increased respiratory effort. Diagnostics revealed a Grade IV/VI systolic murmur, cardiomegaly, pulmonary congestion, elevated NT-proBNP and Troponin I along with mitral valve abnormalities on echocardiography. A comprehensive treatment regimen including furosemide, pimobendan, an ACE inhibitor, spironolactone, and dietary modifications led to clinical improvement. This report highlights the significance of early diagnosis and multimodal therapy in managing MMVD in small-breed dogs.

Keywords: ECG, echocardiography, systolic murmur, cardiomegaly

Introduction

Myxomatous Mitral Valve Disease (MMVD) also referred to as degenerative mitral valve disease is the most common acquired cardiac disorder in dogs predominantly affecting geriatric small-breed dogs (Atkins *et al.*, 2009; Keene *et al.*, 2019) ^[1, 2]. The condition is characterized by progressive degeneration of the mitral valve leaflets and chordae tendineae resulting in mitral regurgitation (MR) and left-sided cardiac overload (Keene *et al.*, 2019) ^[2]. This disease accounts for approximately 75% of canine cardiovascular disorders making it a significant contributor to morbidity in the canine population (Borgarelli & Buchanan, 2012) ^[3]. Clinical signs of MMVD vary with disease progression ranging from asymptomatic murmurs in early stages to congestive heart failure (CHF) in advanced cases (Häggsström *et al.*, 2005). Common clinical signs include coughing, exercise intolerance, tachypnea, and syncope which may worsen with disease severity. Diagnostic evaluation typically includes auscultation, thoracic radiography, electrocardiography (ECG) and echocardiography, the latter being the gold standard for diagnosing MR and assessing disease severity (Boon, 2011) ^[5].

This report describes the clinical presentation, diagnostic evaluation, and therapeutic management of MMVD in an 8-year-old male Shih Tzu, with a focus on echocardiographic findings and long-term outcomes.

Case History and Clinical Observations

An 8-year-old male Shih Tzu was presented at the Veterinary Clinical Complex (VCC), College of Veterinary Science & A.H., Kamdhenu University, Navsari, Gujarat, with a history of chronic coughing, particularly at night or following physical exertion. The dog also exhibited exercise intolerance and increased difficulty breathing at rest, with symptoms worsening over the past month. During the clinical examination, the rectal body temperature was recorded at 102.2°F, within the normal range. The mucous membranes appeared normal, and the capillary refill time (CRT) was less than 1 second, indicating adequate perfusion.

However, the heart rate was elevated at 170 beats per minute, with a pulse rate of 165 beats per minute, and the respiratory rate was increased at 70 breaths per minute. Auscultation revealed a Grade IV/VI left apical systolic murmur, and a pulse deficit was noted, suggesting potential cardiac involvement. These clinical findings raised concern for a cardiovascular condition, leading to further diagnostic evaluation.

Laboratory Findings and cardiac biomarkers evaluation

Complete blood count and serum biochemical parameters were within normal reference ranges with mildly decreased sodium (Table 1) may indicate a slight electrolyte imbalance potentially due to chronic heart disease or diuretic therapy. The elevation of biomarkers NT-proBNP (1752ng/mL) and cardiac troponin I (0.7ng/ml) were also noticed.

Table 1: Hematological, biochemical, and cardiac biomarker parameters

Parameter	Value	Normal Values
Hb	15.6	10-16 gm/dL
PCV	48	30-50%
RBC	6.8	5-8x10 ⁶ /uL
Platelet	1.17	2-8lakh/uL
WBC	5500	6-16x10 ³ /uL
Creatinine	1.3	0.5-1.5 mg/dL
BUN	17.7	8-28mg/dL
ALT	43	25-92 U/L
AST	38	10-62U/L
Chlorine	111	102-117mEq/L
Sodium	136	141-152mEq/L
Phosphorus	4.1	2.9-5.3mg/dl
NT-proBNP	1752pmol/L	< 900pmol/L
Troponin I	0.7	< 0.1ng/mL

Radiographic Findings

Thoracic radiographs revealed left atrial enlargement, an enlarged pulmonary vein and pulmonary congestion, all consistent with cardiac involvement and indicative of increased left heart pressure and impaired cardiac function with fluid accumulation in the lungs.



Fig 1: Thoracic Radiograph of a Dog with Myxomatous Mitral Valve Disease

Electrocardiography (ECG)

ECG showed sinus tachycardia (172 bpm), increased P wave amplitude and width suggesting atrial enlargement and ST segment elevation in Lead II indicating potential myocardial injury.

Echocardiography

Echocardiography revealed thickened mitral valve leaflets with mitral regurgitation and left ventricular hyperkinesis indicating the severity of Myxomatous Mitral Valve Disease

(MMVD). The left atrium was enlarged (3.15 cm) and the aorta was dilated (0.88 cm) with an increased left atrium/aorta ratio of 3.58 cm confirming the diagnosis of MMVD.

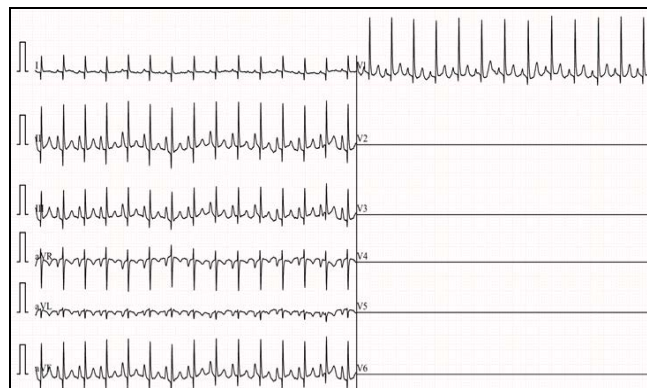


Fig 2: Electrocardiographic findings in a dog with mitral valve disease (MMVD). P-wave abnormalities, including changes in amplitude or duration.

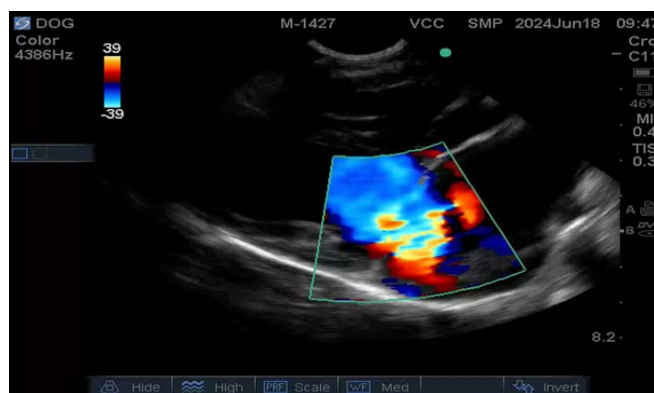


Fig 4: Echocardiographic findings Mitral regurgitation observed, with retrograde blood flow from the left ventricle into the left atrium

Clinical Management and Follow-Up Care

The therapeutic plan for managing mitral valve disease (MMVD) in this dog included a combination of pharmacologic and dietary interventions aimed at alleviating symptoms, improving cardiac function, and preventing disease progression. The medications prescribed were Benazepril (0.25 mg/kg every 12 hours orally), to reduce afterload and manage blood pressure, thereby decreasing the workload on the heart. A combination of Spironolactone and Furosemide (2 mg/kg every 12 hours orally) was used to address pulmonary edema and fluid retention, improving respiratory function and reducing symptoms of congestive heart failure. Pimobendan (0.25 mg/kg every 12 hours orally) was added to enhance cardiac contractility and reduce the heart's workload, thereby improving left ventricular efficiency. A low-sodium diet was recommended to minimize fluid retention and reduce cardiac stress, helping to control heart failure symptoms and slow disease progression. Follow-up care involved regular monitoring of cardiac parameters, including auscultation for murmurs and arrhythmias, echocardiography to assess valve function and ventricular dimensions, and radiographs to evaluate heart size and pulmonary congestion. Adjustments to the treatment plan were made based on clinical response and disease progression.

Outcome

After 60 days of treatment, the dog demonstrated a significant

reduction in pulmonary congestion, indicating an improvement in heart failure symptoms. However, intermittent coughing persisted despite the initial therapeutic interventions. To address this, Prednisolone was added to the treatment regimen for a short duration, leading to an uneventful improvement in activity levels and complete resolution of the coughing. This adjustment helped further manage the symptoms and enhance the dog's overall quality of life.

Conclusion

This case underscores the importance of early diagnosis and a multi-modal therapeutic approach in managing dogs with Myxomatous Mitral Valve Disease (MMVD). Echocardiography plays a critical role in the assessment of cardiac parameters, providing valuable insights into the progression of the disease. Additionally, a combination of pharmacological therapy, including ACE inhibitors, diuretics, and positive inotropes, along with dietary adjustments, can significantly improve clinical outcomes. Early intervention and tailored treatment plans are essential for managing MMVD and enhancing the quality of life in affected dogs.

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Conflict of Interest: Not available

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