Mitral valve prolapse in Cavalier King Charles Spaniel: A review and case study

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A 5 year-old spayed female Cavalier King Charles Spaniel was presented after a 3- to 5-day onset of severe respiratory distress. The dog also had a history of several episodes of syncope prior to presentation. A comprehensive diagnostic investigation revealed a midsystolic click sound on cardiac auscultation, signs of left sided cardiac enlargement in ECG and thoracic radiography, mitral valvular leaflet protrusion into left the atrium, decreased E-point-to septal separation (EPSS) and mitral regurgitated flow in echocardiography, all of which are characteristic signs of mitral valvular prolapse. After intensive care with antidiuretics and a vasodilator with oxygen supplement, the condition of the dog was stabilized. The dog was then released and is being medicated with angiotensin converting enzyme (ACE) inhibitor with regular follow-up.

Key words: Cavalier King Charles Spaniel, mitral valve prolapse, valvular endocardiosis, heart

Introduction

Mitral valve prolapse of the Cavalier King Charles Spaniel (MVP-CKCS) is characterized by valvular insufficiency due to abnormal myxomatous accumulation and nodular changes on valvular leaflets of the left atrioventricular valve [5,28]. For the last decade, there has been a dramatic increase in its prevalence in this dog breed [2]. Retrospective studies on auscultatory findings on MVP-CKCS revealed a prevalence of 11.4-44.95%. Heart murmur was age and sex-dependent [28,34]. Similar degenerative valvular disease, also known as chronic valvular fibrosis, myxomatous valvular degeneration, valvular endocardiosis, has been reported in other dog breeds, especially in small and deep-chested breed such as Miniature Poodles, Miniature Schnauzers, Chihuahuas, Dachshunds and small terriers [3,19,28]. This disease accounts for about 75% of all heart disease cases in dogs [6]. The tricuspid valves can be also affected, less frequently [28]. While valvular disease in other dog breed becomes increasingly prevalent as dogs get older, MVP-CKCS is showing the disease at a much younger age, with around 19% of dogs under 1 year of age having a heart murmur, and probably more than 50% of 5 year of age having murmurs [10].

MVP-CKCS is an idiopathic disease with evidence of polygenic inheritance in Cavalier King Charles Spaniels (CKS) and 1.5 times more prevalent in male dogs [10,30]. Although there is no known aetiology for this disease, genetic defect in hyaluronic acid signalling for epithelial-mesenchymal transformation in endocardial cushion formation may involve in the pathogenesis. In human, MVP is genetically heterogeneous and is inherited as an autosomal dominant exhibiting age and sex dependent penetrance. Although two genetic loci have been mapped at 16p121-p11.2 and Xq28[8,32], the actual causative gene has not been found yet.

MVP-CKCS is a slowly progressive disease and do not show any detectable signs in early stage of disease process [12]. As the disease progresses, an abnormal myxomatous accumulation on valvular leaflets causes nodular degeneration on valvular tissue, often extending to chordae tendineae [4,17]. The valve is then prolapsed into the left atrium, leading to a midsystolic click sound. The disease is eventually progressed to significant valvular distortion, leading to hemodynamic changes due to valvular insufficiency and regurgitation concurrent with left side heart enlargement. The entire process can take many years and can be ended in congestive heart failure, although the affected dogs can die suddenly.

Mitral valvular regurgitation (reverse blood flow from the high pressure ventricle to the low pressure atrial chamber) is characteristic in MVP-CKCS [3,24,28]. The determinants of regurgitant volume and disease severity include: regurgitant orifice size, pressure differences between left atrium and ventricle, and time from onset of contraction to opening of the aortic valve [15]. Severe mitral regurgitation (MR) causes LV volume overload, which can lead to left heart
failure. MR also predisposes to cardiac arrhythmias, especially those originating in the dilated atrium. However, many dogs have severe cardiomegaly but minimal clinical signs, because atrial compliance (distensibility) increases as the regurgitant volume gradually increases [14].

The main clinical signs of MVP-CKCS are attributable to cardiac disease or left-sided heart failure and include exercise tolerance, progressive cough or tachypnea, and syncope. Cough is the clinical sign that is observed most commonly in dogs with clinically evident mitral regurgitation. Syncope is a particularly important and may be related to insufficient forward flow, pulmonary hypertension or arrhythmias [25,28].

Although the physical examination findings may vary depending on the progress of disease, a systolic murmur with a characteristic midystolic click sound (due to mitral valve prolapse) can be audible over the mitral area and left apex. Sometimes precordial thrill can be palpable over the left apex.

P mitrale (long duration of P wave), P pulmonale (increased amplitude of P wave) and sinus arrhythmia are common finding in ECG. Progressive cardiomegaly with left-sided enlargement is a predominant finding in routine thoracic radiography. As the disease progresses, generalized cardiomegaly, left mainstem bronchial compression, and pulmonary venous distension are obvious. Due to pulmonary oedema, overall lung density (interstitial and alveolar infiltrates) can be increased especially, in the perihilar lung zones. These infiltrates are characteristically dorsal and bilaterally symmetric; however, oedema may be worse in the right caudal lobe.

Echocardiography sometimes provides the definitive evidence for MVP-CKCS. In four-chamber view at mitral valve level, the prolapsed and thickened mitral valve and enlarged left atrium can be observed, although it is not clear in the early stage of disease [21]. Furthermore, in the same echocardiographic view, regurgitated mitral blood flow can be also observed in colour-Doppler echocardiography [7, 34]. M-mode echocardiography will provide cardiac measurement, which is useful to determine the disease progress and prognosis [21]. Due to nodular degeneration on valvular leaflets, valvular tip may locate closer to interventricular septum, causing shortening of EPSS (E point to septal separation) and decreased F slope (implying decreased blood flow in mitral orifice). As the left atrium is enlarged, LA/Ao ratio (left atrium/Aorta ratio) may increase. However, the left ventricle may be normal, increased or decreased in size, depending on the amount of mitral regurgitation. Therefore, fractional shortening (FS) may also vary. The clinical laboratory tests will be useful to differentiate extracardiac disorders such as Cushing’s disease, renal failure, and the effects of drug therapy [29]. However, there will be no pathognomic haematological and biochemical changes indicating MVP-CKCS, although high prevalence rate of thrombocytopenia with enlarged platelets (giant platelet) in this dog breed has been reported [32]. However, the association is not clear. In human with familial mitral prolapse, high prevalence rate of haemophilia has also been reported [28].

The differential diagnosis of MVP-CKCS includes dilated cardiomyopathy, congenital AV valve malformations, bacterial endocarditis and primary respiratory diseases.

Unfortunately, there is currently no practical way of curing the disease, although valvular replacement by surgical method is being used in human. However it is simply not practical in dogs. Therefore treatment is aimed at ameliorating the existing signs. Treatment will depend upon the grade of murmur and clinical signs. Treatment of the asymptomatic dog with a murmur is not recommended unless there is evidence of impending heart failure such as gross cardiomegaly and pulmonary venous distension.

Initial therapy for MVP-CKCS showing signs of congestive heart failure or pulmonary oedema includes antidiuretics for reducing ventricular preload and eliminating pulmonary fluid accumulation; vasodilators for reducing vascular afterload and oxygen supply for improving ventilation. Dietary modification to low salt diet and exercise restriction will be required. However, restrictive low salt diet is not necessary for dog having early stage of MVP-CKCS. Dietary supplements such as fish oil and enzyme Q may be beneficial, although the effect of these supplements has not been proven. Baseline home therapy of MVP-CKCS involves angiotensin converting enzyme (ACE) inhibitor and antidiuretics, and sometimes digitalis.

Prognosis will vary depending on the stage of disease. Dogs with low-grade murmur may survive for several years without therapy. Although the intensity of murmur is generally correlated with the disease progress, some dogs with severe murmur may survive longer than dogs with moderate murmur.

Materials and Methods

Animal

A 5 year-old spayed female Cavalier King Charles Spaniel, weighing 5.7 kg, was presented several weeks after a 3- to 5-day history of severe respiratory distress.

Diagnostic work-ups

Haematology and blood chemistry was done using a Roche ABX blood cell counter (Cobras Minos Vet, Roche diagnostic System, Germany) and, a Cobas Mira system (Roche Diagnostic Systems, Germany) using Boehringer Mannheim reagents (Germany), respectively. Phonocardiographic assessment was done at the point of maximal intensity (PMI) using amplified stethoscope (I-stethos, Androscope™, USA) with analysing software (STG®, Stethographics, USA). A 6-lead system electrocardiographic assessment