The Latest on Managing Mitral Valve Disease

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Chronic degenerative valvular disease (CDVD) is the most common cause of cardiac disability in dogs, accounting for as many as 75% of all dogs with signs of congestive heart failure. The disease process is best described as myxomatous degeneration of the heart valves wherein the integrity of the valves is compromised often resulting in valvular insufficiencies. During the initial stages of the disease there is no valvular insufficiency so there is no hemodynamic change or murmur ausculted, and the patients are entirely asymptomatic. As the lesions progress and the valves become incompetent, a systolic murmur results at the affected valve site and atrial pressure begins to rise. Left atrial enlargement and eccentric hypertrophy of the left ventricle maintain normal cardiac output for an indefinite period of time, often months to years. Eventually, left atrial and pulmonary venous pressures rise resulting in pulmonary venous congestion and ultimately pulmonary edema. The two primary determinants of the volume of valvular regurgitation include the size of the regurgitant orifice and the ventricular to atrial pressure gradient.

Most of the early signs of mitral regurgitation result from pulmonary congestion and most owners seek treatment for their dog after noticing some degree of respiratory distress. Coughing is a common but nonspecific sign of developing heart failure in dogs. When due to heart failure, coughing is usually accompanied by an elevated respiratory rate (tachypnea) and increased respiratory effort (dyspnea). Some dogs with valvular disease develop signs of right-heart failure due to degeneration of the tricuspid valve, as a consequence of pulmonary hypertension, or a combination of these disorders. Generalized muscle weakness and progressive exercise intolerance become evident when forward output is impaired by severe valvular regurgitation, pulmonary hypertension, and/or declining myocardial contractility.

Cardiac auscultation is the most practical and economical diagnostic method for detecting mitral regurgitation. There is a strong relationship between murmur intensity, heart size, the severity of regurgitation, and class of heart failure. The murmur of mitral regurgitation is usually best heard at the left fifth intercostal space, but dorsal, cranial, caudal, or rightward radiation of the murmur is common. It is particularly difficult to determine whether murmurs heard over the tricuspid valve area originate from that valve or if they are referred from an incompetent mitral valve. Cardiac arrhythmias can be readily identified as they interrupt the predominating cadence of the heart, create abnormal pauses in the rhythm, and alter the intensity of both murmurs and transient heart sounds.

Therapy

At this time early institution of therapy, in the asymptomatic patient and prior to the onset of heart failure, has been unable to demonstrate significant reduction in the time to development of congestive heart failure. Diuretics, vasodilators, angiotensin converting-enzyme inhibitors, and positive inotropic drugs all have demonstrated the capacity to lessen the severity of clinical signs associated with mitral regurgitation under certain conditions. Therapeutic recommendations should be based on a complete cardiovascular evaluation to identify the specific requirements of each dog. Many cardiologists consider the use of furosemide, an ACE inhibitor, and pimobendan standard therapy for dogs with valvular disease and heart failure. Dogs requiring medical therapy to control the signs of heart failure should avoid strenuous exercise and may achieve benefit from a low sodium diet.

Diuretics are the most effective drugs available for the symptomatic short-term treatment of congestive heart failure in animals. They are administered to reduce blood volume and, thereby, to lower filling pressures and alleviate congestion and associated clinical signs. With judicious use of diuretics, indirect improvement in cardiac output may result from improved oxygenation as pulmonary function returns towards normal. Diuretics tend to decrease preload and can aggravate low cardiac output signs if used overzealously. Always use the lowest dose necessary to control signs. In chronic, refractory cases of congestive heart failure, subcutaneous or intramuscular furosemide may be effective even if the animal is refractory to oral therapy. Alternatively, a combination of different types of diuretics can be used in this circumstance. The angiotensin-converting enzyme (ACE) inhibitors are the most important class of neurohormonal antagonists currently available for treating congestive heart failure. ACE inhibiting drugs are believed to palliate the deleterious consequences of vasoconstriction and sodium retention in patients with heart failure by blocking formation of angiotensin II and aldosterone. Overall, ACE inhibitors appear to be safe and well tolerated in dogs with congestive heart failure. Some of the specific adverse effects of ACE inhibiting drugs include systemic hypotension, hyperkalemia, and renal dysfunction/failure. When appropriate dosages are adhered to, systemic hypotension is an infrequently observed complication of ACE inhibitor treatment in dogs. Hyperkalemia is also occasionally observed in dogs receiving ACE-inhibiting drugs. Hyperkalemia appears to result from reduced glomerular filtration and diminished release of aldosterone. The degree of hyperkalemia is usually mild and few dogs develop clinical signs of hyperkalemia. Evidence of mild to moderate renal dysfunction is common in a substantial percentage of dogs with congestive heart failure, regardless of the form of treatment selected. Azotemia is usually interpreted in this population of dogs as evidence of decreased renal perfusion (prerenal azotemia) combined with an age-related decline in renal functional capacity. Angiotensin converting enzyme inhibitors are known to decrease glomerular filtration pressure by virtue of their vasodilating effects

on the renal efferent arterioles. As a result, treatment with an ACE inhibitor can result in mild azotemia and slightly increased serum creatinine concentrations. In most dogs treated with an ACE inhibitor renal function soon normalizes or stabilizes at a new steady state. In some circumstances, severe renal failure is observed shortly after initiating ACE inhibitor therapy. This consequence may be more common in dogs with serious preexisting renal disease, in dogs that are dehydrated, and in dogs experiencing systemic hypotension. It is prudent to evaluate renal function prior to and about 5 to 7 days after initiating an ACE-inhibiting drug. Most dogs that display intolerance can be adequately managed by decreasing either the dose of the ACE inhibitor or diuretic. On rare occasion, ACE inhibitor therapy may have to be abandoned.

Calcium sensitizers, combined with phosphodiesterase (PDE) inhibition in the form of pimobendan, are an additional drug class used in the management of congestive heart failure in dogs with valvular heart disease. Pimobendan has the ability to augment systolic performance by enhancing calcium-binding to troponin C and/or by affecting the cross-bridge turnover kinetics without increasing cytosolic calcium levels. Because pimobendan displays both calcium sensitization and PDE inhibition it becomes difficult to identify if the positive inotropic action stems from enhanced reactivity of troponin C and Ca^{2+}, cAMP-mediated phosphorylation of phosphoproteins, or a combination of the two. Pimobendan combined with furosemide has shown to improve outcome in dogs with valvular disease and heart failure in comparison to furosemide and an ACE inhibitor. The most common reported sided effects tend to be GI in nature. There are reports of development of ventricular concentric hypertrophy and worsening of the histologic grade of valve lesions in asymptomatic dogs with mitral valve disease, however the frequency of these adverse effects is uncertain and seem rare.

Complications of valvular heart disease

Cardiac arrhythmias

Atrial fibrillation occurs uncommonly but is hemodynamically one of the most serious rhythm disturbances observed. As a result of the loss of the atrial transport, clinical signs usually dramatically worsen with the onset of this rhythm disturbance.

Ruptured chordae tendinea

Rupture of the first-order chordae tendineae results in eversion of the valve leaflet into the atrium, severe mitral insufficiency, and the likelihood of rapid decompensation and acute, severe pulmonary edema. Rupture of second or third order chordae is better tolerated and may not result in rapid decompensation or any clinically recognizable signs.

Left-atrial tears

Endocardial splitting of the left atrial wall may complicate chronic mitral insufficiency. Nonperforating splits are often found at necropsy and are usually observed in the same areas as jet lesions on the posterior wall of the left atrium. Perforating myocardial splits most often produce hemopericardium or more rarely atrial septal defects. The sudden development of cardiac tamponade or signs of right heart failure in a previously compensated patient should alert the astute clinician to this possibility.

Bronchial collapse

Collapse of the left mainstem bronchus due to compression from a greatly enlarged left atrium may result in a chronic cough resistant to therapeutic efforts designed to abolish it.

Prognosis

The prognosis for dogs with asymptomatic mitral valve disease is good for survival although the disease is invariably progressive and may ultimately lead to congestive heart failure. Currently it is impossible to predict the rate of progression for an individual patient. In general, dogs with asymptomatic mitral valve disease carry a favorable prognosis. A large retrospective study by Borgarelli, et al. identified a median survival time of 28 months for dogs with ISACHC 2 and a median survival time of 9 months for dogs with ISACHC 3.