Presentation Notes

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"Puppy murmurs"

- Caused by physiologic anemia
- Characteristics
 - o Systolic
 - o Basilar
 - o Low-grade intensity, usually \leq III/VI
 - Should resolve by 6 months of age
- Echo findings
 - Increased trans-aortic velocities
 - As an aside, many puppies can have a small degree of tricuspid valve regurgitation, which is often considered physiologic.

Pathologic murmurs

- Most common congenital cardiac lesions
 - Patent ductus arteriosus (PDA)
 - Pulmonic stenosis (PS)
 - Subaortic stenosis (SAS)
 - Ventricular septal defect (VSD)
 - Tricuspid valve dysplasia (TVD)

Patent ductus arteriosus

- Heart murmur characteristics
 - o Left-to-right PDA
 - Left basilar continuous heart murmur
 - Diastolic component can be lost if pulmonary pressures increase may sound systolic only
 - Right-to-left PDA
 - No heart murmur present with right-to-left PDA
- Natural outcome
 - Left-sided volume overload → left-sided congestive heart failure
 - Most puppies will succumb to this condition within 2 years of age
 - Pulmonary over-circulation \rightarrow pulmonary hypertension
 - Termed Eisenmenger's physiology if direction reverses to right-to-left
 - Polycythemia can develop → differential cyanosis (mucous membranes of the caudal half of the body are cyanotic)
- Diagnostics
 - Thoracic radiographs
 - Left-sided cardiomegaly
 - "Triple bump" ductus bump of the aorta, dilated main pulmonary artery, enlarged left auricle

- Pulmonary over-circulation; pulmonary arteries AND veins are dilated mimics an interstitial pattern
- o Echocardiography
- Treatment
 - o Left-to-right PDAs ideally should be closed ASAP
 - Interventional occlusion
 - Devices
 - Amplatz Canine Duct Occluder ACDO requires femoral arterial access
 - Preferred method of occlusion
 - Coil embolization can be placed via femoral artery or vein
 - Vascular plug can be placed via femoral artery or vein
 - Considerations for interventional occlusion
 - Size of the patient difficult to gain femoral arterial access in very small dogs
 - Size and shape of the PDA large PDAs or PDAs with odd shapes may not hold devices appropriately
 - Surgical ligation
 - Used for very small patients or patients with a PDA shape/size that is not amenable to interventional closure
 - o Right-to-left PDAs
 - It is contraindicated to close right-to-left PDAs risk intra-operative death is extremely high

Pulmonic stenosis

- Heart murmur characteristics
 - o Left basilar systolic
- Natural outcome
 - o Clinical signs weakness, lethargy, exercise intolerance, syncope
 - o Right-sided pressure overload
 - o Right-sided CHF
 - Some have a normal quality of life and lifespan
- Treatment
 - Treatment options
 - Balloon valvuloplasty
 - Atenolol
 - o Balloon valvuloplasty
 - Indications
 - Severe PS (pressure gradient > 75 mmHg)
 - Right-sided remodeling
 - Clinical signs
 - Significant tricuspid valve regurgitation
 - Patients with significant tricuspid valve regurgitation should undergo balloon valvuloplasty, as the high pressures in the right ventricle exacerbate the regurgitation and CHF occurs sooner
 - Balloon valvuloplasty is warranted in patients with mild or moderate PS that have significant tricuspid valve regurgitation

- Ballooning would not be warranted in mild to moderate cases if tricuspid valve regurgitation was not present
- Considerations
 - Patient size must navigate through the right ventricle
 - Coronary artery anomalies
 - R2A or single left coronary artery anomalies can be present
 - Most often seen in English Bulldogs and related breeds
 - Ballooning of the valve can lead to coronary artery rupture → sudden death
 - We try to rule this out first via angiography prior to ballooning if high suspicion is present
 - Pulmonic valve leaflet thickness and dysplasia
 - Balloon valvuloplasty is less effective if pulmonic valve leaflets are very thick
 - Hypoplastic pulmonary annulus
 - Balloon valvuloplasty is less effective if the pulmonary annulus is hypoplastic
- Balloon success
 - Valvuloplasty considered successful if pressure gradient is reduced by $\geq 50\%$
- Risks
 - Ventricular arrhythmias usually transient
 - Hypotension/decreased systemic perfusion usually transient
- o Atenolol
 - Usually started in all patients if pressure gradient is above mild
 - Usually start around 0.5 mg/kg PO BID and titrate up to 1 mg/kg PO BID over a few weeks
- Prognosis
 - Most dogs will live a normal life if balloon valvuloplasty is successful
 - Some patients with mild to moderate PS can be maintained on atenolol life-long without having any clinical signs

Subaortic stenosis (SAS

- Heart murmur characteristics
 - Left basilar systolic
 - o To-and-fro murmur can be heard if significant aortic insufficiency is also present
 - A right basilar systolic can also be heard, depending on how the turbulent jet radiates
 - o Murmur can be heard with stethoscope over the carotid arteries or on the skull in severe cases
- Natural outcome
 - ***important to note that the lesion itself can progress until the patient is 16-18 months old***
 - This is why we wait until this age for OFA screening in over-represented breeds
 - Left ventricular concentric hypertrophy + aortic insufficiency \rightarrow left atrial enlargement \rightarrow leftsided congestive heart failure
 - o Endocarditis
 - o Arrhythmias
 - Most patients with severe SAS and ventricular arrhythmias will have sudden cardiac death before the age of 5 years old
- Treatment

- Treatment options
 - Atenolol
 - Cutting balloon valvuloplasty
- o Atenolol
 - Used with moderate to severe SAS and if clinical signs are present
 - Usually start around 0.5 mg/kg PO BID and titrate up to 1 mg/kg PO BID over a few weeks
- o Cutting balloon valvuloplasty
 - Indications
 - Clinical signs
 - Severe SAS (pressure gradient > 80 mmHg)
 - Left-sided remodeling with high risk of developing left-sided CHF
 - Procedure
 - Carotid arterial access
 - Cutting balloon is placed across the fibrous stenotic lesion in the left ventricular outflow tract and inflated to score the lesion
 - Cutting balloon has inverted atherotomes which evert when the balloon is inflated
 - o Atherotomes are 3-5x sharper than surgical scalpel blades
 - Cutting balloon removed and replaced with a high-pressure balloon
 - High-pressure balloon used to dilate the scored fibrous lesion
 - Risks
 - Ventricular arrhythmias
 - Worsening aortic insufficiency
 - Damage to surrounding structures (left ventricle, aorta, mitral valve)
- Prognosis
 - Depends on:
 - Success of cutting balloon valvuloplasty, if performed
 - Pressure gradient across the lesion
 - Severity of aortic insufficiency
 - Presence of ventricular arrhythmias
 - Best outcome from cutting balloon valvuloplasty may be seen in dogs with significant pressure gradients (> 250 mmHg)