Echocardiogram study guidelines

IDEXX Telemedicine Consultants

This guide describes general quality guidelines for echocardiogram submissions and provides a detailed protocol explaining exactly what to include.

Technical requirements and recommendations

Maximum number of images by type:
Still images: **20** Cine loops: **35**
Submitting more than the maximum will result in additional charges.

Recommendations:

1. **File format:** Use DICOM* format to maximize image quality. **Note:** Offline measurements cannot be obtained on images submitted as JPG, AVI, or WMV files.
2. **Compression settings:** Use lossless compression (or 70% quality) for images and cine loops to optimize data transfer without losing image quality. Ideal settings may vary between systems.
3. **Cine loop frame rate and length:** Use a cine loop frame rate of 30 and length of 3–5 seconds (long enough to capture 5 beats). Prolonged cine loops do not improve the diagnostic value of the study and may cause technical problems.

Contact your ultrasound vendor support for assistance with system settings.

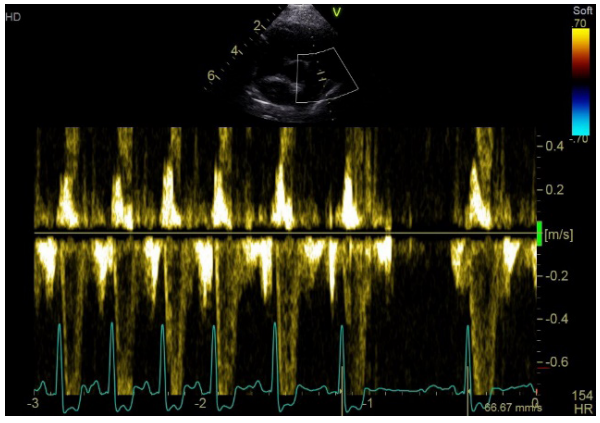
Important: Type and number of images may vary depending on abnormalities or pathology. Some modalities are indicated only if pathology is present. For example: Continuous-wave Doppler is indicated if mitral regurgitation is present. Larger and more complex studies will incur additional charges.
See **VetMedStat.com** for details.

Doppler data quality

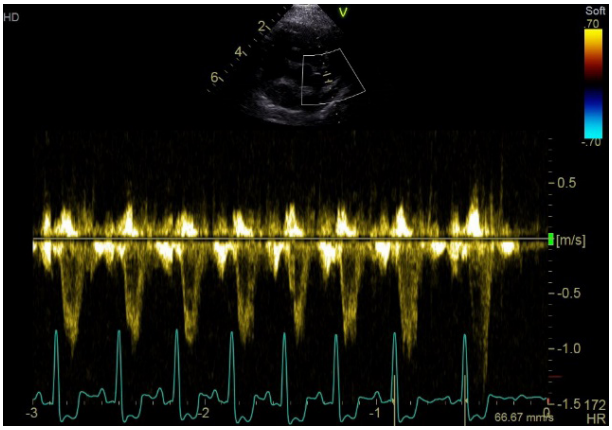
Setting scale and baseline values

If your study includes spectral Doppler data, make sure that the scale and baseline are set to document accurate peak velocity and to show the entire waveform either above or below baseline.

Scale and baseline not well positioned



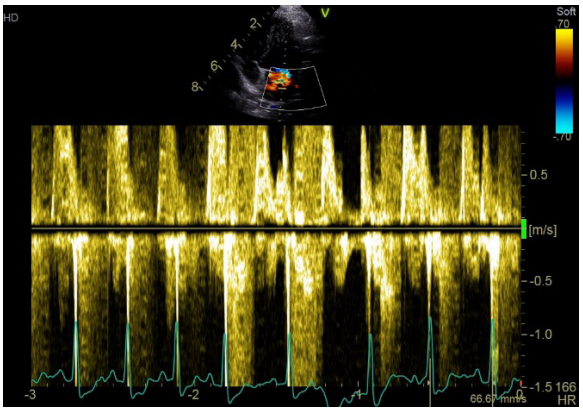
Scale and baseline appropriately positioned



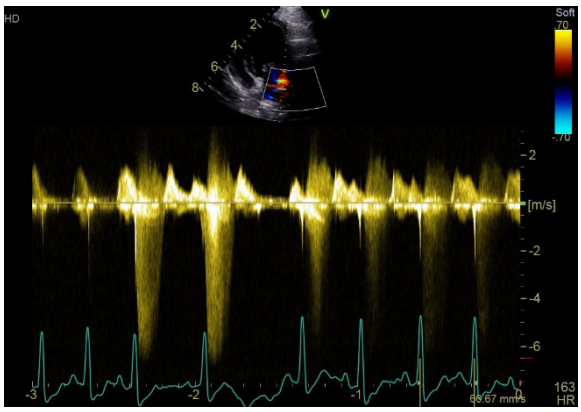
Correcting for aliasing

If aliasing (distortion) is noted on a pulsed-wave (PW) Doppler study, acquire a continuous-wave (CW) Doppler study to capture high-velocity jets.

Aliasing present



Aliasing corrected with continuous Doppler

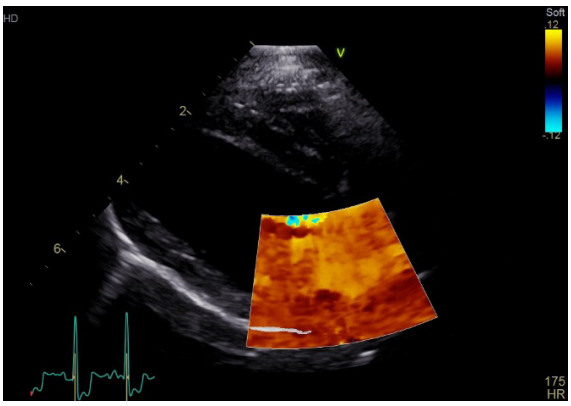


Optimizing Nyquist limits for color Doppler data

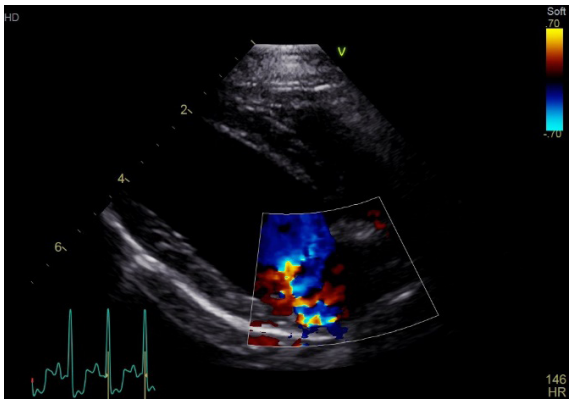
If your study includes color Doppler data, make sure you optimize the Nyquist limit (the velocity scale setting above which aliasing occurs) to show what you are trying to demonstrate. A fixed and low Nyquist limit causes apparent turbulent flow to appear in every part of the circulation and is of low diagnostic value.

For most applications the color Doppler scale should be set at the highest Nyquist limit allowed by imaging depth and probe frequency (usually >70 cm/sec).

Low Nyquist limit



Appropriate Nyquist limit



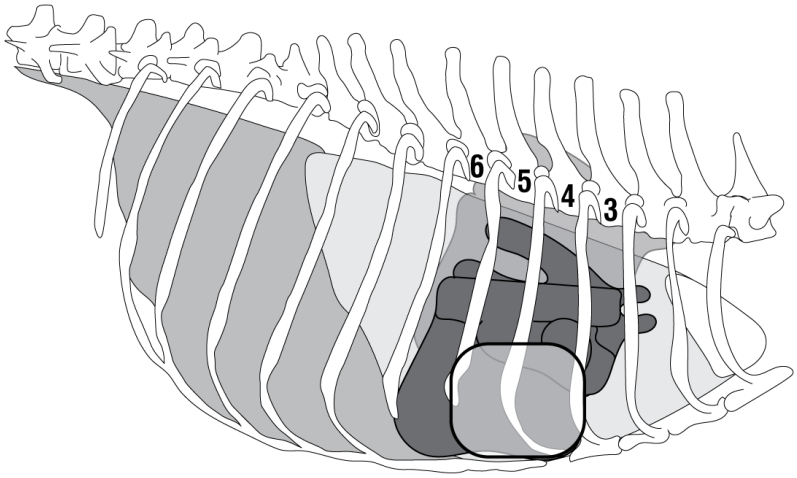
Color Doppler box

The color Doppler box size should be as narrow as possible to optimize the frame rate but large and long enough to adequately interrogate the structure(s) of interest.

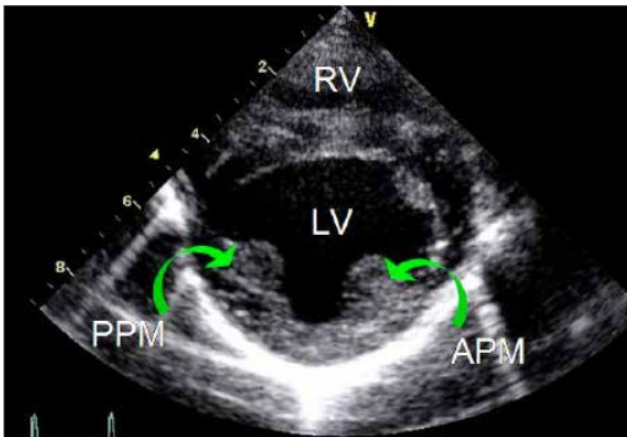
Recommended echocardiogram protocol

An echocardiogram submission should include both the right and left parasternal windows, as described below.

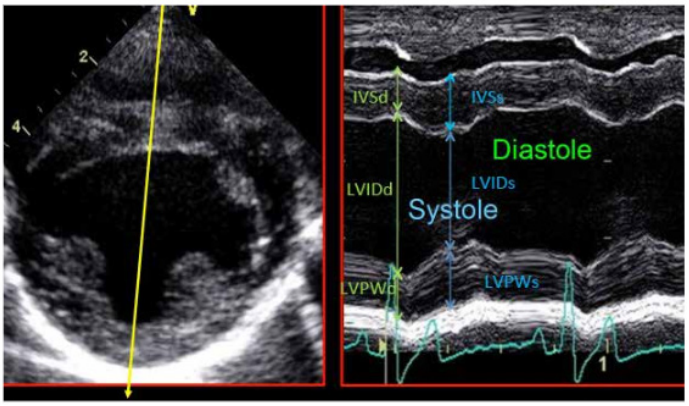
Right parasternal window



Right parasternal short axis—papillary muscle level

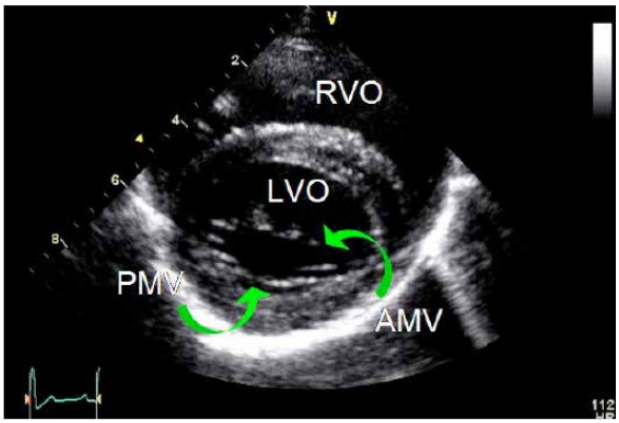


M-mode—left ventricular papillary muscle level

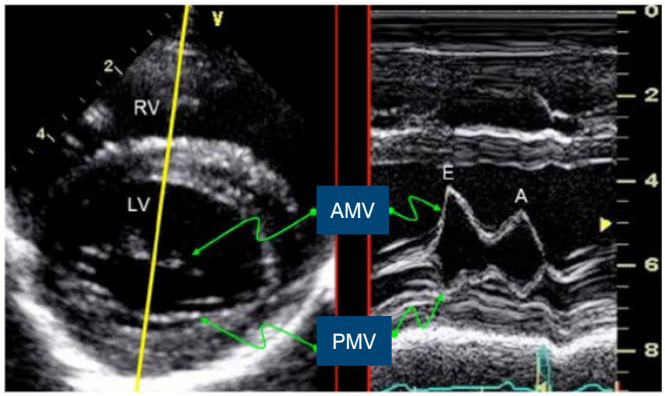


Description:	Anatomic structures:	Images to obtain:	Measurements to include:
Short axis imaging plane of the left ventricular (LV) chamber, which should be slightly apical to the mitral valve, so the mitral valve is not seen. Find a plane where the LV lumen is not obliqued. Diastolic measurements occur at the onset of the QRS or the first frame of mitral valve closure (after atrial contraction). Systolic measurements should occur at the last frame of mitral valve closure. Allows subjective evaluation of contractility.	LV walls LV lumen Anterior (APM) and posterior (PPM) papillary muscles Right ventricle (RV) Pericardium	1–2, 2D cineloops 1–2, M-mode still images	IVSd LVIDd PWd IVSs LVIDs PWs FS

Right parasternal short axis—mitral valve level

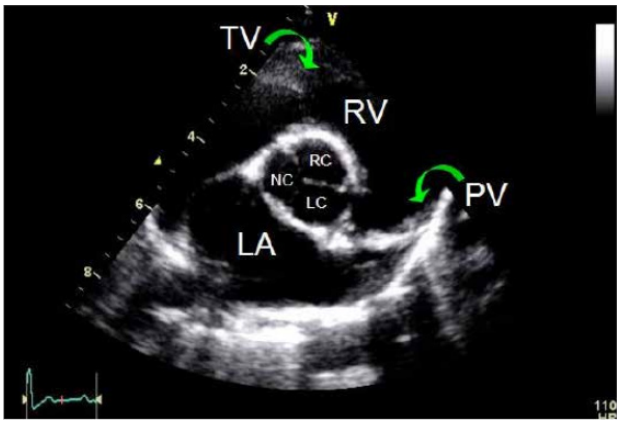


M-mode—mitral valve level



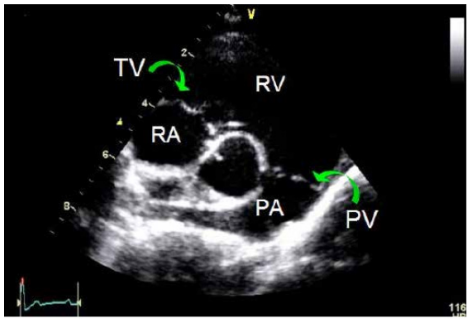
Description:	Anatomic structures:	Images to obtain:	Measurements to include:
Short axis imaging plane at the level of the mitral valve.	Anterior (AMV) and posterior (PMV) mitral valve leaflets Left ventricle (LV) and left ventricle outflow (LVO) Right ventricle (RV) and right ventricle outflow (RVO)	1–2 2D cineloops 1–2 M-Mode still images	E-point septal separation, if needed

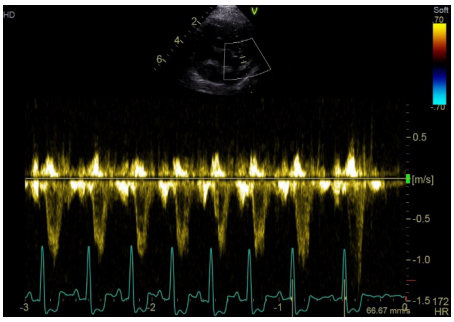
Right parasternal short axis—left atrium/aorta

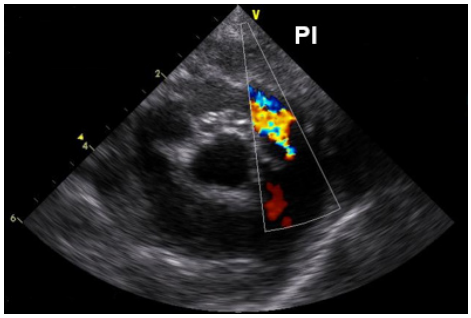


Description:	Anatomic structures:	Images to obtain:	Measurements to include:
Short axis imaging plane at the level of the heart base. Measurements obtained immediately after aortic valve leaflet closure.	Left atrium (LA) Aortic valve with noncoronary (NC), right coronary (RC), and left coronary (LC) leaflets Right atrium Right ventricle (RV) Tricuspid valve (TV) Pulmonic valve (PV) Pericardium	1–2 2D cineloops 1–2 2D cineloops with color 1–2 2D still images	LA Ao LA/Ao PV annular diameter

Right parasternal short axis—right ventricular outflow tract

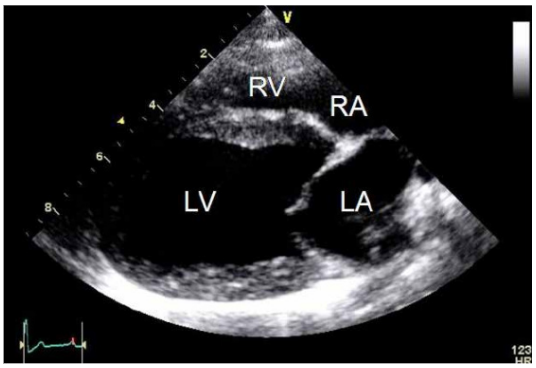


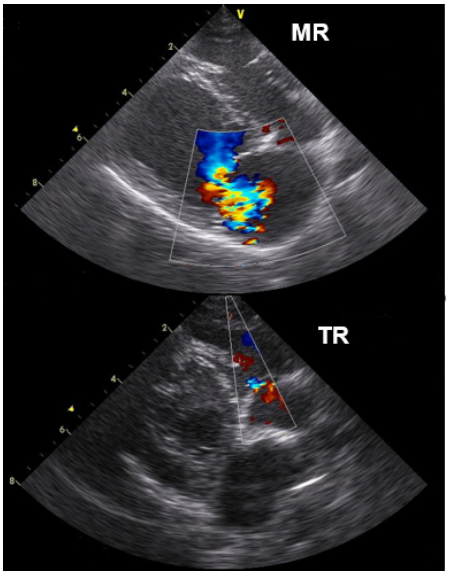




Description:	Anatomic structures:	Images to obtain:	Measurements to include:
Short axis imaging plane at the level of the heart base, optimized for the right ventricular outflow tract. Allows visualization of pulmonary artery thrombi, heartworms, or patent ductus arteriosus, if present, in the pulmonary artery.	Left atrium (minimized) Aortic valve Right atrium (RA) Right ventricle (RV) Tricuspid valve (TV) Pulmonic valve (PV) Pulmonary artery (PA)	1–2 2D cineloops 1–2 2D cineloops with color 1–2 pulsed-wave Doppler studies of the PV 1–2 continuous-wave Doppler studies of the PV if insufficiency or stenosis is identified	PV Vmax Pulmonic insufficiency (PI) Vmax, if present Tricuspid regurgitation Vmax (if present)

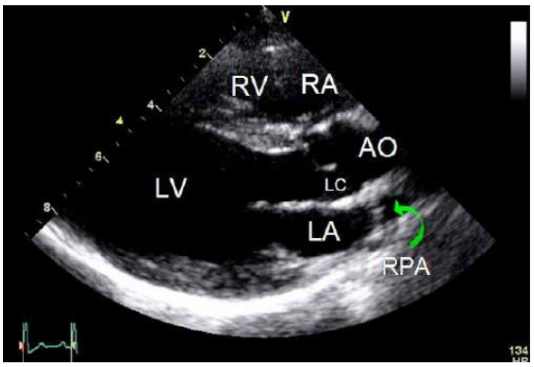
Right parasternal long axis—four chamber

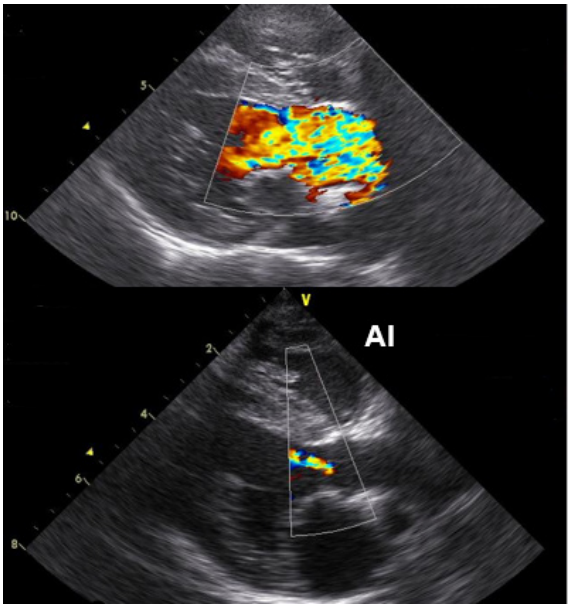




Description:	Anatomic structures:	Images to obtain:	Measurements to include:
Long axis imaging plane of all four cardiac chambers. Image is optimized to the mitral valve inflow (aortic valve should not be visible). Diastolic measurements occur at the onset of the QRS or the first frame of mitral valve closure (after atrial contraction). Systolic measurements occur at the last frame of mitral valve closure. Allows subjective evaluation of contractility. Allows visualization of mitral and tricuspid valve morphology and regurgitation (MR, TR).	Left atrium (LA) Mitral valve Left ventricular (LV) walls and lumen Papillary muscles (minimized) Right atrium (RA) Tricuspid valve Right ventricle (RV) Pericardium	1–2 2D cineloops 1–2 2D cineloops with color to evaluate the mitral valve and tricuspid valve 1–2 M-mode still images with the cursor crossing the LV slightly apical to the mitral valve	IVSd LVIDd PWd IVSs LVIDs PWs FS LA minor

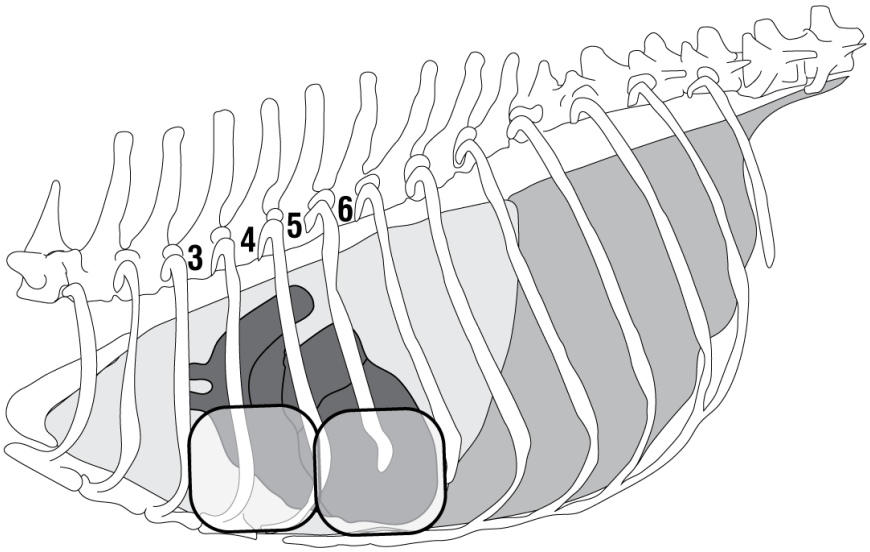
Right parasternal long axis—outflow



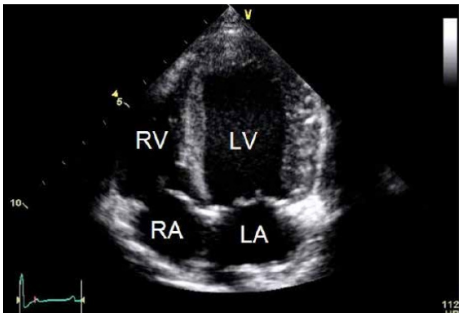


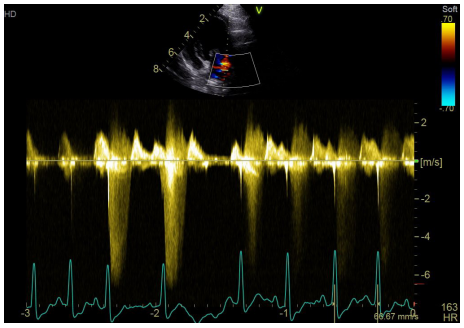
Description:	Anatomic structures:	Images to obtain:	Measurements to include:
Long axis imaging plane of all four cardiac chambers but optimized to visualize the aortic valve. Allows visualization of systolic anterior motion of the mitral valve and aortic valve motion. Allows visualization of subvalvular, valvular, and supravalvular lesions, as well as aortic valve insufficiency (AI).	Left atrium (LA) Mitral valve Left ventricular (LV) walls and lumen Papillary muscles Aortic valve (left coronary cusp [LC]) Ascending aorta (Ao) Right atrium (RA) Tricuspid valve Right ventricle (RV) Pericardium Right pulmonary artery (RPA)	1–2 2D cineloops 1–2 2D cineloops with color to evaluate the aortic valve	None

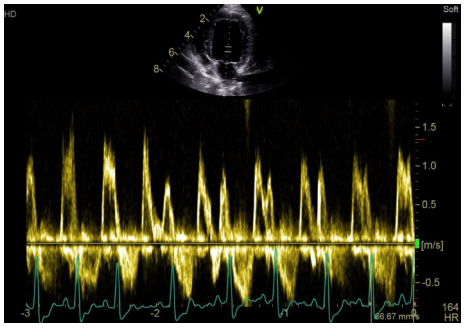
Left parasternal window



Left apical—four chamber

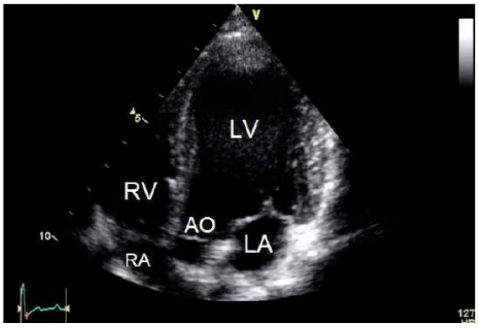


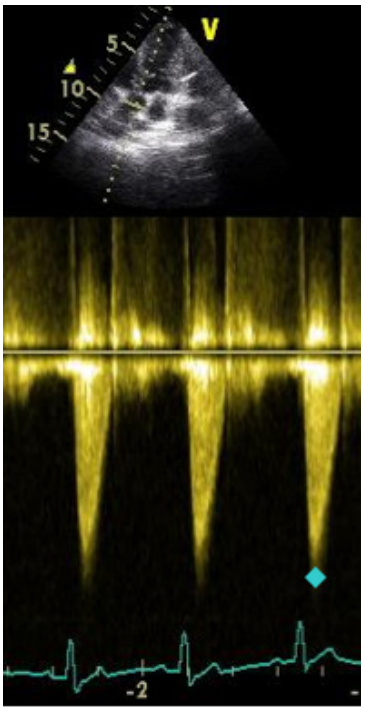




Description:	Anatomic structures:	Images to obtain:	Measurements to include:
Long axis imaging plane of all four cardiac chambers. Image is optimized to the mitral valve inflow (aortic valve should not be visible). Allows comparison of the right and left heart sizes and functions. Allows visualization of mitral and tricuspid valve morphology and regurgitation (MR, TR).	Pulmonary veins Left atrium (LA) Mitral valve Left ventricular (LV) walls and lumen Papillary muscles Right atrium (RA) Tricuspid valve Right ventricle (RV) Pericardium	1–2 2D cineloops 1–2 2D cineloops with color to evaluate the mitral valve and tricuspid valve 1–2 pulsed-wave Doppler studies of the mitral valve inflow 1–2 continuous-wave Doppler studies of the mitral valve or tricuspid valve if regurgitation is identified	Mitral E wave velocity Mitral A wave velocity Mitral E/A ratio MR Vmax, if present TR Vmax, if present

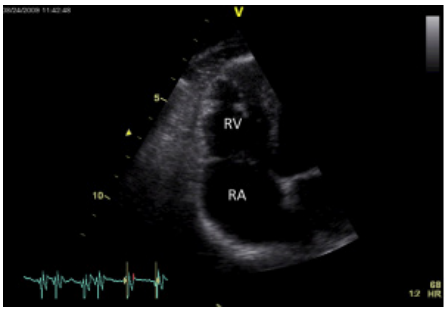
Left apical—five chamber

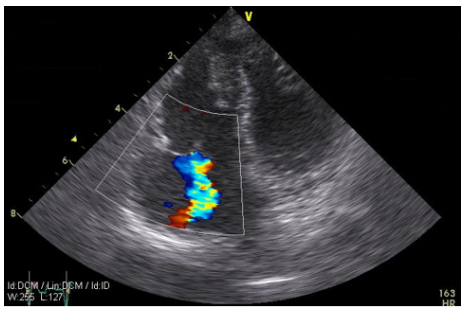


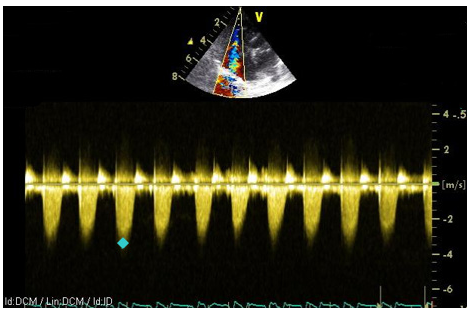


Description:	Anatomic structures:	Images to obtain:	Measurements to include:
Long axis imaging plane of all four cardiac chambers but optimized to visualize the aortic valve. Allows visualization of systolic anterior motion (SAM) of the mitral valve and aortic valve motion. Allows visualization of subaortic, aortic, and supraortic lesions, as well as aortic valve insufficiency.	Left atrium (LA) Mitral valve Left ventricular (LV) walls and lumen Papillary muscles Aortic valve (AV) Ascending aorta (Ao) Right atrium (RA) Tricuspid valve Right ventricle (RV) Pericardium	1–2 2D cineloops 1–2 2D cineloops with color to evaluate the AV 1–2 pulsed-wave Doppler studies of the AV 1–2 continuous-wave Doppler studies of the AV if regurgitation or stenosis is identified	AV Vmax Aortic insufficiency Vmax, if present

Left apical—four chamber (optimized to visualize right heart)







Left image: Gentile-Solomon JM, Abbott JA. Conventional echocardiographic assessment of the canine right heart: reference intervals and repeatability. *J Vet Cardiol*. 2016 Sep;18(3):234–247.

Description:	Anatomic structures:	Images to obtain:	Measurements to include:
Long axis imaging plane of all four cardiac chambers. Image is optimized to the tricuspid valve inflow (generally need to move probe one rib space cranially). Allows optimized visualization of right atrium, right auricle, right ventricle, and tricuspid valve.	Pulmonary veins Left atrium Mitral valve LV walls LV lumen Right atrium (RA) and right auricle Tricuspid valve (TV) Right ventricle (RV) Pericardium	1–2 2D cineloops 1–2 2D cineloops with color to evaluate TV 1–2 continuous-wave Doppler studies of the TV if regurgitation is identified	Tricuspid regurgitation Vmax, if present

For more information on our submission requirements, contact our **Telemedicine Support Team** at **1-800-726-1212** or email **TelemedicineSupport@idexx.com**.

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