

Congenital heart disease

Diagnosis and Staging

Peter Modler, FTA f. Kleintiere, certified member German College of Cardiology (CC)

What can we expect to find?

frequently	rarely
<ul style="list-style-type: none"> • Pulmonic stenosis (valvular) • Aortic stenosis (subvalvular) • PDA • Tricuspid dysplasia • VSD (membranous) 	<ul style="list-style-type: none"> • PS (other than valvular) • AS (other than valvular) • Fallot´s Tetralogy • ASD • VSD (muscular) • Endocardial cushion defect • Cor triatriatum • Double chambered right ventricle • TGA • ...

What do we have to know about them?

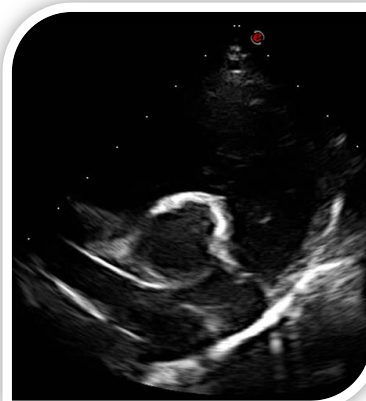
- Some of those can occur in combination!
- Will it get worse? (Prognosis)
- Can we help (medication, intervention)?
- What is known about inheritance?

Pulmonic stenosis

- Mostly valvular
- Rarely supravalvular
- Subvalvular – double chambered right ventricle
- Breeds:
 - Spaniel
 - Beagle
 - Airdale
 - Engl. Bulldog
 - Westie
 - Boxer
 - Samoyede

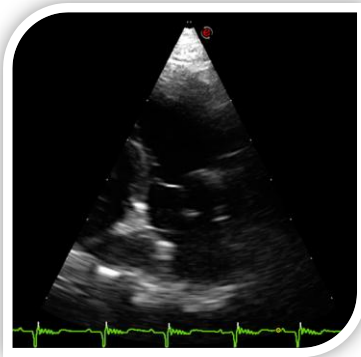


Normal appearance of PV

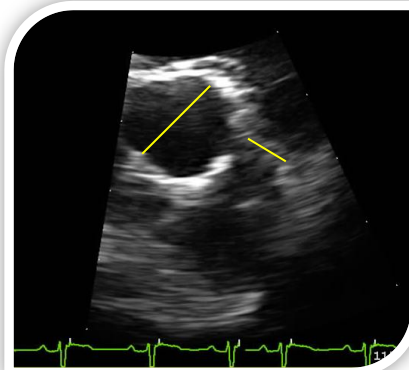


Valvular pulmonic stenosis - Types

Type A



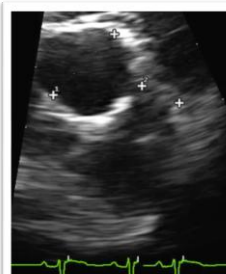
Type B



Valvular pulmonic stenosis - Types

Type A

- Commissural fusion
- Normal anular diameter
- Better for the patient



Type B

- Hypoplasia +/- commissural fusion
 - Reduced anular diameter
- Worse for the patient

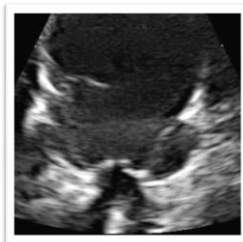
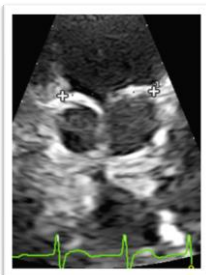
Normal: AO:PV <1,12

Supravalvular Stenosis

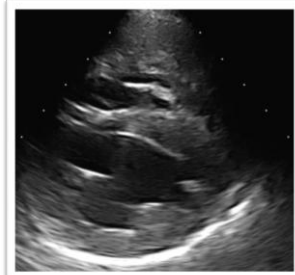
- Sometimes combined with valvular PS
- Influence on treatment!
- Not always easy to find out the relevance of the valvular and supravalvular part.



Diagnosis

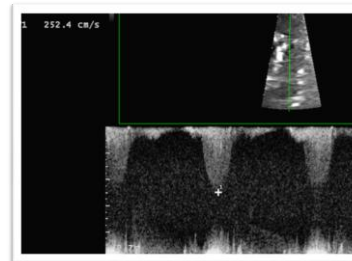
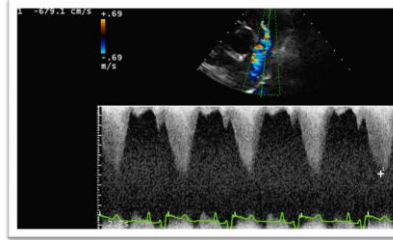


[Clip 2D](#)
[Clip CDI](#)



Diagnosis

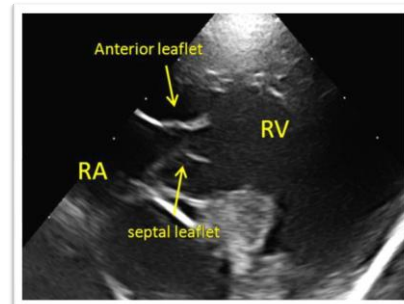
- Vmax over 2,25 m/s is clear evidence
- 2.25-3.5 mild
- 3.5-4.5 moderate
- > 4.5 severe
- More difficult when combined with dynamic obstruction



Always measure from right and left hemithorax!!!

Decision for treatment

- PG more than 4.5 m/s
- PG between 3.5 and 4.5 when
 - Clinical symptoms
 - Concomitant TD
 - Severe RV hypertrophy and/or
 - Significant RA enlargement
- Start with Atenolol 1-2mg/kg bid



CDI

Treatment

Cave: R2A-Anomaly (single right coronary artery)
Bulldog, Boxer, Beagle
Smaller balloons, no surgery possible

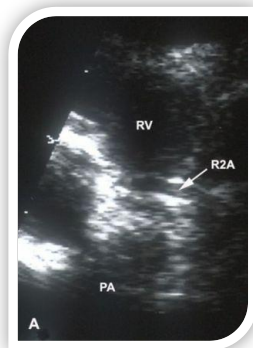
Type A, sometimes B



Severe Type B



R2A-Anomaly



From: James W. Buchanan, DVM, M Med Sci
<http://www.vin.com/library/general/IB109singleR2A.htm>

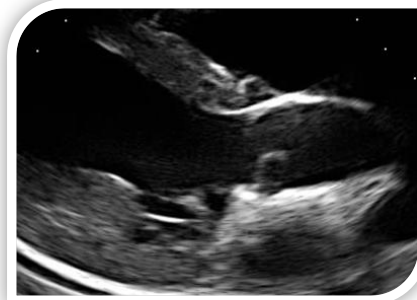
Aortic Stenosis

- Mostly Subaortic Stenosis
- Rarely valvular stenosis
- Very rarely supra-ventricular

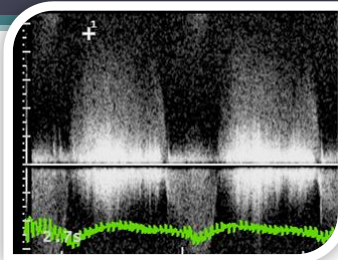
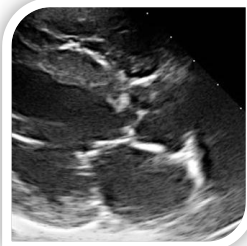
- Breeds:
 - Boxer
 - Rottweiler
 - Newfoundland
 - Golden Retriever
 - German Shepherd
 - ...



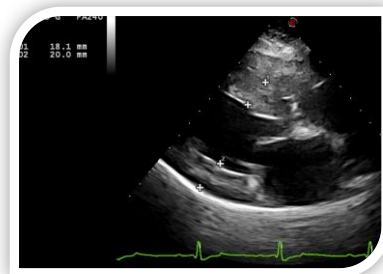
Normal LVOT and AV

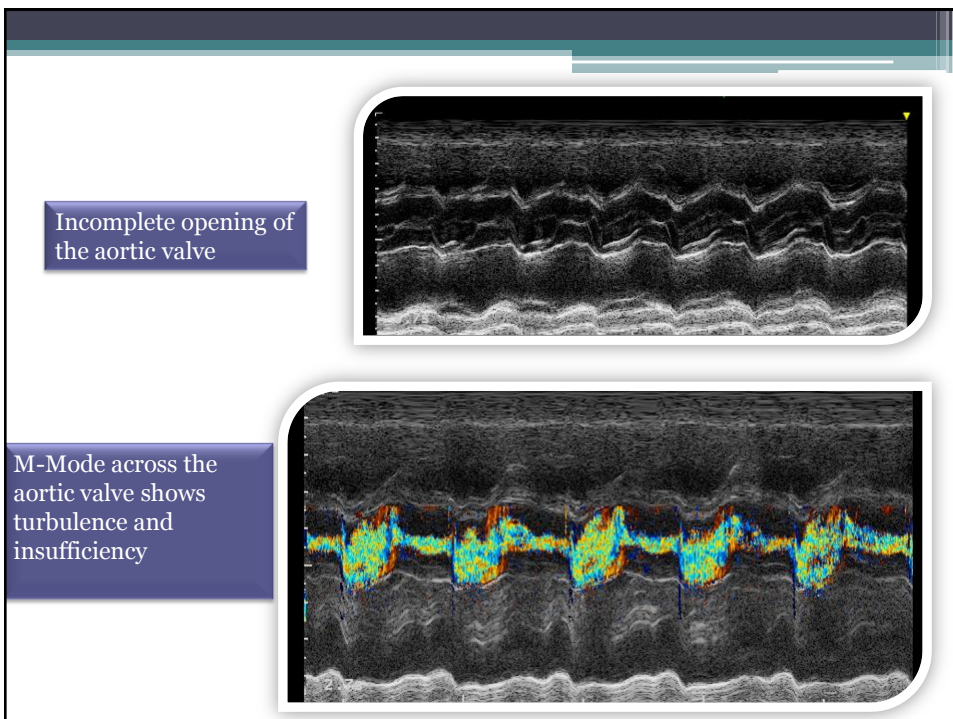
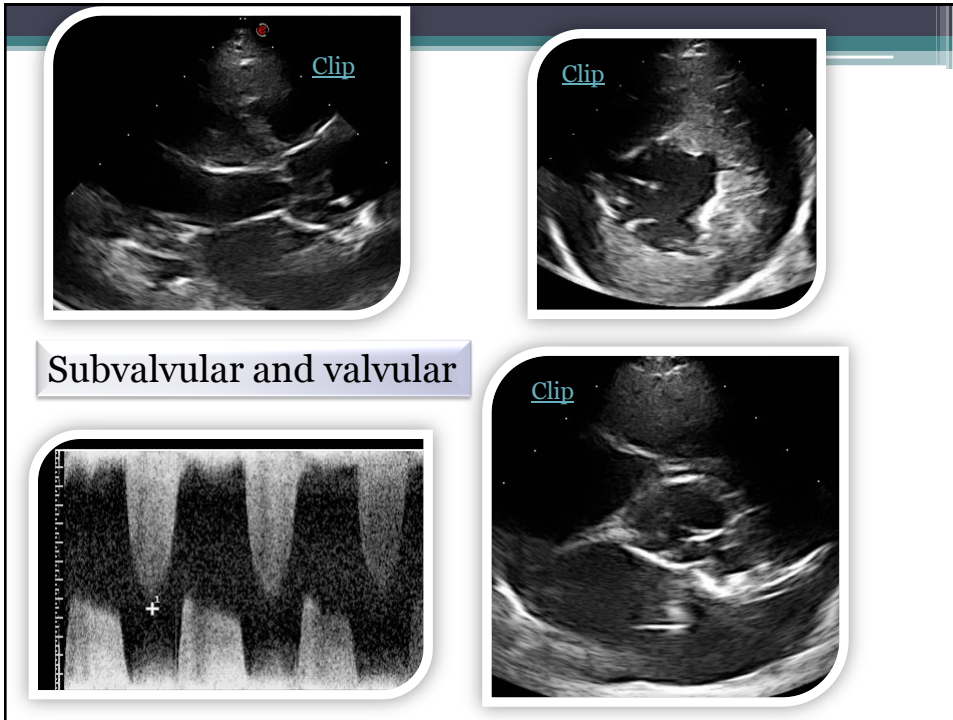


Diagnosis

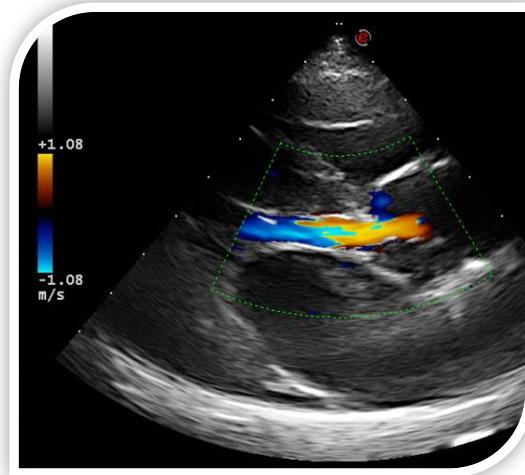


2D
CDI



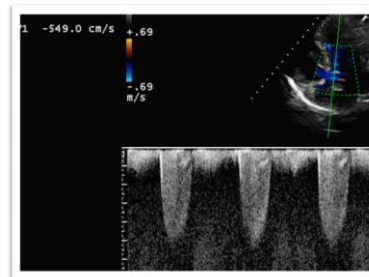


...aortic insufficiency



Staging

- Normal <math>< 1.7 \text{ m/s}</math>
 - (Boxer <math>< 2.0 \text{ m/s}</math>)
- Unclear $1.7\text{-}2.25 \text{ m/s}$
- Mild $2.25\text{-}3.5 \text{ m/s}$
- Moderate $3.5\text{-}4.5 \text{ m/s}$
- Severe $> 4.5 \text{ m/s}$



Severe cases usually develop symptoms within the first 3 years

Treatment

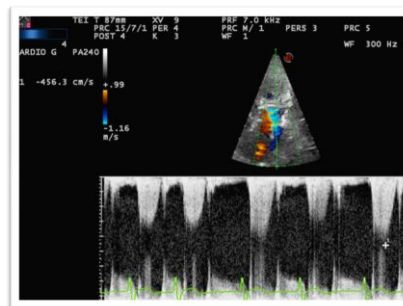
- No balloon valvuloplasty
 - Except for rare pure valvular cases -> difficult procedure
- No surgery
 - (no better outcome than with Betablockers)
- Just medication
 - if PG more than 60 mm Hg
 - Atenolol 1-2mg/kg bid

Both PS and AS

- Sometimes patients develop CHF
- Mostly if there is significant valvular regurgitation present



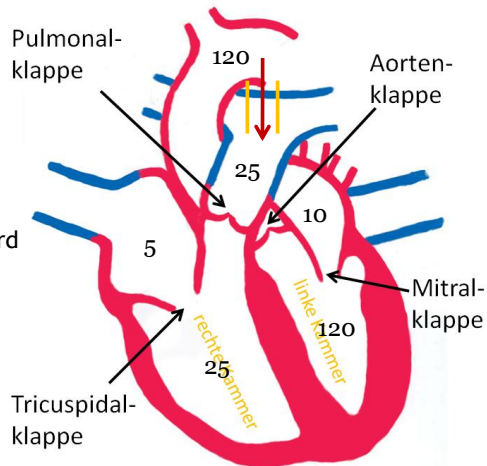
Treatment the same as for every other case of CHF?



CDI

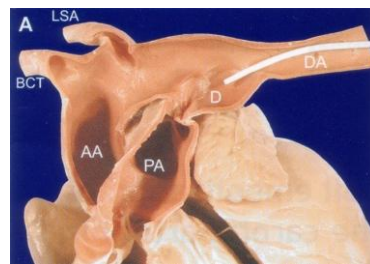
PDA

Breeds: Chihuahua
Spaniel
Collie
German Shepherd
Maltese
Pomeranian
Pudel
Rottweiler
Sheltie
Yorkie



Very important...

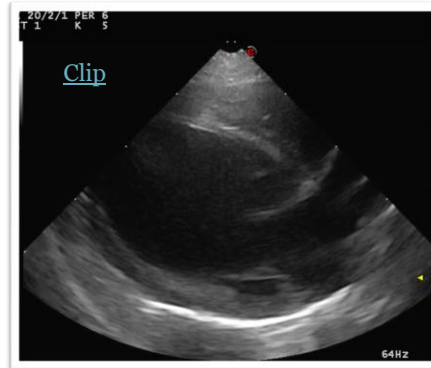
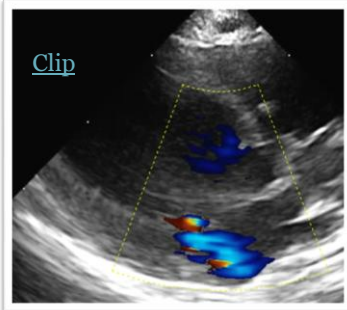
- Differential diagnosis
 - Aorto-Pulmonary window
 - Any other shunt between the PA and the systemic circuit (e.g. bronchopulmonary fistula)



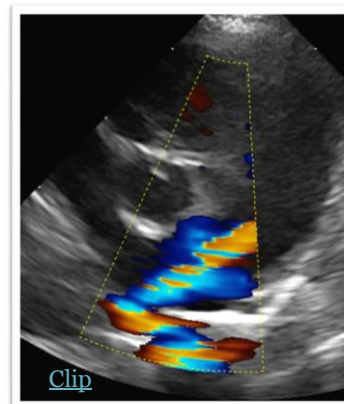
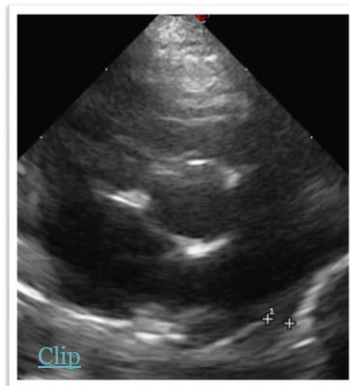
It is essential to visualize the PDA!

L-R Shunt pathophysiology

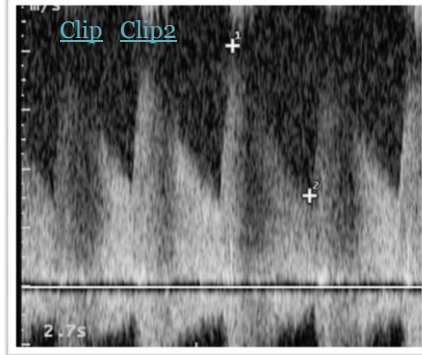
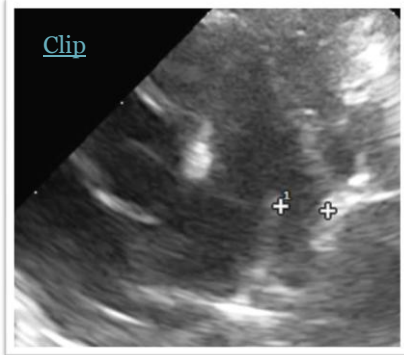
- Left ventricular volume overload
- Mild mitral regurgitation
- Can cause pulmonary edema
- Shunt during systole and diastole



L-R Shunt right parasternal

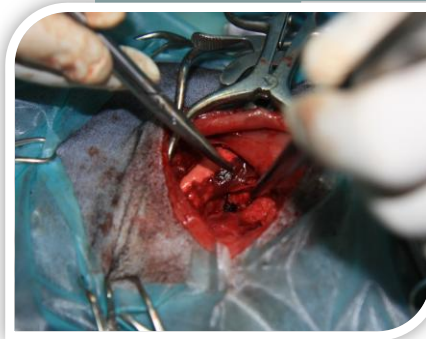


L-R Shunt left parasternal



Therapy

Surgery



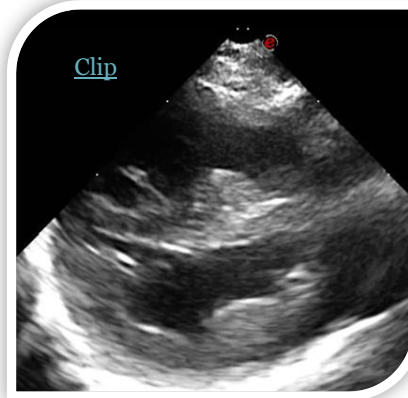
Or closure with Amplatzer/Coil
(not in cats!)

R-L/bidirectional Shunt Pathophysiology

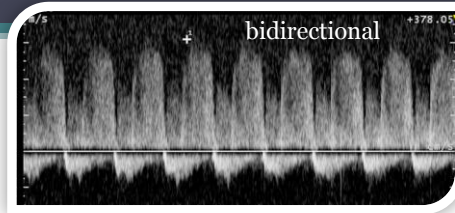
Pulmonary Hypertension
concomitant pulmonic stenosis



Right ventricular hypertrophy
Bidirectional shunt
Or R-L shunt with differential cyanosis

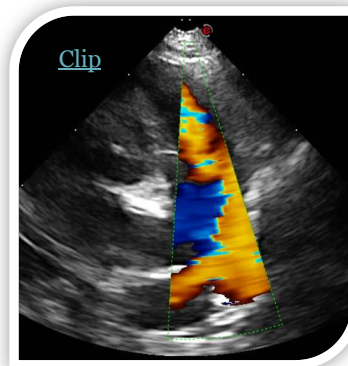
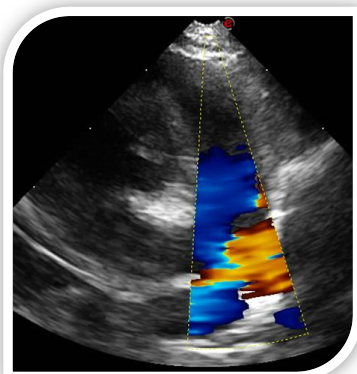


Diagnosis



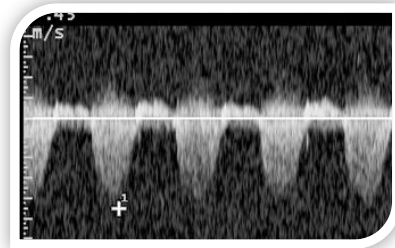
Systole

Diastole



Therapy

- Treat pulmonary hypertension
- Prognosis bad

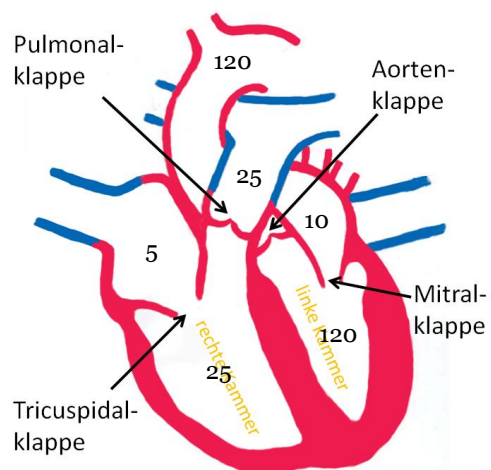


VSD

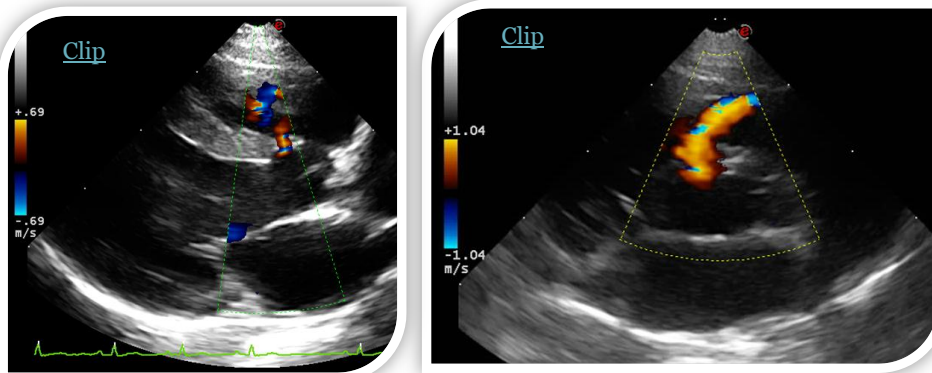
Muscular
Membranous

Cats
Dogs: Bulldog
Westie
Cocker Spaniel

Restrictive defects
Large defects

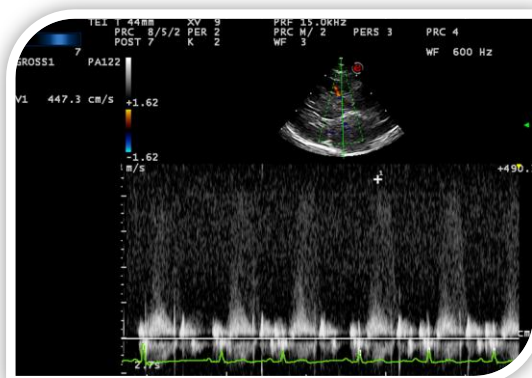


Membranous Defects



What pressure gradient would you expect?

CW interrogation



Pitfall!

You can always record flows with CW Doppler no matter where you place the cursor.

If there is suspicion of a VSD on CDI you should get a flow Profile on CW that lines up With the pathophysiologic Changes noted on 2D

Therapy?

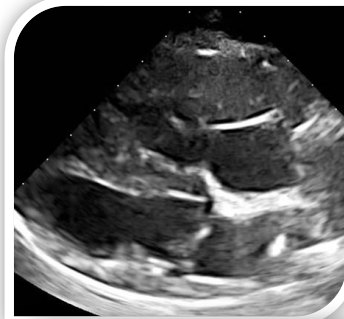
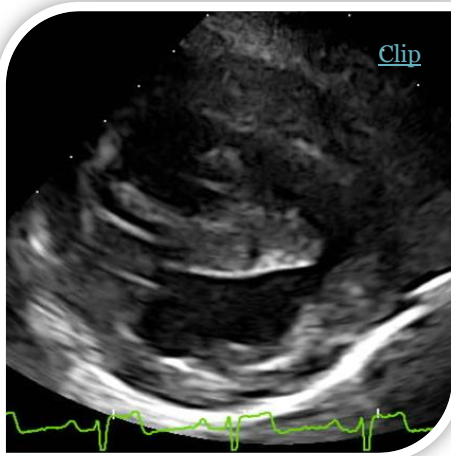
No hemodynamic problems -> no therapy

Small defects sometimes vanish spontaneously

Large defects with left ventricular volume overload
-> ACEI, Furosemide, Pimobendan

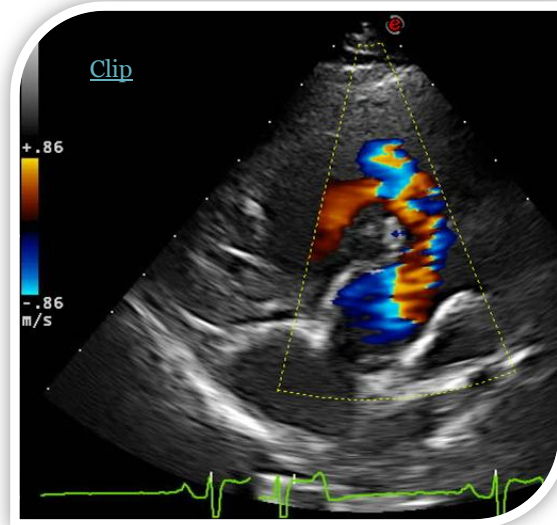
Eisenmenger's Syndrome -> Viagra, Pimobendan,
L-Arginine, Phlebotomy, Heart-Lung-Transplantation

Muscular Defects

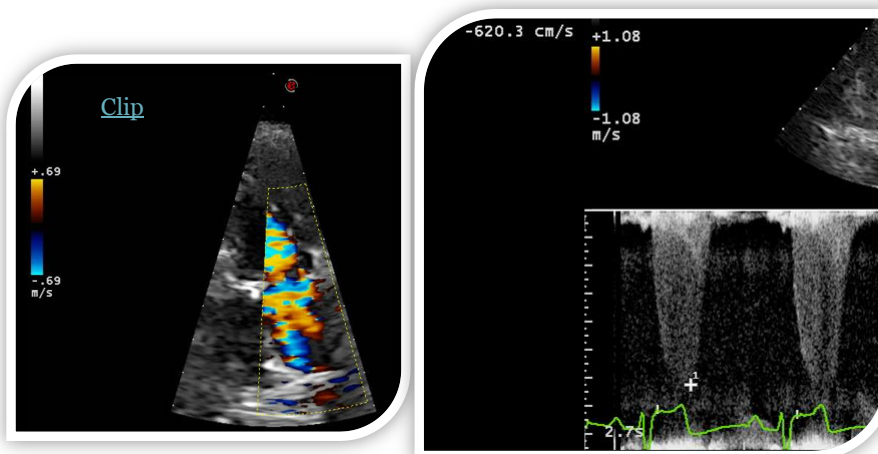


This dog had a PCV of 72%!

CDI



Rule in/out pulmonic stenosis



Therapy

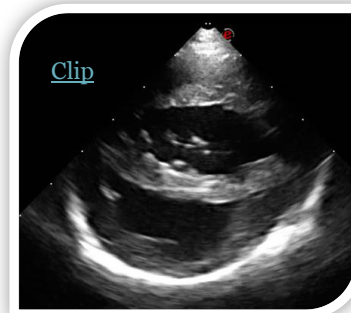
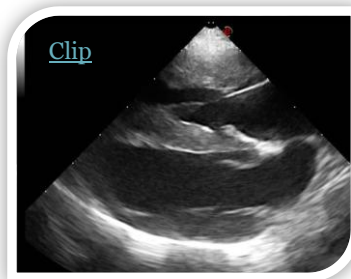
- Balloon Valvuloplasty
- VSD closure with an Amplatzer VSD occluder (only muscular)
- Surgery with CPB



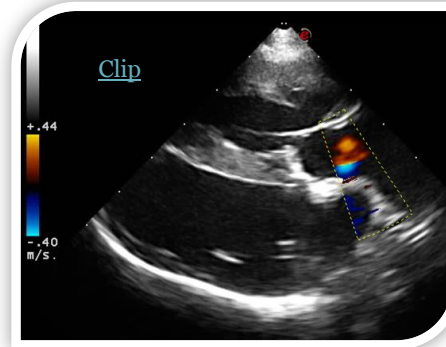
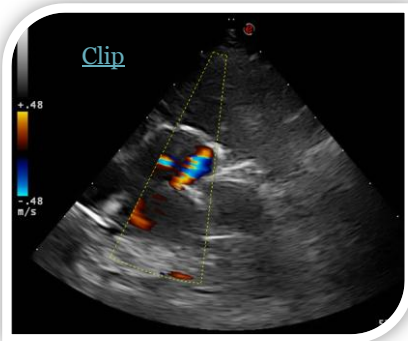
3 weeks later the PCV was 42%

Bidirectional ASD + PS

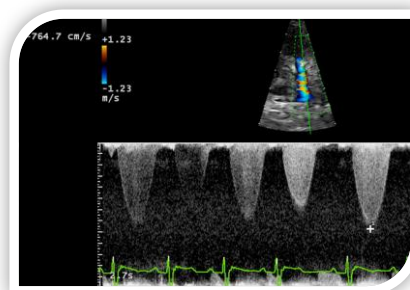
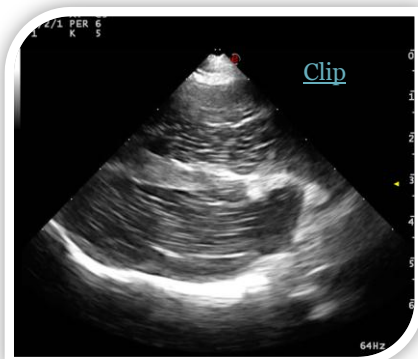
- ASD causes L-R shunt because of higher compliance of the RV
- Right ventricular volume overload can mimic PS (pseudostenosis)
- R-L shunt due to PS or PHT



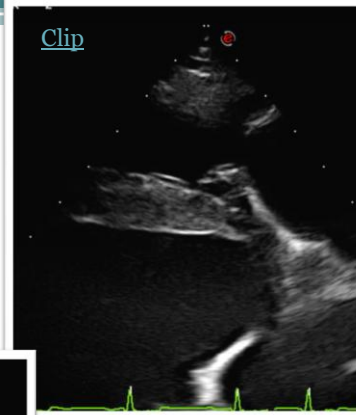
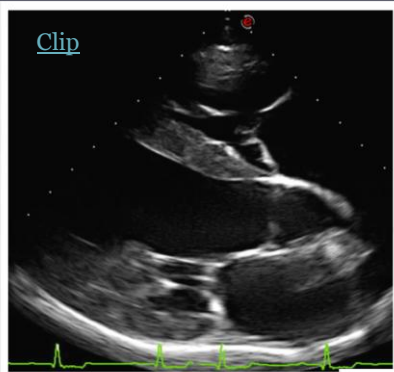
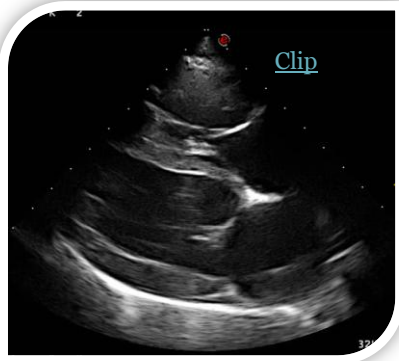
ASD - short axis views important



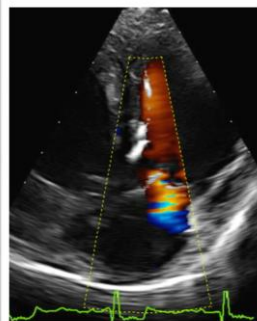
Bubbles...



Tricuspid Dysplasia

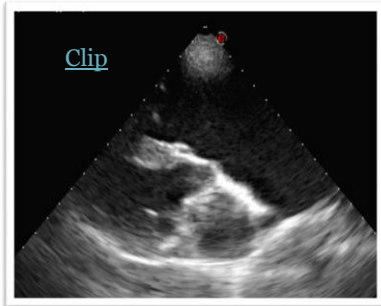


Very mild TD

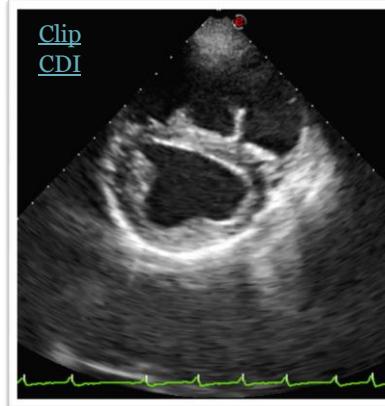


Note: Tethered septal leaflet

TD: Ebstein's Anomaly



Note the position of the tricuspid valve



Therapy

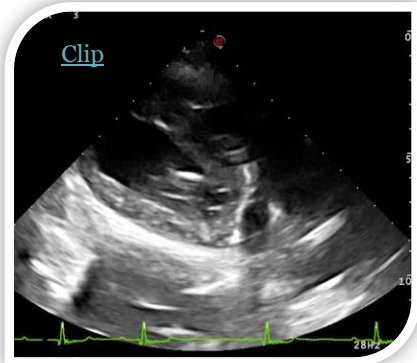
- CHF
 - Triple therapy
 - Hydrochlorothiazide
 - Torasemid
- afib
 - Digoxine
 - Diltiazem
 - HR at home <140/min

Prognosis: most live 3-5 yrs

abdominocentesis



Persistent Left Cranial Vena Cava

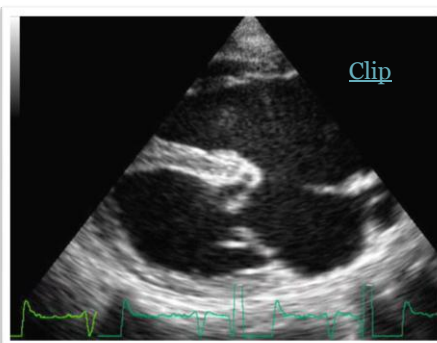


- No clinical significance
- With or without other congenital defects
- Should be ruled out before cardiac catheterization

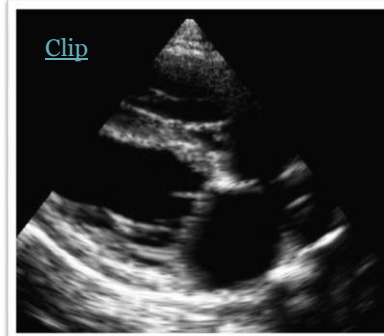
Atrial septal defect

Note the position of the defect

Type I



Type II



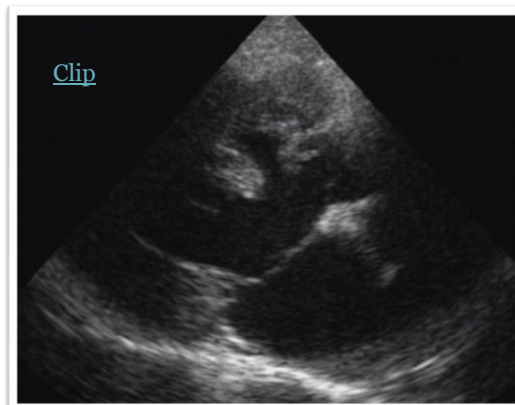
Courtesy of Dr. Jan-Gerd Kresken, Tierärztliche Klinik am Kaiserberg, Duisburg

Atrial septal defect - Pathophysiology

- Right ventricle more compliant than left ventricle
 - L-R Shunt
 - RV volume overload
- Pulmonary hypertension
 - R-L Shunt
 - Cyanosis

- Therapy
 - Small defects -> no therapy
 - Large defects
 - Amplatzer ASD-occluder
 - Surgery

Double outlet right ventricle

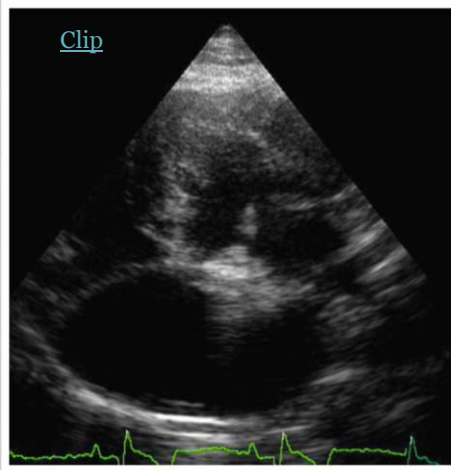


Incomplete AV-Canal



Courtesy of Dr. Alan Kovacevic, Dipl. ECVIM, Tierärztliche Klinik Stommeln

Cor triatriatum sinister



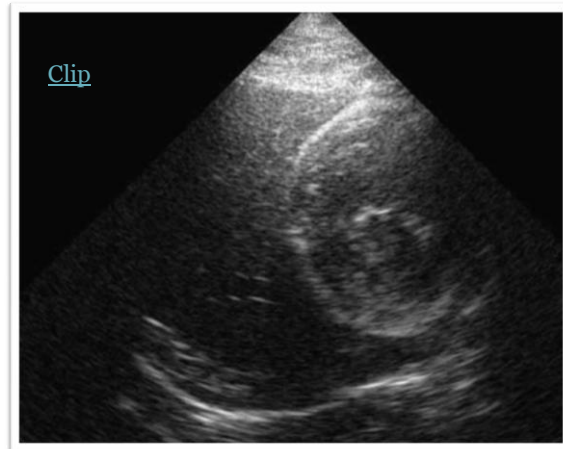
Treatment difficult:

- Surgery
- Therapy of pulmonary congestion

Danger of reducing diastolic filling of the LV

Courtesy of Dr. Jan-Gerd Kresken, Tierärztliche Klinik am Kaiserberg, Duisburg

Peritoneo-Pericardial Hernia



Courtesy of Dr. Jan-Gerd Kresken, Tierärztliche Klinik am Kaiserberg, Duisburg