# LIVE SCAN – Cardiac Doppler : The Basics


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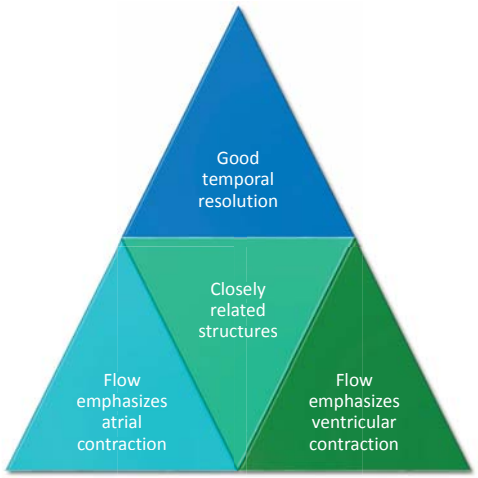
**OBJECTIVES**

At the conclusion of this activity, participants will be able to :

1. Understand why Doppler is important
2. Recognize normal mitral and tricuspid inflow patterns
3. Recognize normal outflow Doppler velocities
4. Understand the SVC-Aortic Doppler
5. Recognize normal and abnormal cardiac venous Doppler

# Why is Doppler useful?




Changes cardiac Doppler reflect changes in the rhythm an/ or function of the heart

# Doppler and the cardiac cycle

- Electrical events lead to myocardial contraction
- Myocardial contraction and subsequent relaxation results in pressure changes
- Pressure changes results in blood flow
  - Ventricular ejection - **Cardiac Output**
  - Chamber filling

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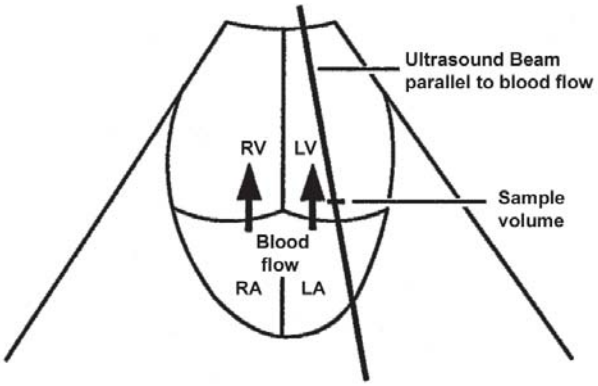
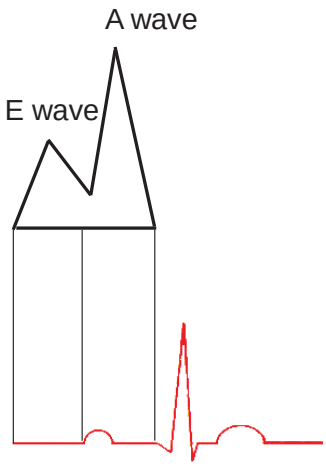
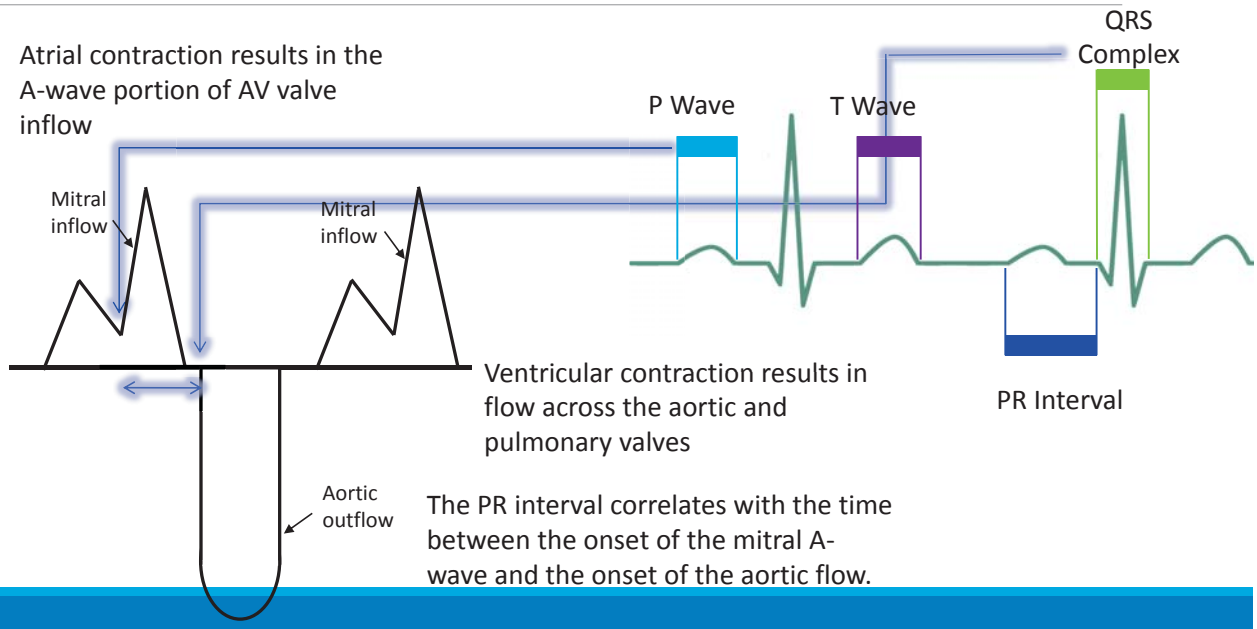
Inflow Doppler

# Mitral and Tricuspid Inflow

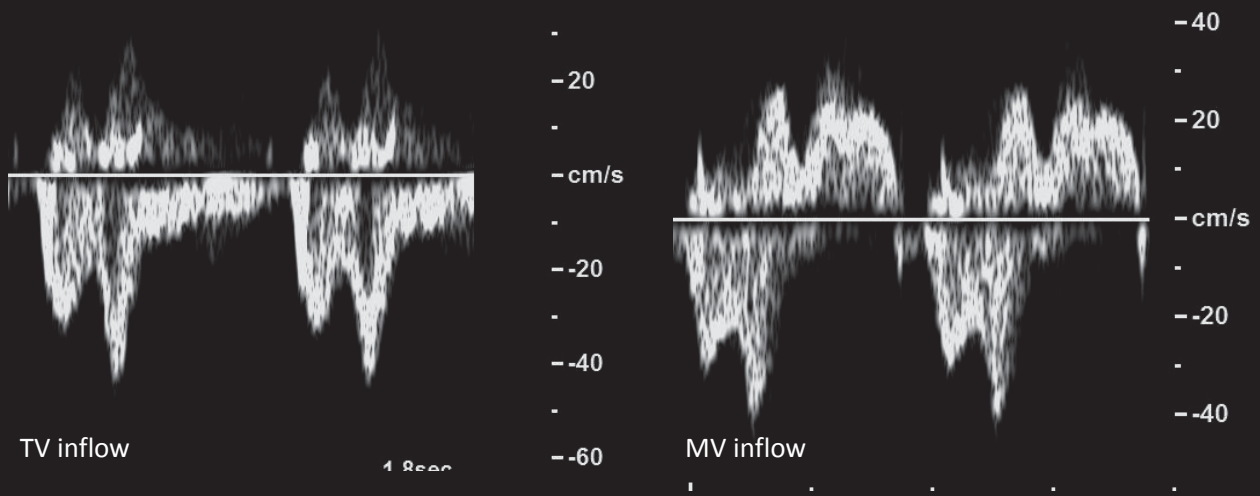


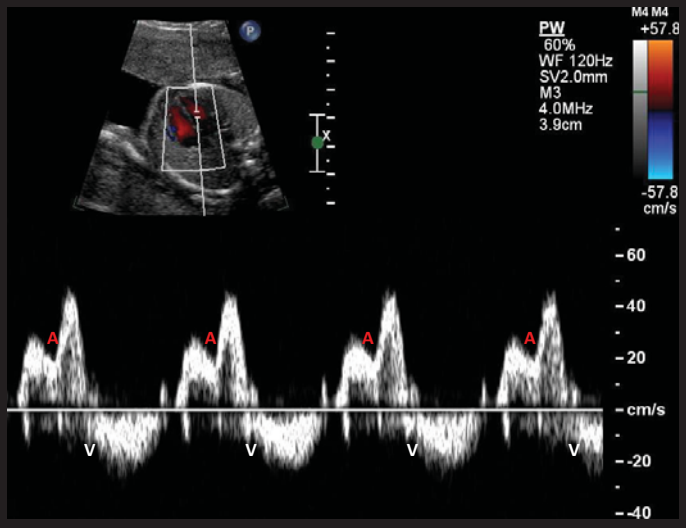
# Mitral Inflow outflow for rhythm

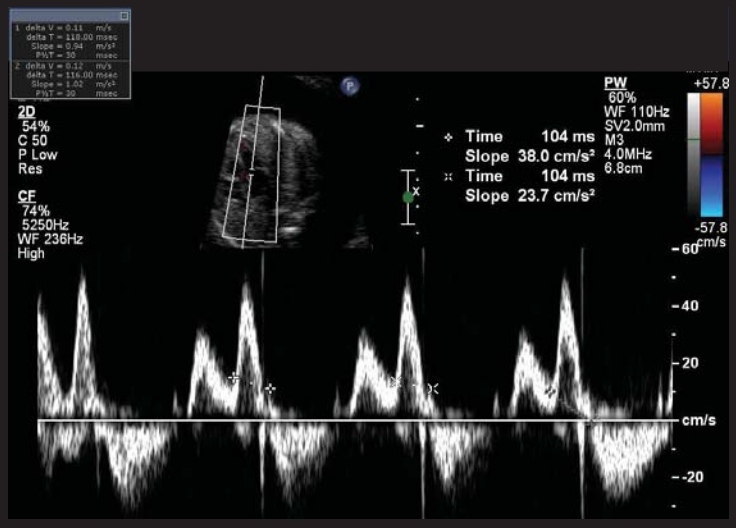



# Normal Inflow patterns

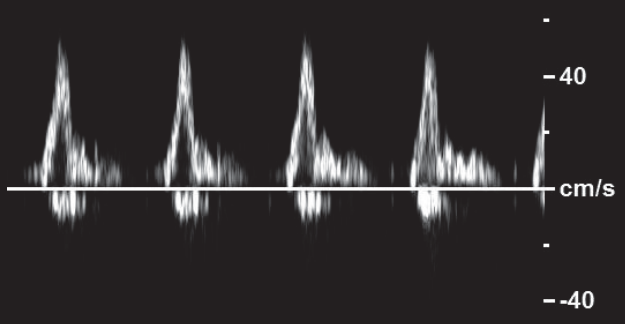


# Rhythm assessment using mitral inflow



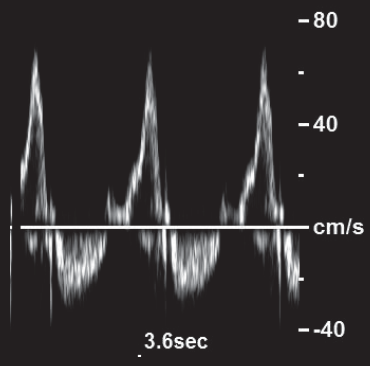




# Abnormal Inflow Patterns




Monophasic tricuspid inflow

With abnormal filling pressures the inflow is short and there is a single waveform resulting from atrial contraction.




Blended mitral inflow

Tachycardia results in a shorter time for filling and may result in a fusion of the E and A waves.

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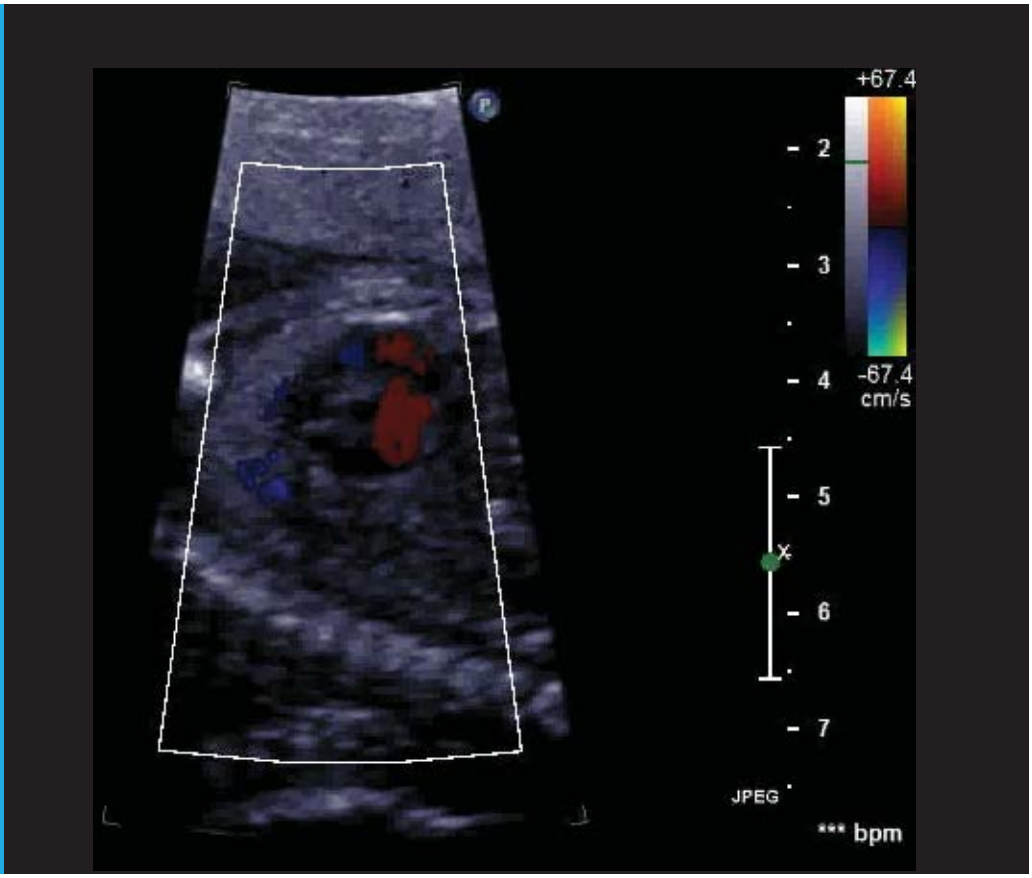
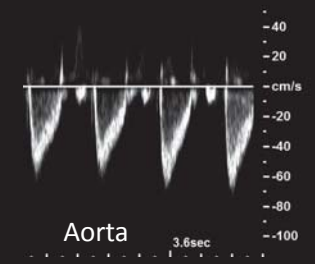
Outflow Doppler




# Outflow Doppler

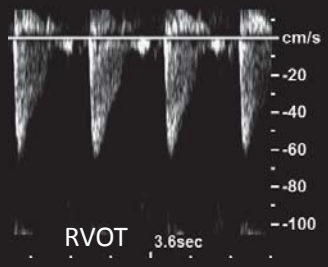
## Aortic Outflow

- 70 cm/sec
- 55-100 cm/sec




## Pulmonary Outflow

- 60 cm/sec
- 50-80 cm/sec



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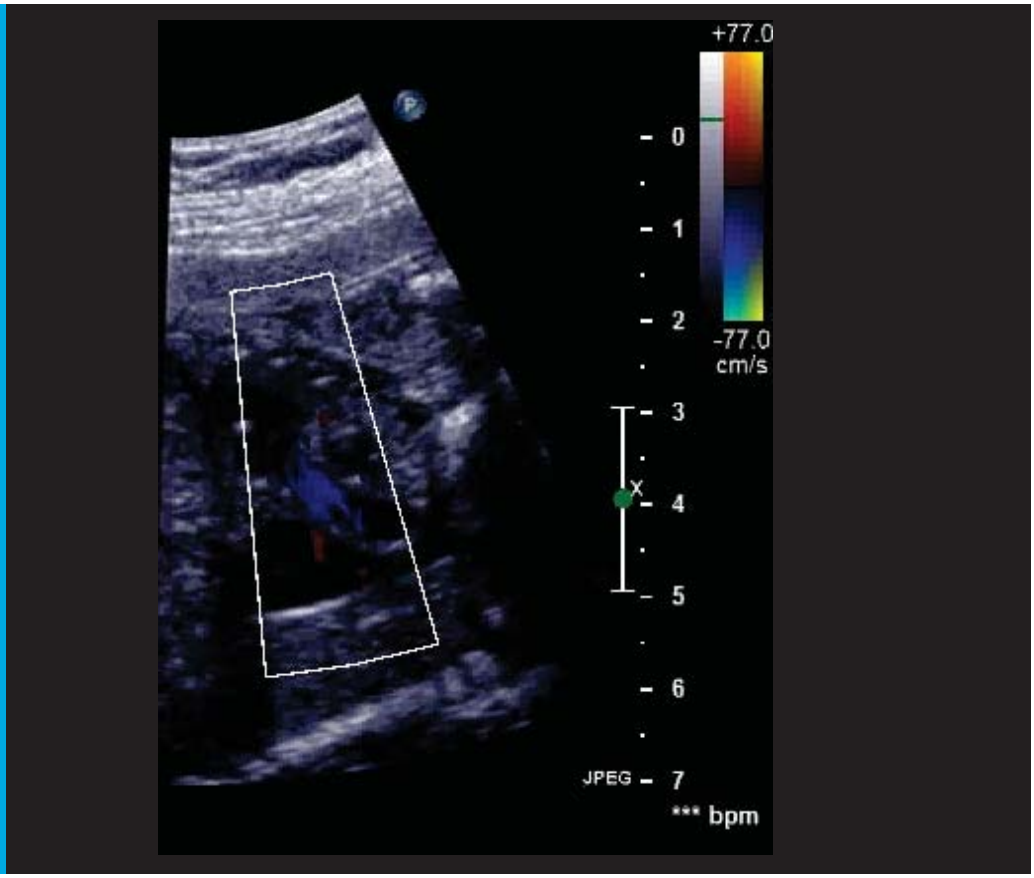
SVC Aortic Doppler




# Simultaneous SVC-Aortic Doppler

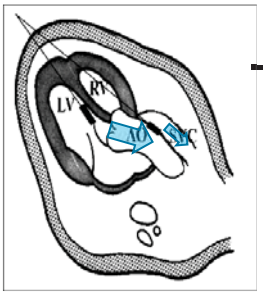
Atrial contraction results in a small amount of reversed flow in the SVC

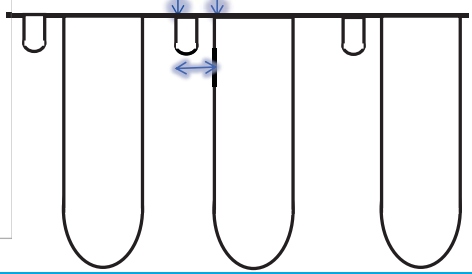
QRS Complex

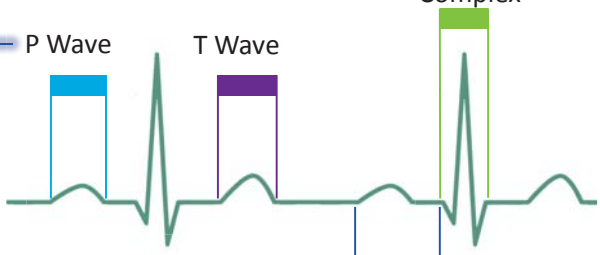
P Wave

T Wave

Ventricular contraction results in flow in the aorta



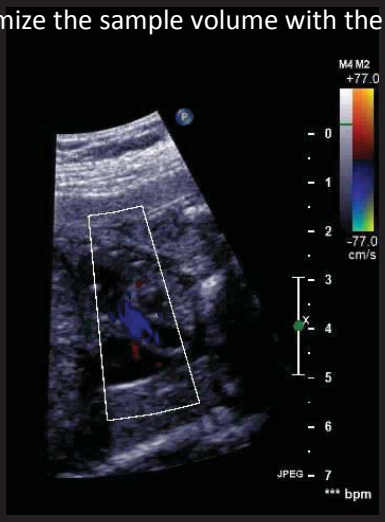


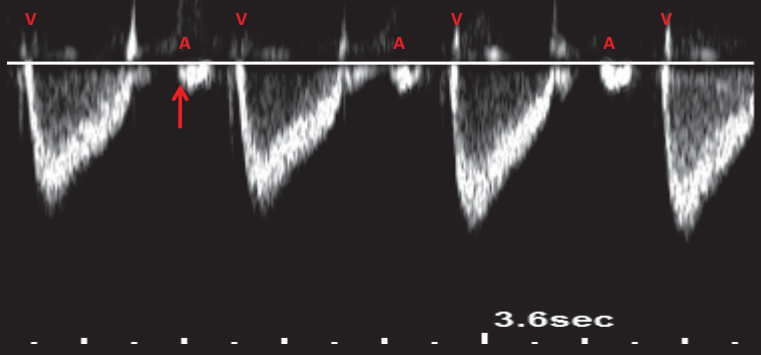
The PR interval correlates with the time between the onset of the SVC A-wave reversal and the onset of the aortic flow.

PR Interval

# Simultaneous SVC-aortic Doppler

Obtain the LVOT view and place a sample in the ascending aorta.
Optimize the sample volume with the direction of flow

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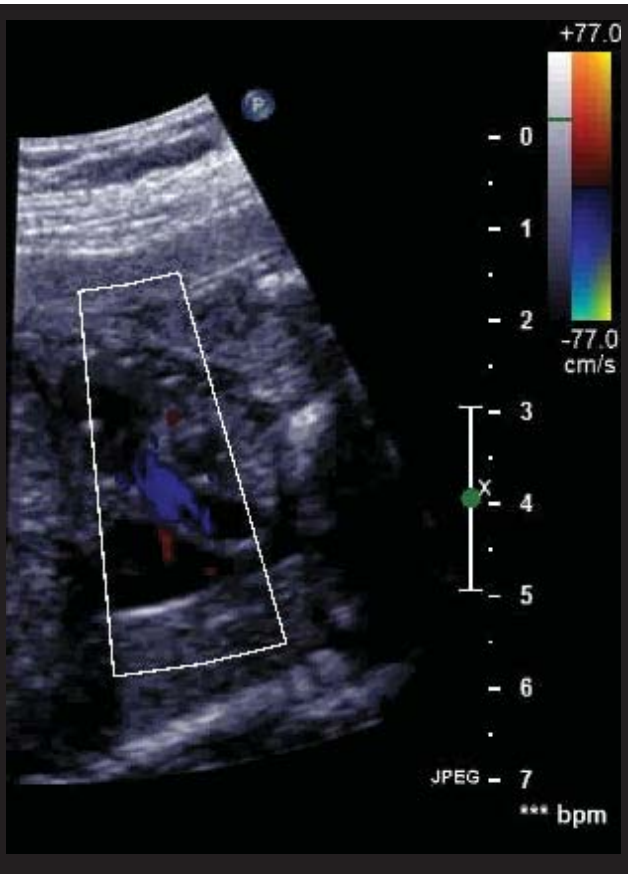
Cardiac Venous Doppler

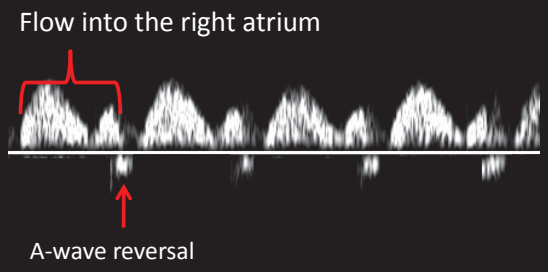


# Components of Venous Doppler

Components of any venous Doppler

- S wave: systolic contraction
  - During systole there is descent of the mitral or tricuspid annulus causes suction and flow into the left or right atrium.
- D wave: diastole
  - When the mitral or tricuspid valve opens, flow into the ventricle results in a pressure drop in the atria and blood flows from the veins into the atria.
- A dip: atrial contraction
  - When the atria contract, a pressure wave is reflected back into the veins.
  - In the IVC, SVC, and pulmonary veins there is a small amount of flow reversal.
  - In the Ductus venosus there is a decrease in the forward flow velocity. In the first trimester flow may reach baseline or there may be slight reversal of flow.

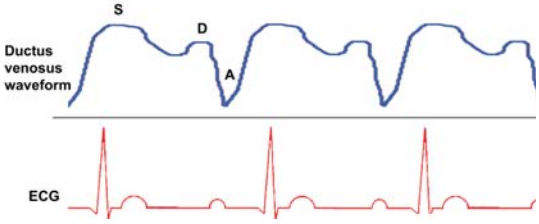
Example of an IVC Doppler tracing

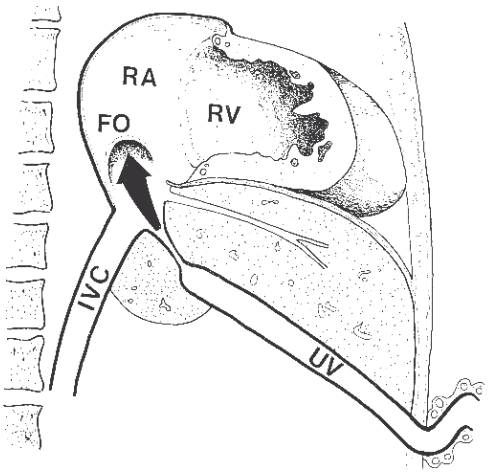



# Ductus Venosus Doppler

The ductus venosus flow reflects pressure changes within the heart and transmits these to the umbilical vein.

Changes can occur due to abnormal function due to increased venous pressures or from arrhythmias.

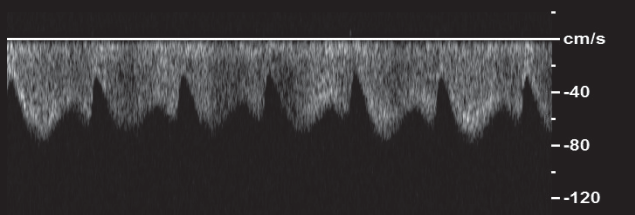


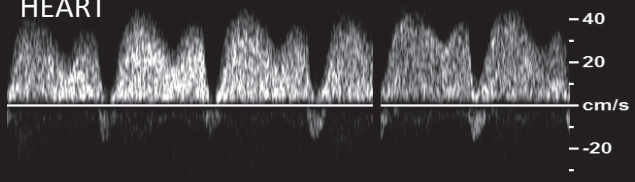
# Ductus Venosus Doppler

NORMAL FLOW IN NORMAL RHYTHM

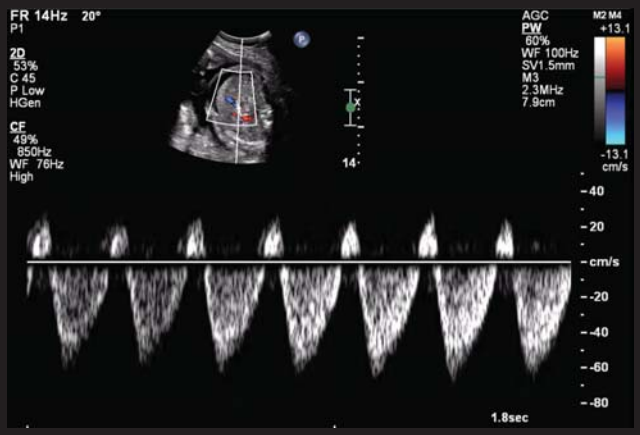

NORMAL TRACING




SAMPLE VOLUME POSITIONED TOO CLOSE TO HEART




# SVT with abnormal A-Wave Reversal in Ductus Venosus



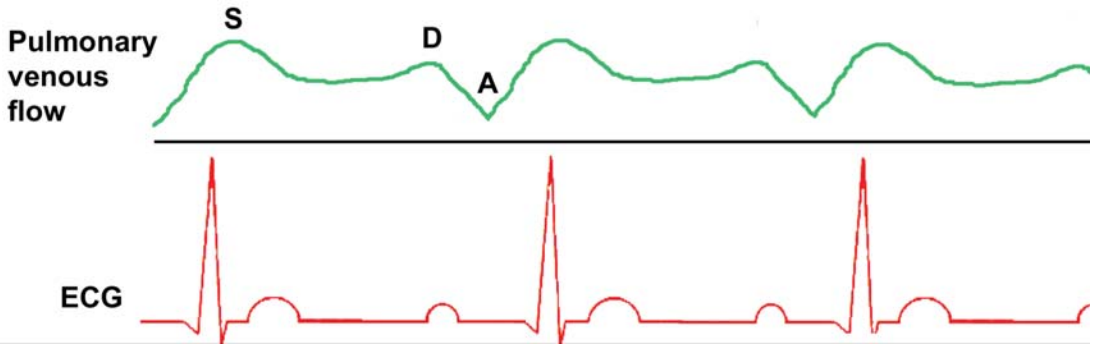
# Pulmonary Vein Doppler

Pulmonary venous flow represent changes in left atrial pressure throughout the cardiac cycle.

S wave: systolic contraction

D wave: diastole

A dip: atrial contraction

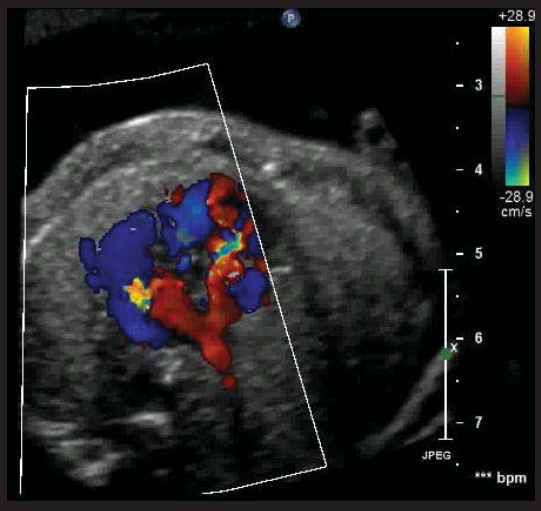



# Pulmonary Veins Colour Doppler

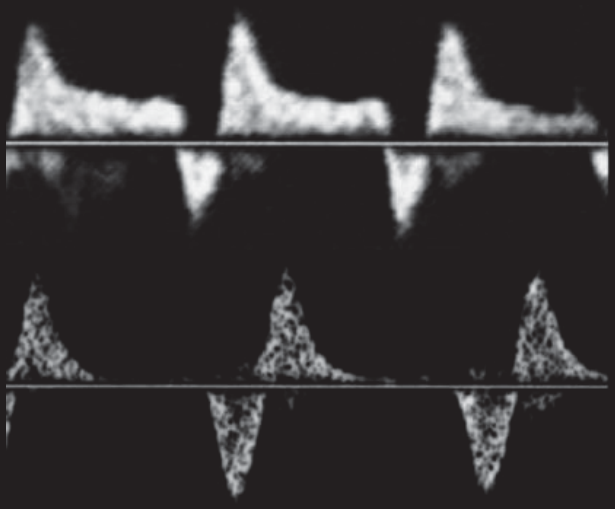
Pulmonary venous colour Doppler.

Tips:

- Low colour scale
- Low wall filters
- Low colour frequency



# Abnormal Pulmonary Venous Doppler



With a rise in left atrial pressure:

- Initially there is increased A-wave reversal
- Reduction in the D-wave velocity accompanies further increases in A-wave reversal.
- In significantly elevated left atrial pressures there may be biphasic flow representing only A-wave reversal and S-wave antegrade flow.