

The use of echocardiography in the severely ill obstetric patient

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Introduction

- The severely ill obstetric patient poses a number of challenges
- The physiological changes of pregnancy make it difficult to interpret signs and symptoms
- Fear of harm to the fetus cause a delay in doing imaging studies

Introduction

- Ultrasound is a well known in the obstetric setting
 - But
- Is usually used for fetal evaluation and less frequent for maternal assessment



Why cardiac ultrasound

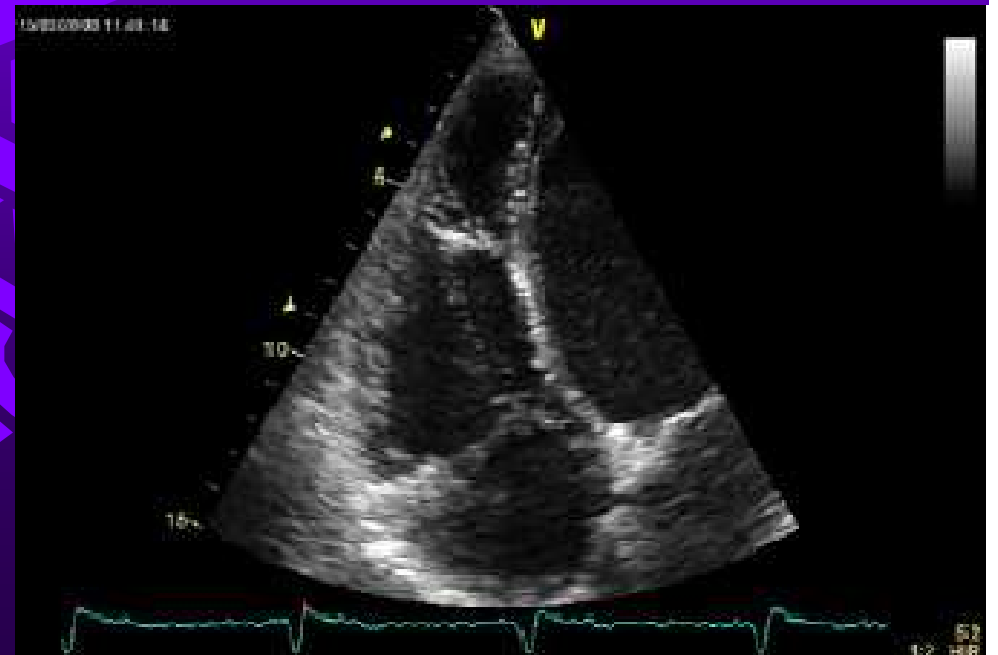
- Safe
- Non invasive
- Quick
- Assessment of structure and function

Examination of the left heart

- Structure
- Ejection fraction
- Fractional shortening
- Cardiac output
- Systemic vascular resistance

Examination of the right heart

- Morphological evaluation
- Pulmonary artery pressure
 - Doppler - $\Delta P = 4V^2$
 - Tissue Doppler imaging
- Right arterial pressure
- Pulmonary vascular pressure
- Myocardial performance index
- Right ventricular strain



Selton-Suty C et al. Arch Cardiovascular
Dis. 2009;102;219-232

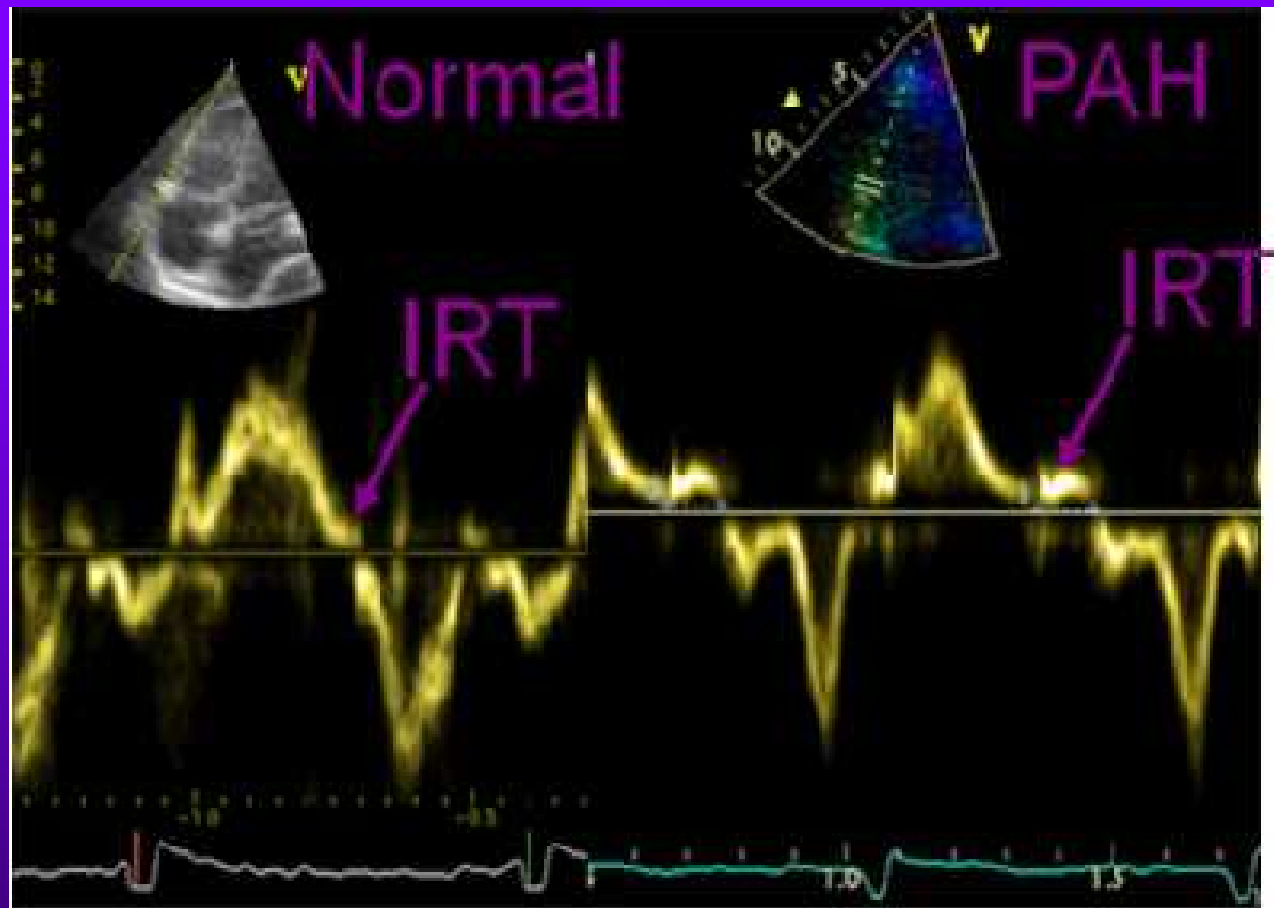


Figure 2. Increase in myocardial regional IVRT in pulmonary hypertension. Left panel: normal patient; IVRT is almost virtual. Right panel: increase of IVRT in a patient with pulmonary arterial hypertension.

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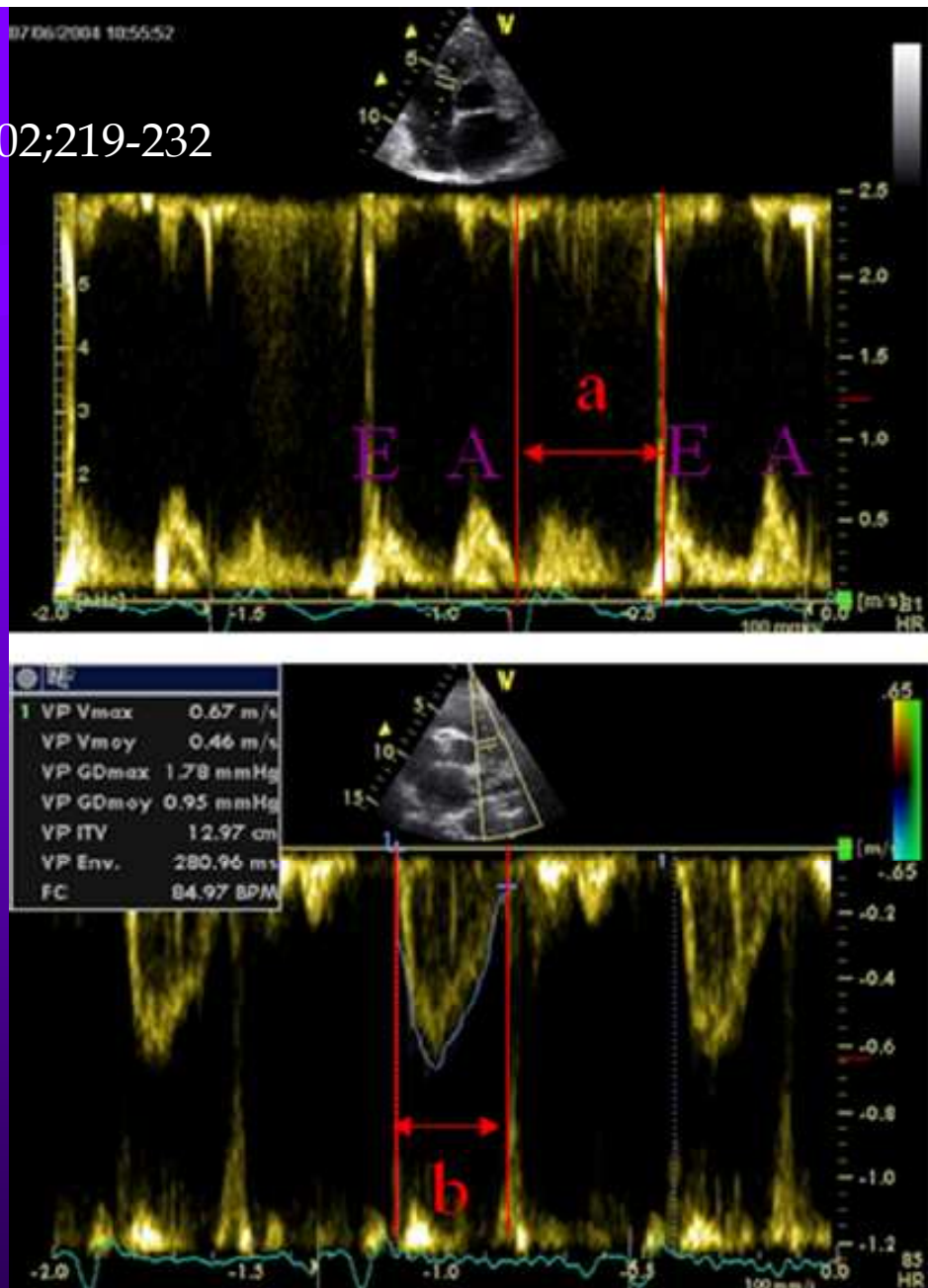
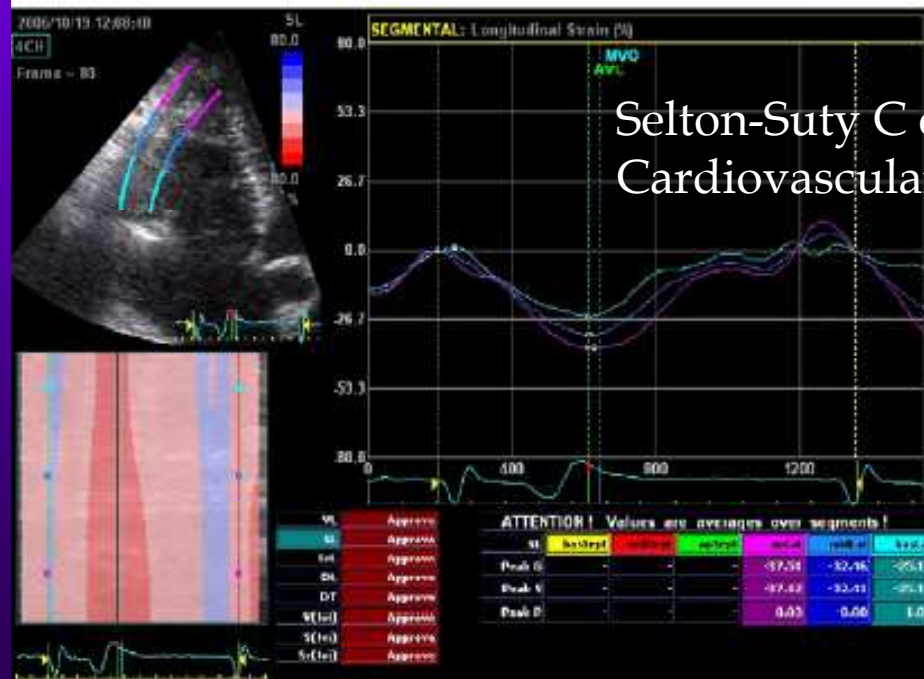
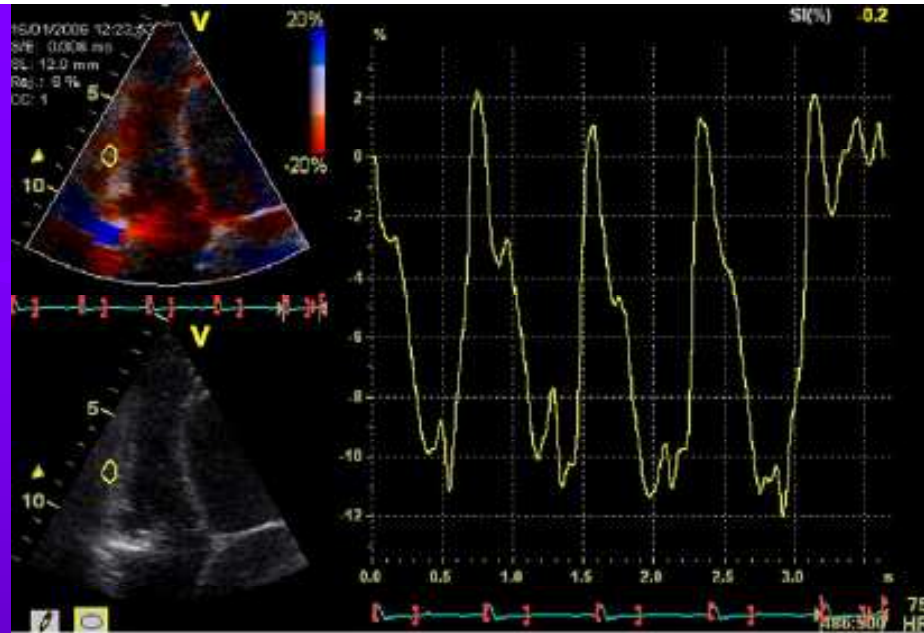


Figure 4. $MPI = (a - b)/b$ where a is the sum of isovolumic contraction time, ejection time and isovolumic relaxation time, and b is ejection time.



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Figure 7. Upper panel: RV strain derived from 2D colour DTI. Lower panel: RV strain derived from 2D speckle imaging.

Conditions where right heart assessment is important

- Pulmonary hypertension
- Factors related to prognosis:
 - Right atrium size
 - Severity of tricuspid regurgitation
 - MPI
- Right ventricular myocardial infarction
 - Localised akinesia

Conditions where it can be of value

- Amniotic fluid embolism
- Pulmonary embolism
- Myocardial infarction
- Thrombosed mechanical valves
- Aortic dissection
- Cardiomyopathy

Amniotic fluid embolism

- Trans oesophageal echo can show:
 - Pulmonary hypertension
 - Right ventricular overload
 - Discrepancy between the left and right ventricles
 - D-shaped right ventricle on a short axis view
 - Left ventricle normal function
 - Pulmonary trunks are dilated

Pulmonary embolism

- Depend on the size of the emboli
- Right ventricular strain
- Tricuspid regurgitation

Myocardial infarction:

- Earliest signs are akinesia of the wall that is affected
- Decreased function
- Aneurism of the ventricle

Thrombosed mechanical valve

- Class I and II diagnosed with echocardiography
- Class III and IV is obstructive
- Thrombosis can be seen on the valve
- Change in the size of the valve opening
- Signs of cardiac dysfunction or strain

Aortic dissection

- Changes in the aorta as well as a double lumen
- Cardiac dysfunction can be present

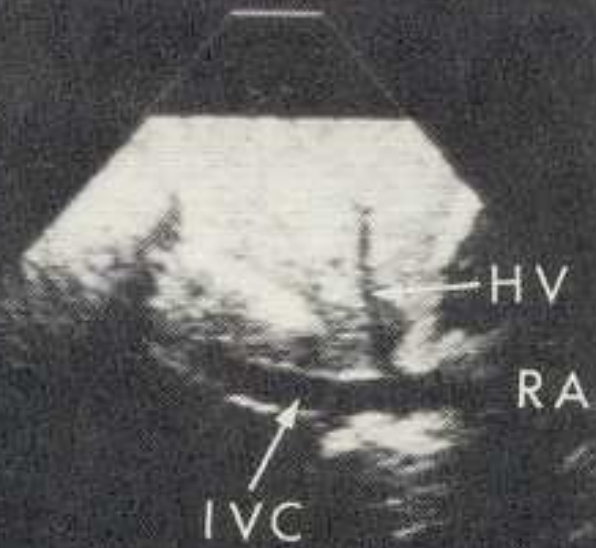
Peripartum cardiomyopathy

- Certain criteria for the diagnosis
 - Ejection fraction $< 45\%$
 - Fractional shortening $< 30\%$
 - End-diastolic dimension $> 2.7\text{cm}$ per m^2 body surface area

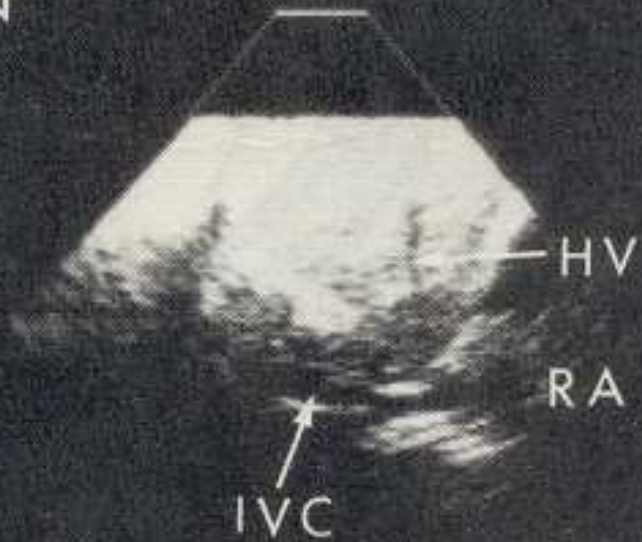
Central venous pressure estimation

- Measurement of the IVC 2,5cm from entering the right atrium
- Measure the dilatation of the IVC during inspiration and expiration
- Work out the CVP

EXPIRATION



INSPIRATION



METHOD:

- The Central Venous Pressure was calculated as follows.

IVC Measurement	IVC Collapse	CVP
< 20 mm	> 50%	0 to 5
<20 mm	< 50%	6 to 10
>20 mm	> 50%	11 to 15
>20 mm	< 50%	> 15

Central venous pressure estimation

- Can be of value to establish the fluid status in a patient where placement of invasive lines are dangerous.

Severe PET and poor urinary output

Subset	Causal mechanism	Pulmonary artery wedge pressure	Systemic vascular resistance	Left ventricular function	Treatment
1	Intravascular volume depletion	Low or low normal	Moderately increased	Hyper dynamic Increased cardiac output	Volume Resuscitation
2	Renal arteriospasma	Increased	Normal	Increased	Volume Resuscitation Preload reduction After load reduction
3	Generalized vasospasm	Increased	Increased	Suppressed Decreased cardiac output	After load reduction Diuresis

Other uses of cardiac ultrasound

- Gestational hypertension:
 - Total vascular resistance
 - Left ventricular geometry
- Classify women into high and low risk groups
- High risk
 - TVR > 1340dyn seconds/cm⁵
 - OR 64.4 95% CI 25.9-160.1
 - Concentric geometry
 - OR 4.72 95% CI 1.85-12.04

Gestational hypertension

- Low risk
 - TVR < 1340 dyn seconds/cm⁵
 - Non concentric geometry

Cardiac function and IUGR

- Women with IUGR that are normotensive have
 - Decreased diastolic and systolic cardiac function

Conclusion

- Ultrasound can assist in making a diagnosis in the pregnant patient that present with cardio respiratory complaints
- It can help to identify high risk women with Gestational Hypertension
- There is some relation between maternal cardiac function and IUGR

Conclusion

- BUT
- It form part of a whole clinical assessment

