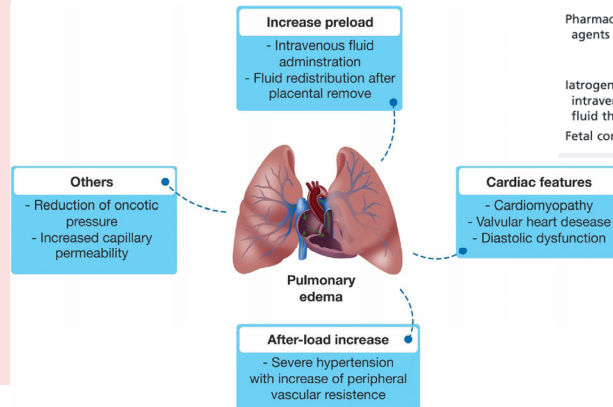


## PULMONARY EDEMA AND PREECLAMPSIA

- Often confused with PPCM
- Normal EF (> 45%) on echo
- Often has increased BNP/proBNP
- Fluid Matters
  - Study looking at lower fluid in LD in HTN pregnancy
    - Median fluid 2100 ml vs 5550 ml
    - 0 vs 19 cases of Pulm Edema



Category	Specific risk factors
Pre-existing pre-pregnancy conditions	Cardiovascular disease (hypertension, ischaemic heart disease, congenital heart disease, valvular heart disease, arrhythmias, cardiomyopathy) Obesity Increased maternal age Endocrine disorders (phaeochromocytoma and hyperthyroidism)
Specific diseases in pregnancy	Pre-eclampsia Cardiomyopathy Sepsis Preterm labour Amniotic fluid embolism Pulmonary embolism
Pharmacological agents	$\beta$ -Adrenergic tocolytic agents Corticosteroids Magnesium sulphate Illicit drugs including cocaine
Iatrogenic intravenous fluid therapy	Positive fluid balance > 2000 ml
Fetal conditions	Multiple gestation

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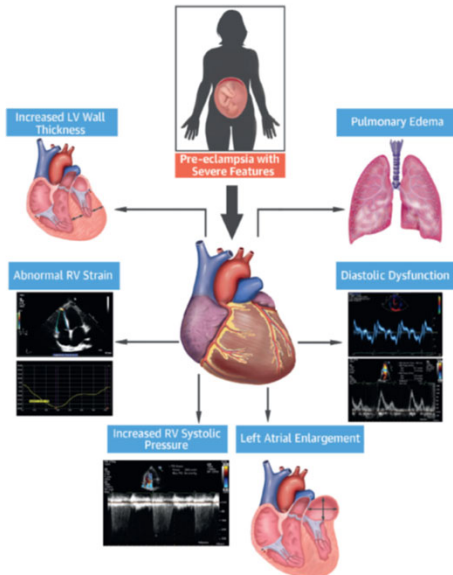
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Brazilian Journal of Anesthesiology 2021;71(4):421---428, Dennis Anesthesia 2012, Thornton 2011

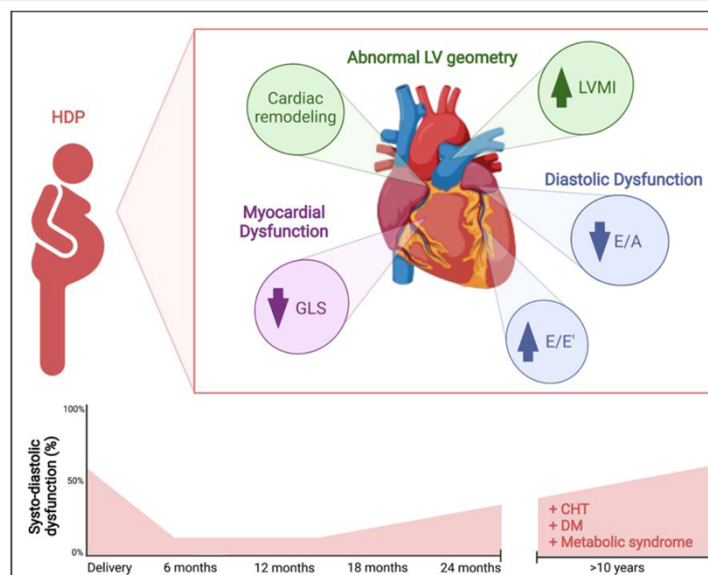
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## ACUTE CHANGES AND CHRONIC CV CHANGES

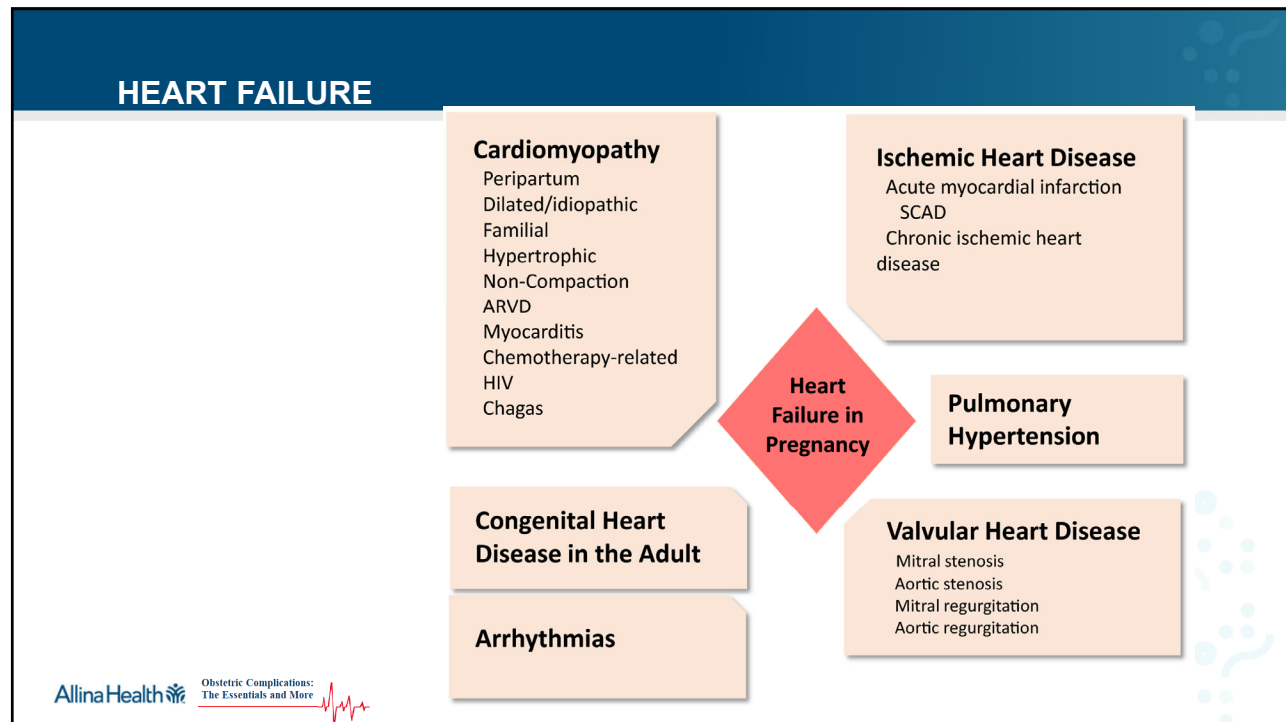
CENTRAL ILLUSTRATION Pre-Eclampsia With Severe Features: Effects on the Heart



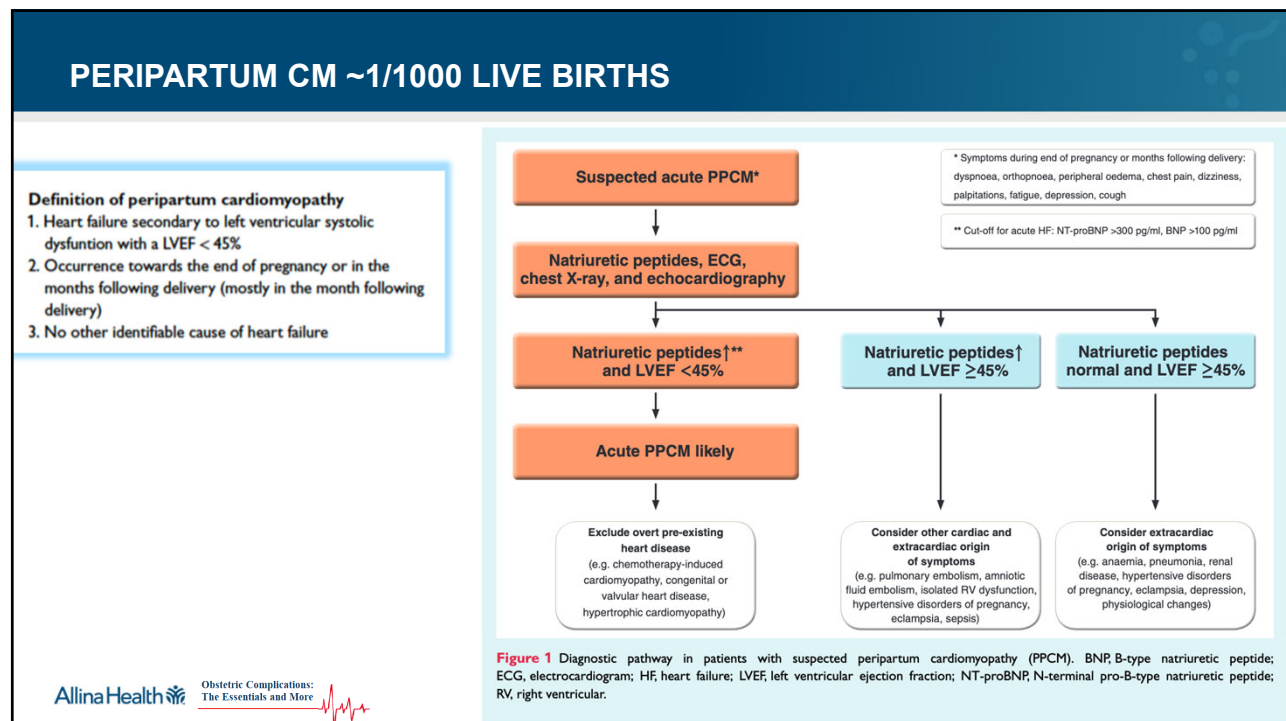
Vaughn, A.J. et al. J Am Coll Cardiol. 2019;73(13):B.



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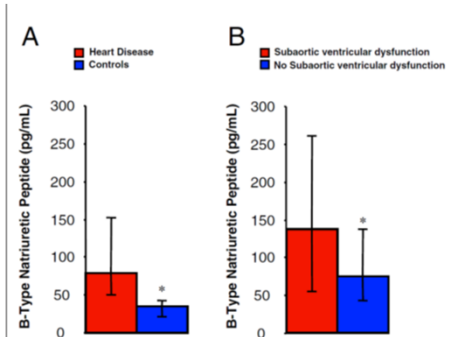
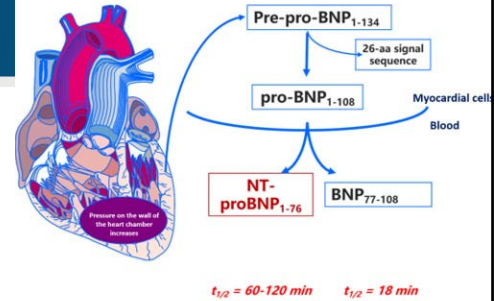
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## CARDIAC BIOMARKERS: BNP/PROBNP

- BNP/NT PROBNP – released by ventricle when stressed and stretched
- BNP  $\leq 100$  pg/ml had a negative predictive value of 100% for identifying events during pregnancy.
- Pregnant BNP levels were approximately twice as high as the nonpregnant BNP levels.
- Both can be used longitudinally to follow a woman through pregnancy



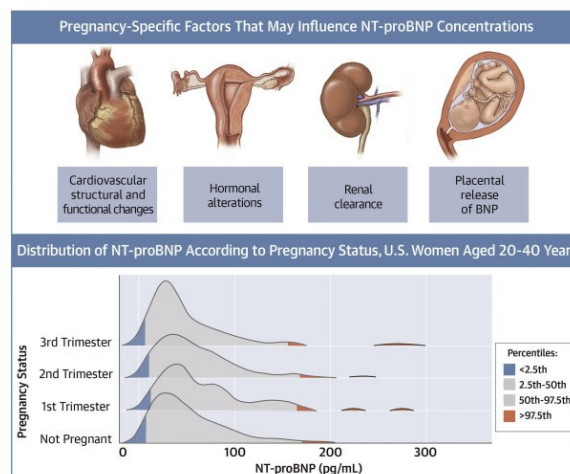
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## PREGNANCY AND NT PROBNP

### CENTRAL ILLUSTRATION: Pregnancy-Specific Factors That May Influence NT-proBNP Levels



Minhas AS, et al. JACC Adv. 2023;2(2):100265.

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## NT PROBNP

**TABLE 1 B-Type Natriuretic Peptide Use During Pregnancy**

Normal Pregnancy	Preeclampsia	PPCM	Pre-Existing Cardiomyopathy	Congenital Heart Disease	Valve Disease
<b>General principles</b>					
Stable through trimesters	↑ concentration compared to normotensive	↓ BNP and NT-proBNP at index diagnosis	↑ concentration among pregnant individuals with congenital heart disease vs normal pregnancy	NT-proBNP concentration >128 pg/mL at 20 wk predictive of future events in CHD	No specific BNP data in pregnant patients with valve disease
	↑ concentration with early-onset PE and greater disease severity	predictive of LV recovery over time as compared with ↑ index values	Retains negative predictive value		
	Second trimester NT-proBNP value not predictive of future preeclampsia	↑ concentration seen in heart failure associated with pregnancy without systolic dysfunction (not meeting criteria for PPCM), but to a lesser degree than in patients with reduced LVEF			
	↑ NT-proBNP concentration in the first trimester is associated with lower risk of HDP and future hypertension				
<b>Clinical recommendations</b>					
BNP/NT-proBNP can be used to exclude heart failure as it has a high negative predictive value	Obtain measurements of BNP/NT-proBNP in patients with signs or symptoms of heart failure	Obtain measurements of BNP/NT-proBNP at the time of presentation for diagnosis and prognosis	Consider baseline and serial measurements of BNP/NT-proBNP in pregnant patients with cardiomyopathy who are at risk for heart failure (eg, systolic dysfunction)	Consider baseline and serial measurements of BNP/NT-proBNP in pregnant patients with congenital heart disease who are at risk for heart failure (eg, complex congenital lesions, systolic dysfunction)	Consider baseline and serial measurements of BNP/NT-proBNP in pregnant patients with valve lesions who are at risk for heart failure (eg, severe stenotic or regurgitant valve lesions, systolic dysfunction)

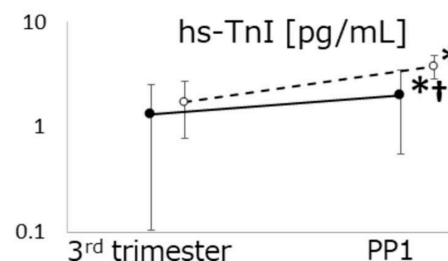
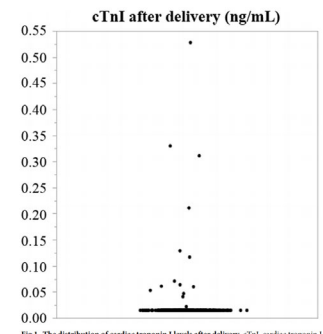
BNP = B-type natriuretic peptide; CHD = congenital heart disease; CVD = cardiovascular disease; HDP = hypertensive disorders of pregnancy; LVEF = left ventricular ejection fraction; NT-proBNP = N-terminal pro-B-type natriuretic peptide; PE = preeclampsia; PPCM = peripartum cardiomyopathy.

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## CARDIAC MARKERS IN PREGNANCY: TROPONIN

- Cardiac troponin can neither cross the placenta, due to its molecular size, nor can it be produced in the placenta
- PIH, placental abnormality, and decreased hemoglobin after delivery were the factors associated with elevated cTnI levels
- Pre eclampsia is associated the Trop elevation
- Troponin elevation in pregnancy should be evaluated
- An ischemic rise and fall is still an MI



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## TROPONIN AND PREGNANCY

**TABLE 4 Cardiac Troponin Use During Pregnancy**

Normal Pregnancy	Preeclampsia	Peripartum Cardiomyopathy	Pre-Existing Cardiomyopathy	Coronary Artery Disease	Valve Disease
<b>General principles</b>					
Stable through trimesters May be ↑ using high-sensitivity assays without clinical consequence in the early postpartum period A significant portion of patients will have values below the limit of detection using high-sensitivity assays	↑ concentration compared to normotensive pregnancies	Incident troponin values are inversely correlated with LV recovery	No specific data available in the pregnant population with cardiomyopathy	No specific data available in the pregnant population with pre-existing ischemic heart disease	No specific data available in the pregnant population with valve disease
<b>Clinical recommendations</b>					
↑ values should prompt investigation into potential ischemia	Obtain measurements of troponin in patients with signs or symptoms of ischemia	Obtain measurements of troponin at the time of presentation to aid with prognosis related to recovery of left ventricular systolic function	No data to support routine measurement of troponin in the absence of clinical concern for ischemia	No data to support routine measurement of troponin in the absence of clinical concern for ischemia Should be measured for acute chest pain or other clinical concern for ischemia both during pregnancy and the postpartum period (with the highest risk for P-SCAD occurring in the first postpartum week)	No data to support routine measurement of troponin in the absence of clinical concern for ischemia

↑ = increased/increase; P-SCAD = pregnancy-associated spontaneous coronary artery dissection.



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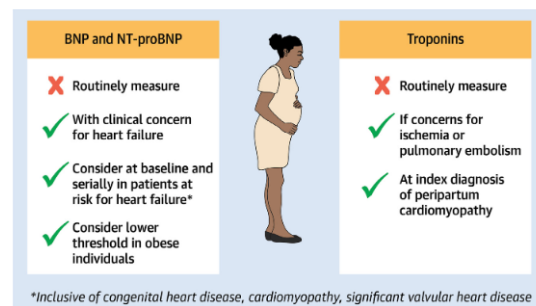


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## BIOMARKERS

- Pro BNP < 128 is normal
- Pro BNP > 200 is seen in Preeclampsia
- ProBNP > 300 is consistent with PPCM
- Higher levels of ProBNP are associated with worse outcomes in PPCM
- Should not be used as a sole marker of pathology
- Troponins are always abnormal

**CENTRAL ILLUSTRATION** The Utilization of Cardiac Biomarkers During Pregnancy: Suggestions for Clinical Practice



Sarma AA, et al. JACC Adv. 2022;1(3):100064.



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