



Maryland Chapter

**AMERICAN COLLEGE OF
EMERGENCY PHYSICIANS**

**Maryland ACEP Chapter Educational Conference & Annual Meeting
March 12, 2020**

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PRESENTATION

HFrEF, HFpEF, what the (EF)? Point-of-Care Echo in the Evaluation of Heart Failure

DESCRIPTION

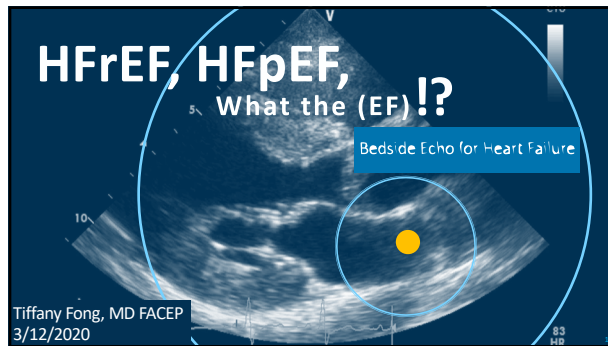
Decompensated heart failure is a commonly encountered clinical syndrome in the emergency department. Though emergency care providers have significant comfort with the diagnosis and management of patients with reduced ejection fraction, heart failure with preserved ejection fraction can be more enigmatic. This talk will provide an overview of the relevant pathophysiology, point-of-care echo findings, and management of HFrEF and HFpEF.

OBJECTIVES

- Recognize the clinical syndromes of heart failure with reduced and preserved ejection fraction (HFrEF and HFpEF).
- Describe multiple techniques to estimate ejection fraction on point-of-care echocardiography.
- Explain the basic physiology of left ventricular diastole.
- Identify key sonographic findings in HFpEF.
- Describe the management strategies for HFrEF and HFpEF.

DISCLOSURE

No significant financial relationships to disclose.



ROADMAP

- Define and recognize HF
- HFrEF vs. HFpEF
- Echo evaluation of SYSTOLIC dysfunction
- Echo evaluation of DIASTOLIC function
- Ultrasound adjuncts to heart failure
- Management and clinical integration

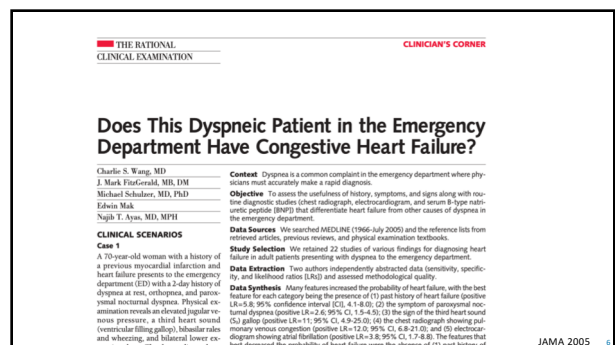
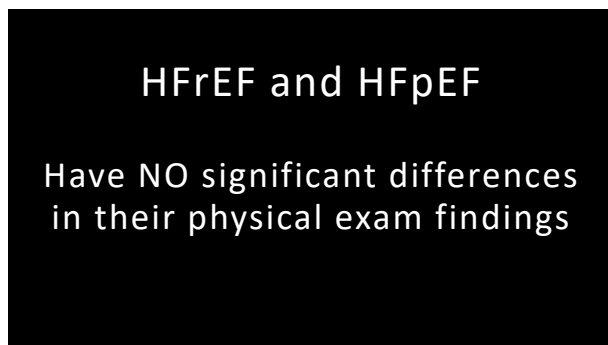
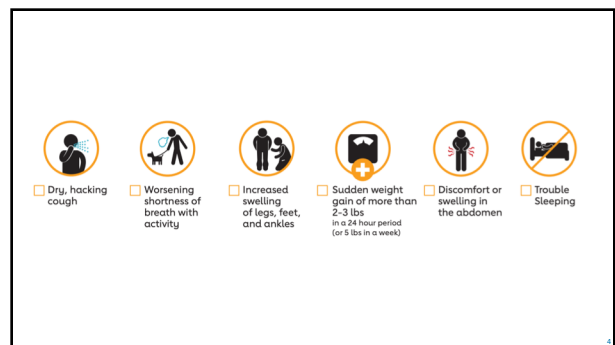
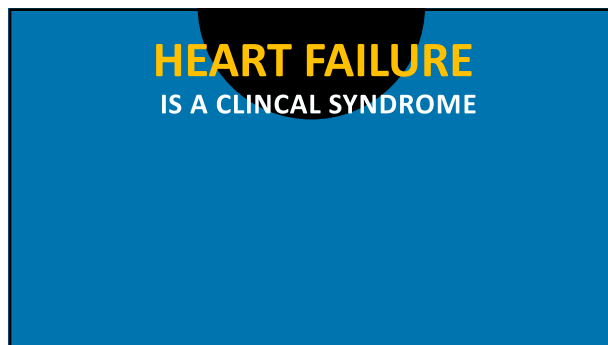


Table 3. Summary of Diagnostic Accuracy of Findings on History and Physical Examination in Emergency Department Patients

Finding	Pooled		Summary LR (95% CI)*	
	Sensitivity	Specificity	Positive	Negative
Initial clinical judgment ^{†††††}	0.61	0.86	4.4 (1.8-10.0)	0.45 (0.28-0.73)
History				
Heart failure ^{†††††}	0.60	0.90	5.8 (1.1-8.0)	0.45 (0.38-0.53)
Myocardial infarction ^{†††††}	0.40	0.87	3.1 (2.0-4.9)	0.69 (0.54-0.92)
Coronary artery disease ^{†††††}	0.52	0.70	1.8 (1.1-2.8)	0.68 (0.48-0.96)
Dyslipidemia ^{†††††}	0.23	0.87	1.7 (0.43-6.9)	0.89 (0.69-1.1)
Diabetes mellitus ^{†††††}	0.38	0.83	1.7 (0.9-2.7)	0.86 (0.71-1.0)
Hypertension ^{†††††}	0.60	0.56	1.4 (1.1-1.7)	0.71 (0.55-0.93)
Stroke ^{†††††}	0.62	0.27	0.8 (0.58-1.2)	1.4 (0.98-2.0)
Chronic obstructive pulmonary disease ^{†††††}	0.34	0.57	0.81 (0.60-1.1)	1.1 (0.95-1.4)
Symptoms				
Paroxysmal nocturnal dyspnea ^{†††††}	0.41	0.84	2.6 (1.5-4.5)	0.70 (0.54-0.91)
Orthopnea ^{†††††}	0.50	0.77	2.2 (1.2-3.9)	0.65 (0.45-0.92)
Edema ^{†††††}	0.51	0.76	2.1 (0.92-6.0)	0.64 (0.38-1.1)
Dyspnea on exertion ^{†††††}	0.84	0.34	1.3 (1.2-1.4)	0.48 (0.30-0.67)
Fatigue and weight gain ^{†††††}	0.31	0.70	1.0 (0.74-1.4)	0.99 (0.85-1.1)
Cough ^{†††††}	0.36	0.61	0.9 (0.70-1.2)	1.0 (0.87-1.3)
Physical examination				
Third heart sound (ventricular filling gallop) ^{†††††}	0.13	0.99	11 (4.9-25.0)	0.88 (0.83-0.94)
Abdominojugular reflux ^{†††††}	0.24	0.96	6.4 (0.81-51.0)	0.79 (0.62-1.0)
Jugular venous distension ^{†††††}	0.39	0.96	5.1 (3.2-7.8)	0.86 (0.57-1.3)
Rales ^{†††††}	0.60	0.78	2.8 (1.8-4.1)	0.51 (0.37-0.70)
Any murmur ^{†††††}	0.27	0.90	2.6 (1.7-4.1)	0.81 (0.73-0.90)
Lower extremity edema ^{†††††}	0.60	0.78	2.3 (1.5-3.7)	0.64 (0.47-0.87)
Valvular murmurs ^{†††††}	0.73	0.65	2.1 (1.0-4.2)	0.41 (0.17-1.0)
Systolic blood pressure <100 mm Hg ^{†††††}	0.06	0.97	2.0 (0.60-6.6)	0.97 (0.91-1.0)
Fourth heart sound (late gallop) ^{†††††}	0.05	0.97	1.6 (0.47-5.8)	0.98 (0.93-1.0)
Systolic blood pressure ≥150 mm Hg ^{†††††}	0.38	0.73	1.0 (0.69-1.6)	0.99 (0.84-1.2)
White ^{†††††}	0.22	0.58	0.9 (0.36-2.7)	1.3 (1.1-1.7)
Acute ^{†††††}	0.01	0.97	0.30 (0.04-2.9)	1.0 (0.90-1.1)

Table 4. Summary of Diagnostic Accuracy of Findings on Chest Radiograph and Electrocardiogram in Emergency Department Patients

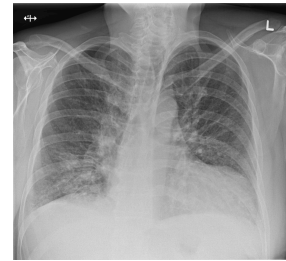
Finding	Pooled		Summary LR (95% CI)*	
	Sensitivity	Specificity	Positive	Negative
Chest radiograph				
Pulmonary venous congestion ^{†††††}	0.54	0.96	12.0 (5.8-21.0)	0.48 (0.28-0.83)
Interstitial edema ^{†††††}	0.34	0.97	12.0 (5.2-27.0)	0.68 (0.54-0.85)
Alveolar edema ^{†††††}	0.06	0.99	6.0 (2.2-16.0)	0.95 (0.90-0.97)
Cardiomegaly ^{†††††}	0.74	0.78	3.3 (2.4-4.7)	0.33 (0.23-0.48)
Pleural effusion ^{†††††}	0.26	0.92	3.2 (2.4-4.3)	0.81 (0.77-0.85)
Any edema ^{†††††}	0.70	0.77	3.1 (0.60-16.0)	0.38 (0.11-1.3)
Pneumonia ^{†††††}	0.04	0.92	0.50 (0.29-0.87)	1.0 (1.0-1.1)
Hyperinflation ^{†††††}	0.03	0.92	0.38 (0.20-0.69)	1.1 (1.0-1.1)
Electrocardiogram				
Abnormal bundle ^{†††††}	0.26	0.93	3.8 (1.7-8.8)	0.79 (0.65-0.96)
New T-wave changes ^{†††††}	0.24	0.92	3.0 (1.7-5.3)	0.83 (0.74-0.92)
Any abnormal finding ^{†††††}	0.50	0.78	2.2 (1.5-3.1)	0.64 (0.47-0.88)
ST elevation ^{†††††}	0.05	0.97	1.6 (0.80-4.0)	0.98 (0.94-1.0)
ST depression ^{†††††}	0.11	0.94	1.7 (0.97-2.9)	0.95 (0.90-1.0)

Abbreviations: CI, confidence interval; LR, likelihood ratio.
 *95% are not independent of each other and should not be multiplied in series when multiple findings are considered.
 †Pulmonary venous congestion, manifest as distention of pulmonary veins and redistribution to the apices.

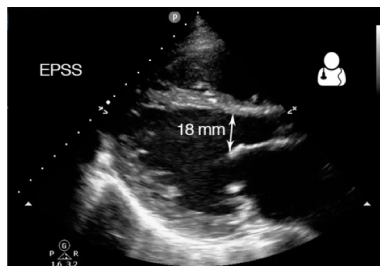
Table 5. Summary of Operating Characteristics of Serum BNP in Emergency Department Patients

	Pooled		Summary LR (95% CI)	
	Sensitivity	Specificity	Positive	Negative
Clinical judgment or BNP ≥100 pg/mL ^{†††††}	0.94	0.70	3.1 (2.8-3.5)	0.09 (0.06-0.11)
BNP alone, pg/mL				
≥250 ^{†††††}	0.89	0.81	4.6 (2.6-8.0)	0.14 (0.06-0.33)
≥200 ^{†††††}	0.92	0.75	3.7 (2.6-5.4)	0.11 (0.07-0.18)
≥150 ^{†††††}	0.89	0.71	3.1 (2.1-4.5)	0.15 (0.11-0.21)
≥100 ^{†††††}	0.93	0.66	2.7 (2.0-3.9)	0.11 (0.07-0.16)
≥80 ^{†††††}	0.96	0.71	3.3 (1.8-6.3)	0.06 (0.03-0.13)
≥50 ^{†††††}	0.97	0.44	1.7 (1.2-2.6)	0.06 (0.03-0.12)

Abbreviations: BNP, B-type natriuretic peptide; CI, confidence interval; LR, likelihood ratio.
 †Either an initial clinical probability of heart failure ≥50% or BNP ≥100 pg/mL was considered a positive result. A negative result was a clinical probability of heart failure <50% and BNP <100 pg/mL.

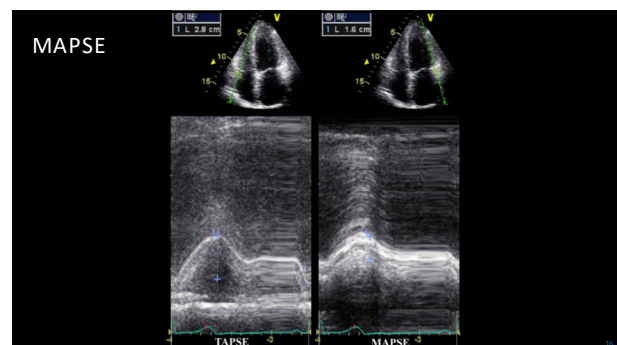
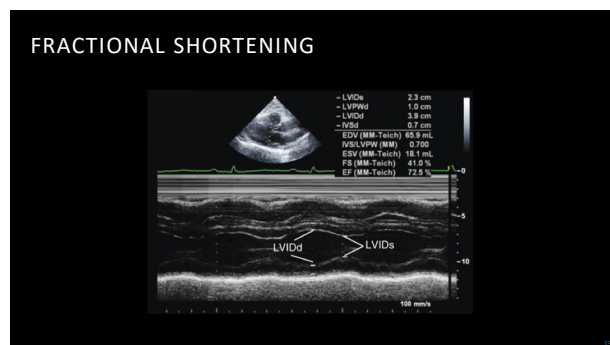
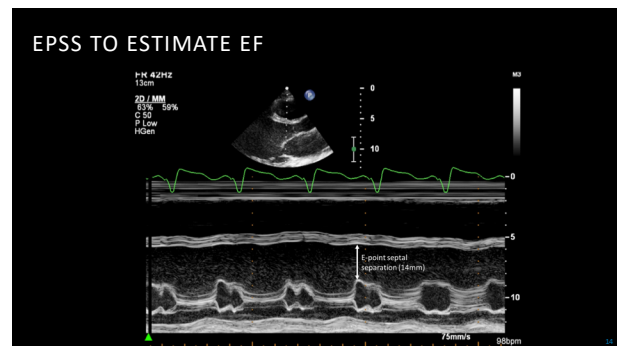


(ECHO CLIP OF POOR LVEF)



First discrimination point in CHF:

Determine
preserved vs. reduced
 ejection fraction

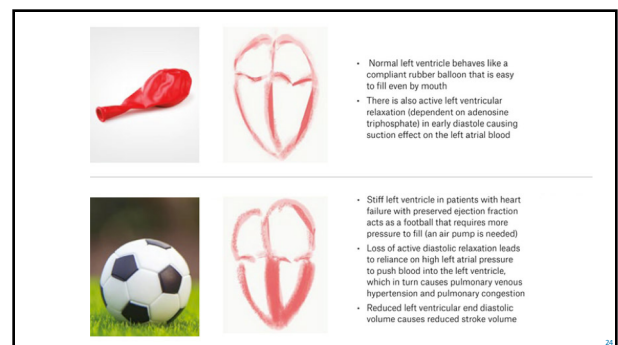
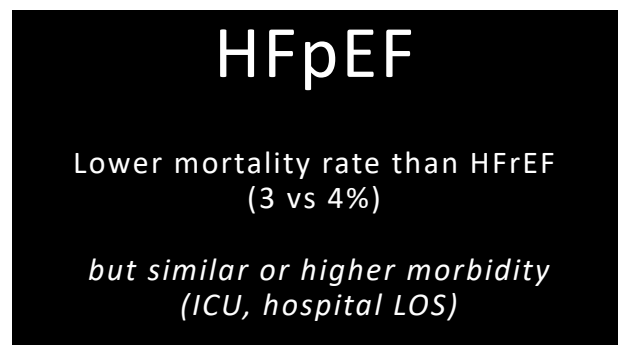
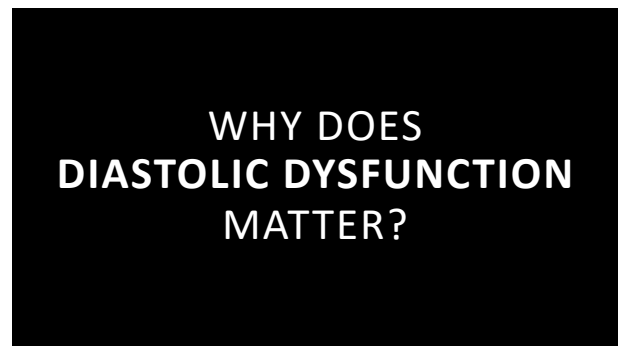


Reduced (HFrEF): EF <40%

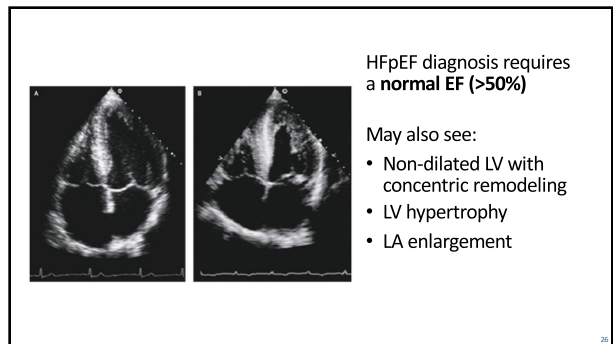
Gray-zone: EF 40-50%

Preserved (HFpEF): EF >50%

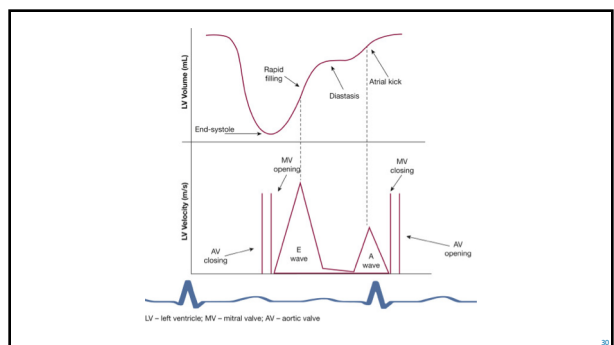
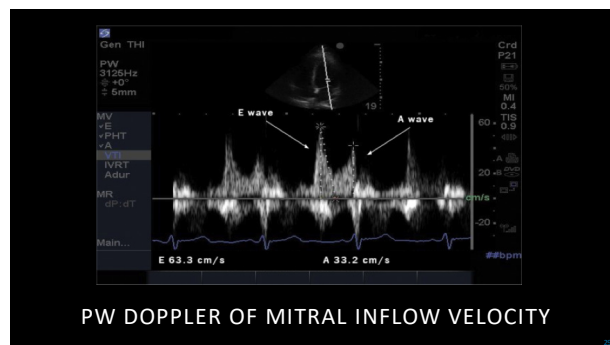
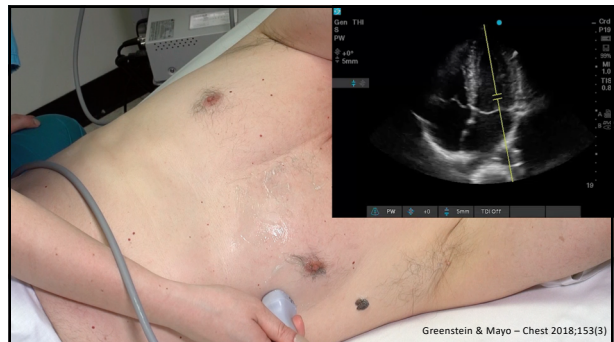
HFpEF

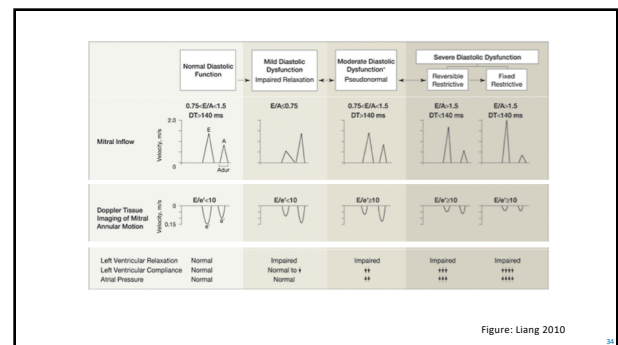
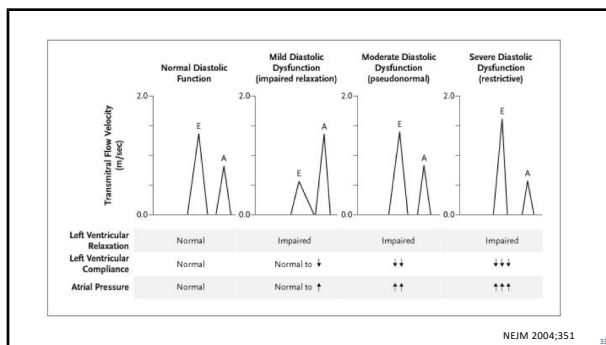
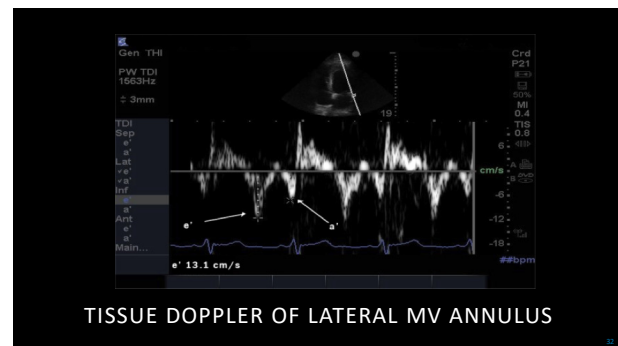


DIY: DIASTOLIC EVALUATION

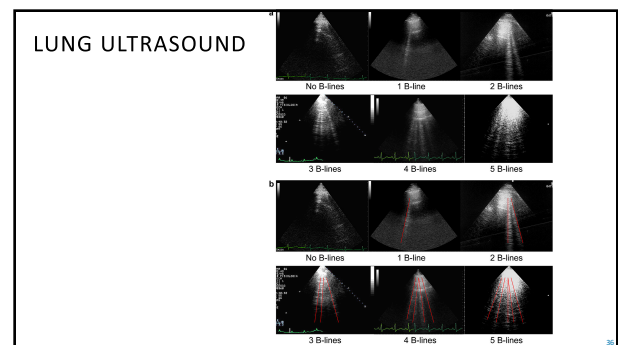


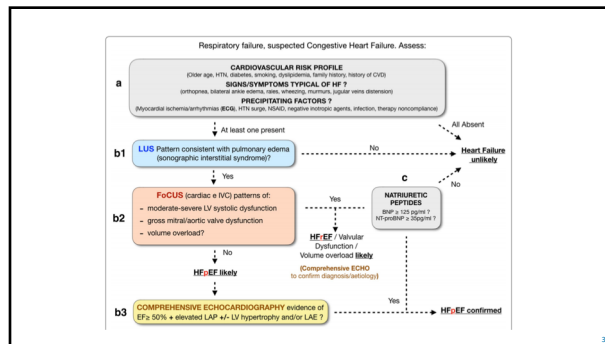
KEY:
Identify \uparrow LA
pressure





SUPPORTING EVIDENCE OF DIASTOLIC EVALUATION





***EVOLVING THOUGHT:**

**HFpEF IS NOT SIMPLY
DIASTOLIC DYSFUNCTION**

BASIC TREATMENT

Table 1. Management Principles for Patients with Diastolic Heart Failure.

Goal	Treatment*	Daily Dose of Medication†
Reduce the congestive state	<ul style="list-style-type: none"> Salt restriction Diuretics 	<ul style="list-style-type: none"> <2 g of sodium per day Furosemide, 16–120 mg Hydrochlorothiazide, 12.5–25 mg Etoripril, 2.5–40 mg Lasixolol, 10–40 mg Carvedilol, 4–16 mg Losartan, 25–100 mg
Maintain atrial contraction and prevent tachycardia	<ul style="list-style-type: none"> Calcium channel blockers Beta-blockers Calcium channel blockers Beta-blockers Calcium channel blockers Beta-blockers 	<ul style="list-style-type: none"> Amlodipine, 10–20 mg Metoprolol, 25–100 mg Verapamil, 120–240 mg Diltiazem, 120–180 mg Amlodipine, 10–20 mg Metoprolol, 25–100 mg Verapamil, 120–240 mg Diltiazem, 120–180 mg
Treat and prevent myocardial ischemia	<ul style="list-style-type: none"> Nitrites Beta-blockers Calcium channel blockers 	<ul style="list-style-type: none"> Isosorbide dinitrate, 36–180 mg Isosorbide mononitrate, 36–90 mg Amlodipine, 10–20 mg Metoprolol, 25–100 mg Verapamil, 120–240 mg Diltiazem, 120–180 mg
Control hypertension	<ul style="list-style-type: none"> Angiotensin-converting enzyme inhibitors Angiotensin receptor blockers Calcium channel blockers Beta-blockers Diuretics 	<ul style="list-style-type: none"> Lisinopril, 10–40 mg Enalapril, 10–20 mg Hydrochlorothiazide, 12.5–25 mg Amlodipine, 10–20 mg Metoprolol, 25–100 mg Verapamil, 120–240 mg Diltiazem, 120–180 mg
Prevent progression of hypertrophy and prevent myocardial fibrosis	<ul style="list-style-type: none"> ACE inhibitors Angiotensin receptor blockers Spironolactone 	<ul style="list-style-type: none"> Enalapril, 10–20 mg Lisinopril, 10–40 mg Metoprolol, 25–100 mg Verapamil, 120–240 mg Diltiazem, 120–180 mg Spironolactone, 25–50 mg

NEJM 2004

CORRECT DX
DECONGEST
CONTROL HTN
CONTROL AFIB

PUTTING IT TOGETHER
(Clinical Case)

SUMMARY

THANK YOU!

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