Diastolic Heart Function: Applying the New Guidelines
Case Studies

William A. Zoghbi MD, FASE, MACC
Professor and Chairman, Department of Cardiology
Elkins Family Distinguished Chair in Cardiac Health
Houston Methodist Hospital

HOUSTON Methodist LEADING MEDICINE

Relation with Industry

HOUSTON Methodist DEBAKEY HEART & VASCULAR CENTER

- None relevant

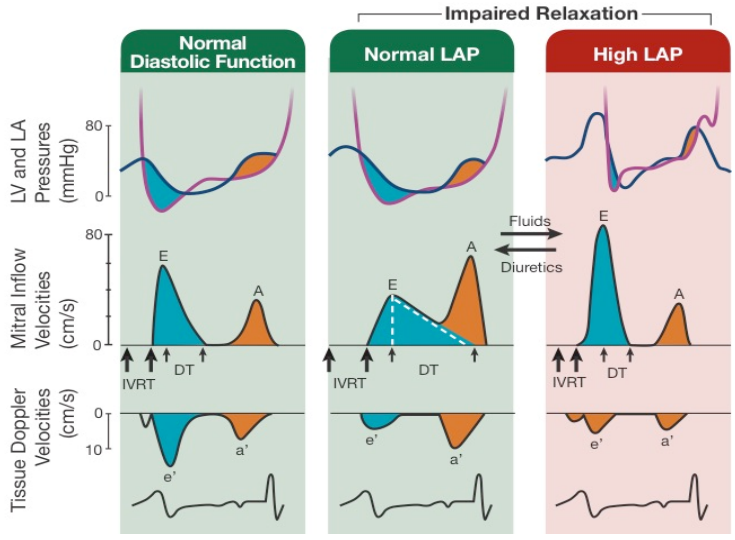
ASE/EACVI GUIDELINES AND STANDARDS

Recommendations for the Evaluation of Left Ventricular Diastolic Function by Echocardiography: An Update from the American Society of Echocardiography and the European Association of Cardiovascular Imaging

Sherif F. Nagueh, Chair, MD, FASE,[1] Otto A. Smiseth, Co-Chair, MD, PhD,[2] Christopher P. Appleton, MD,[1] Benjamin F. Byrd, III, MD, FASE,[1] Hisham Dokainish, MD, FASE,[1] Thor Edvardsen, MD, PhD,[2] Frank A. Flachskampf, MD, PhD, FESC,[2] Thierry C. Gillebert, MD, PhD, FESC,[2] Allan L. Klein, MD, FASE,[1] Patrizio Lancellotti, MD, PhD, FESC,[2] Paolo Marino, MD, FESC,[2] Jae K. Oh, MD,[1] Bogdan Alexandru Popescu, MD, PhD, FESC, FASE,[2] and Alan D. Waggoner, MHS, RDCS[1], *Houston, Texas; Oslo, Norway; Phoenix, Arizona; Nashville, Tennessee; Hamilton, Ontario, Canada; Uppsala, Sweden; Ghent and Liège, Belgium; Cleveland, Ohio; Novara, Italy; Rochester, Minnesota; Bucharest, Romania; and St. Louis, Missouri*

(J Am Soc Echocardiogr 2016;29:277-314.)

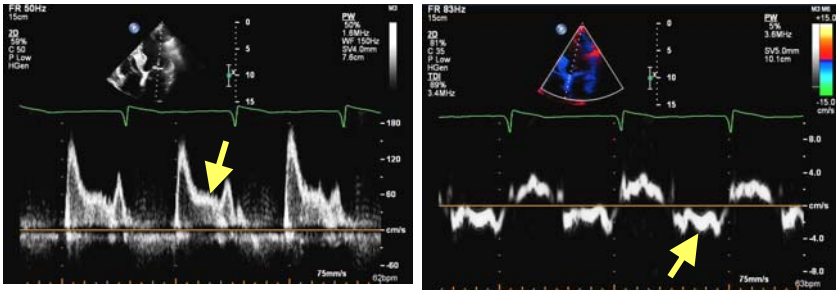
Relation of Mitral Inflow and TD Velocities with LV Filling Pressures



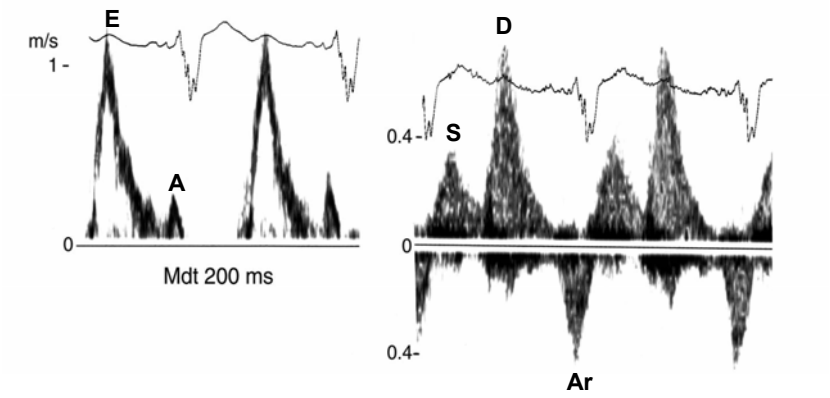
How To Determine if Diastolic Dysfunction is Present ?

- Known CV disease as CAD
- Pathologic LVH
- Hypertensive CV Disease
- LV systolic Dysfunction as noted by depressed LV EF
- Established clinical diagnosis of HFpEF
- Reduced LV global longitudinal strain, TD mitral annulus s' velocity and MAPSE
- Specific Doppler signals (Prominent Ar in PV, L wave…)

Mitral Inflow "L" Velocity

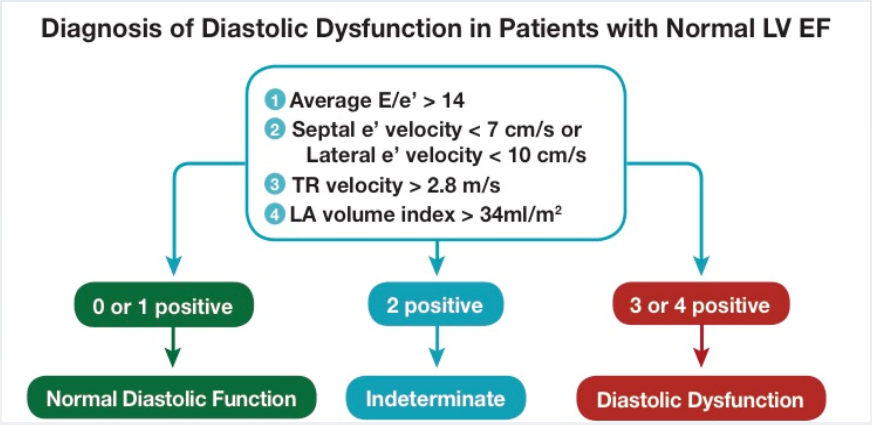


Pulmonary Vein Ar Velocity in a Patient with HFpEF



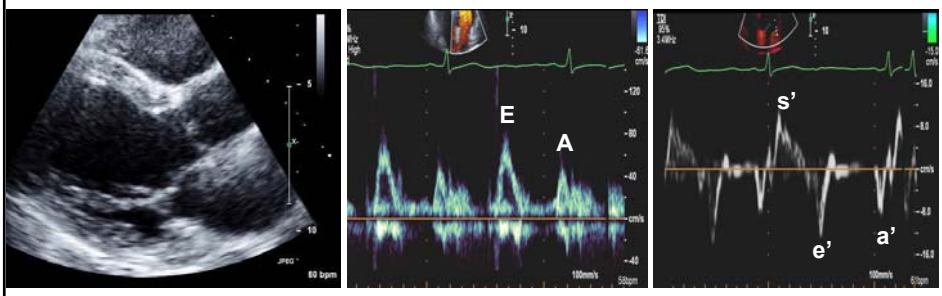
What to Do if Clinical and 2D Findings Are Not Indicative of Cardiac Disease?

Criteria for Diagnosis of LV Diastolic Dysfunction



Nagueh S et al. JASE 29: 277, 2016

2D and Echo Doppler Findings in a 31 Year Old Male referred with a "Murmur" Diagnosis



- LA maximum volume index = 29 ml/m^2
- TR jet peak velocity = 2.4 m/s
- LV EF = 65% (BP = 120/80 mmHg, HR = 60/min)

How would you Assess LV Diastolic Function

A-Normal

B-Grade I diastolic dysfunction

C-Grade II diastolic dysfunction

D-Grade III diastolic dysfunction

E-Cannot be determined

How would you Assess LV Diastolic Function

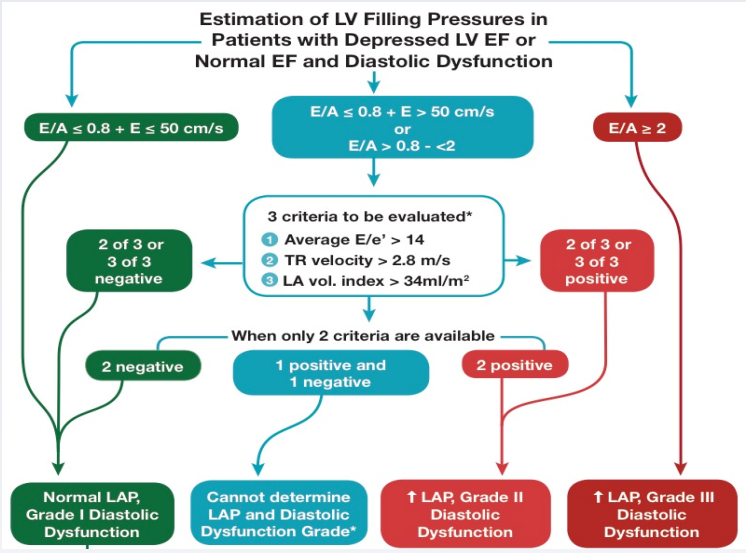
A-Normal

B-Grade I diastolic dysfunction

C-Grade II diastolic dysfunction

D-Grade III diastolic dysfunction

E-Cannot be determined

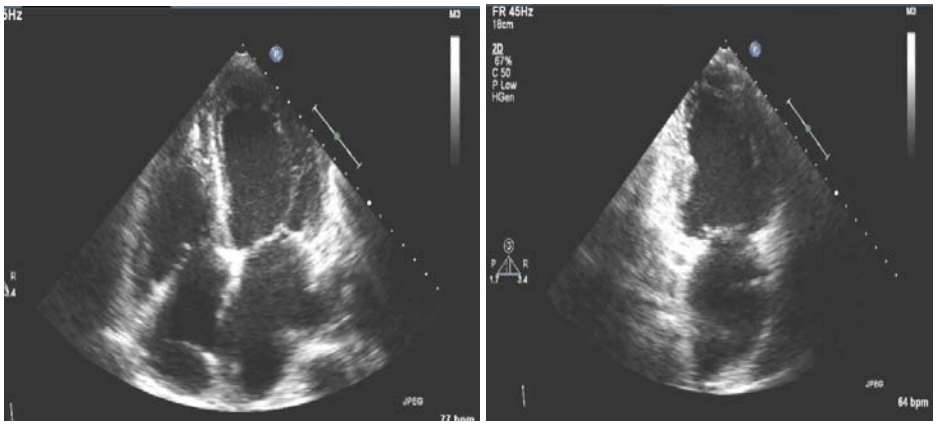


Nagueh S et al. JASE 29: 277, 2016

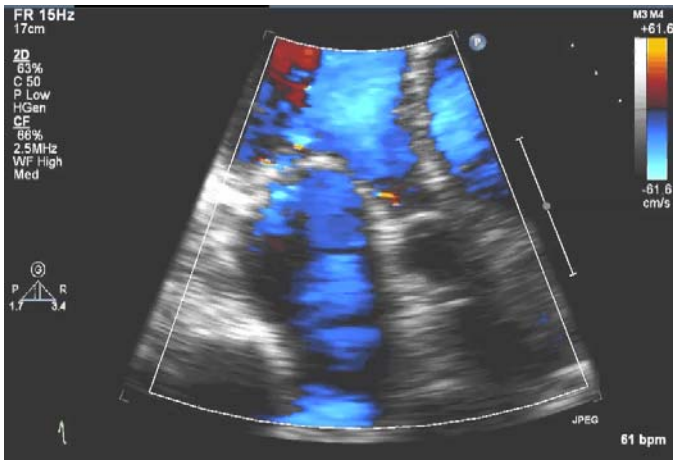
Case 1

- 63 year old male with recurrent dyspnea on daily activity, orthopnea and bilateral ankle swelling
- Gradual onset, and progressive course
- Has DM on oral medications and insulin
- Hypertension for > 10 years
- Chronic renal disease, serum creatinine = 2.5 mg/dL
- BP = 160/85 mmHg, HR = 64/min

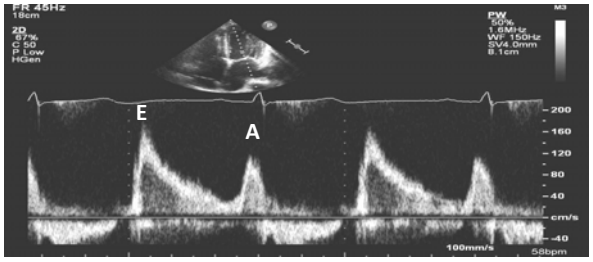
Apical Views

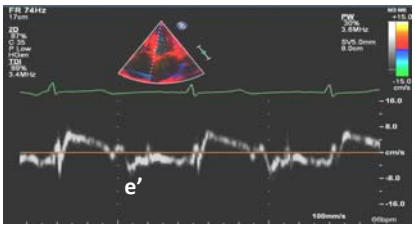


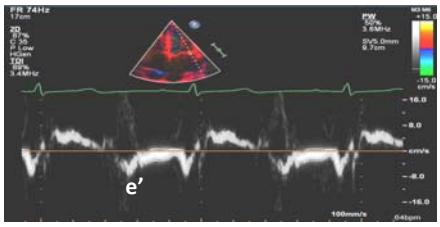
MR by Color Doppler



Mitral Inflow and Annulus TD Velocities



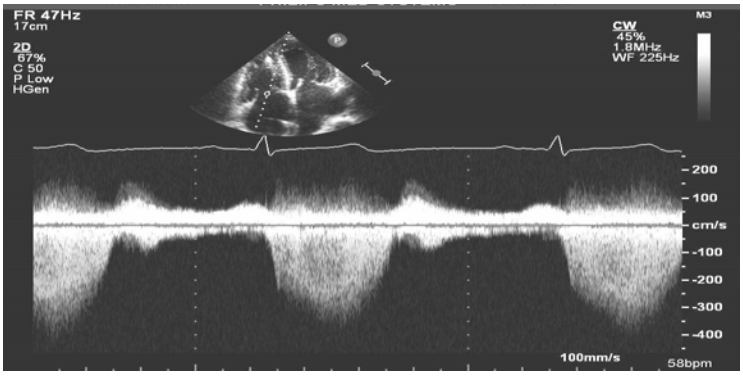




Septal E/e' = 160/6 = 26

Lateral E/e' = 160/8 = 20

TR Jet by CW Doppler



Peak TR Velocity = 3.6 m/s

How would you Assess LV Diastolic Function

A-Normal

B-Grade I diastolic dysfunction

C-Grade II diastolic dysfunction

D-Grade III diastolic dysfunction

E-Cannot be determined

Summary

- Clinical data consistent with cardiac disease
- E/A ratio >0.8 and <2
- Average E/e' = 20
- LA enlarged > 34 mL/m^2
- TR 3.6 m/s

How would you Assess LV Diastolic Function

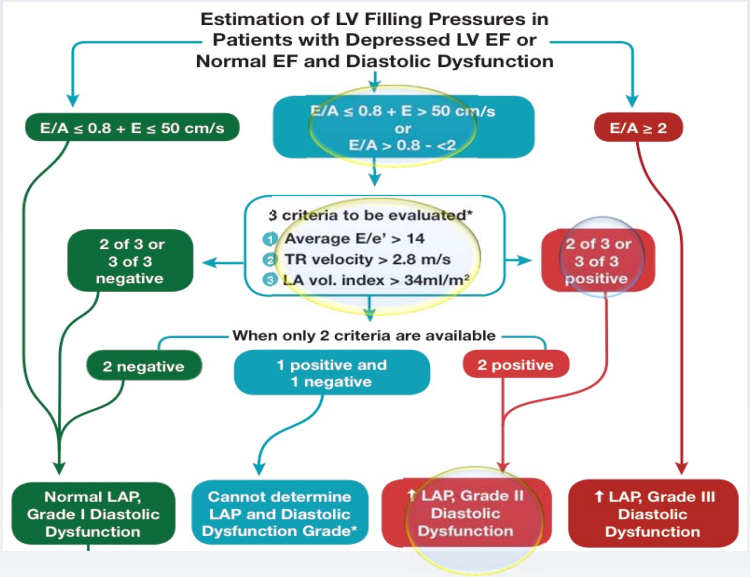
A-Normal

B-Grade I diastolic dysfunction

C-Grade II diastolic dysfunction

D-Grade III diastolic dysfunction

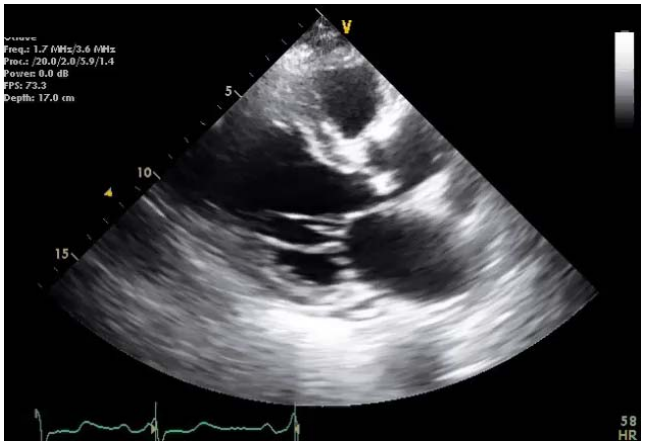
E-Cannot be determined



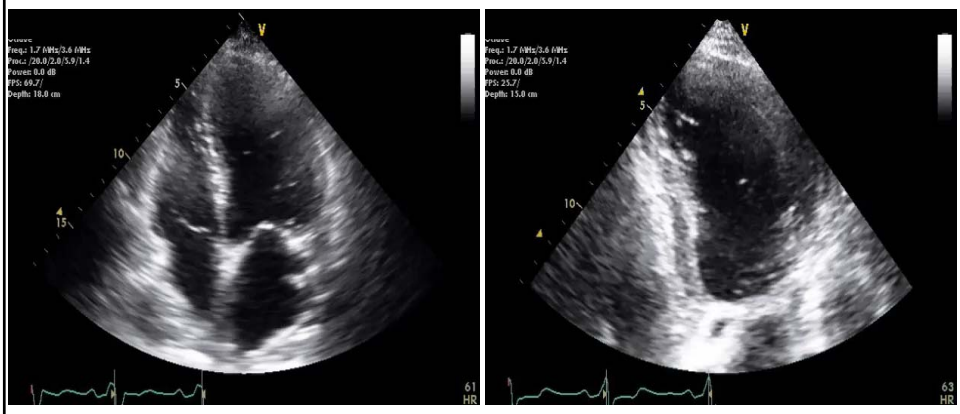
Case II

- 66 year old woman with history of previous MI presents with recurrent episodes of dyspnea with daily activities
- Onset of dyspnea 6 months ago, with a progressive course
- Has history of HTN, diabetes mellitus, and hypercholesterolemia
- No history of pulmonary disease
- BP = 116/68 mmHg, HR =60/min

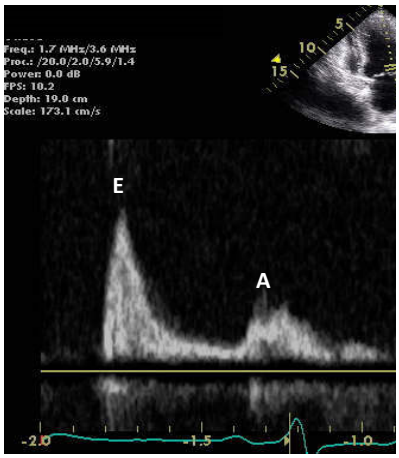
Parasternal Long axis View

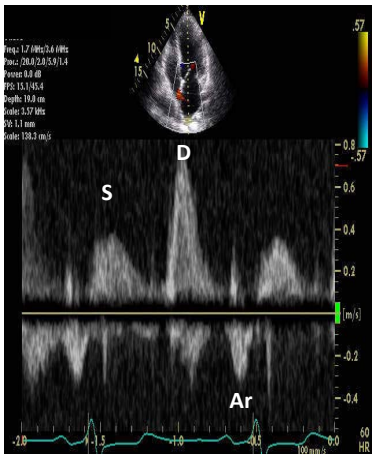


Apical Views



Mitral and Pulmonary Venous Flow





How would you Assess LV Diastolic Function

A-Normal

B-Grade I diastolic dysfunction

C-Grade II diastolic dysfunction

D-Grade III diastolic dysfunction

E-Cannot be determined

Summary

- Clinical data consistent with cardiac disease
- LV EF depressed
- E/A ratio > 2
- Pulmonary vein S/D ratio <1
- LA enlarged > 34 mL/m^2

How would you Assess LV Diastolic Function

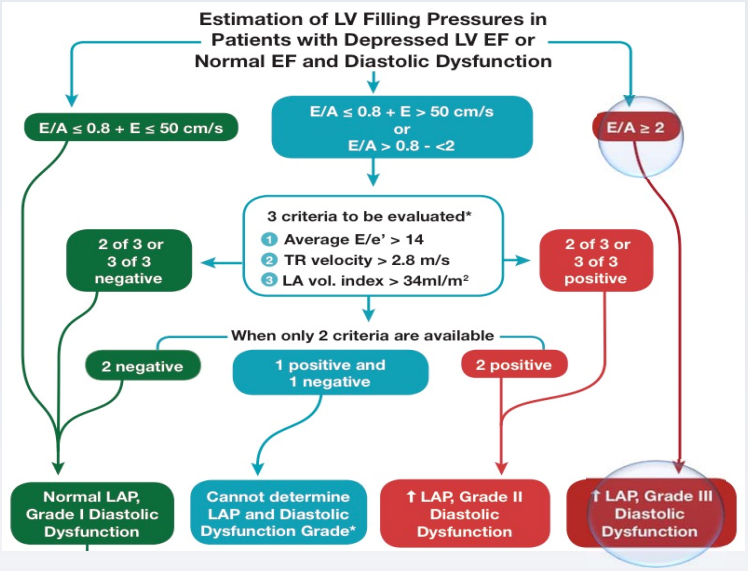
A-Normal

B-Grade I diastolic dysfunction

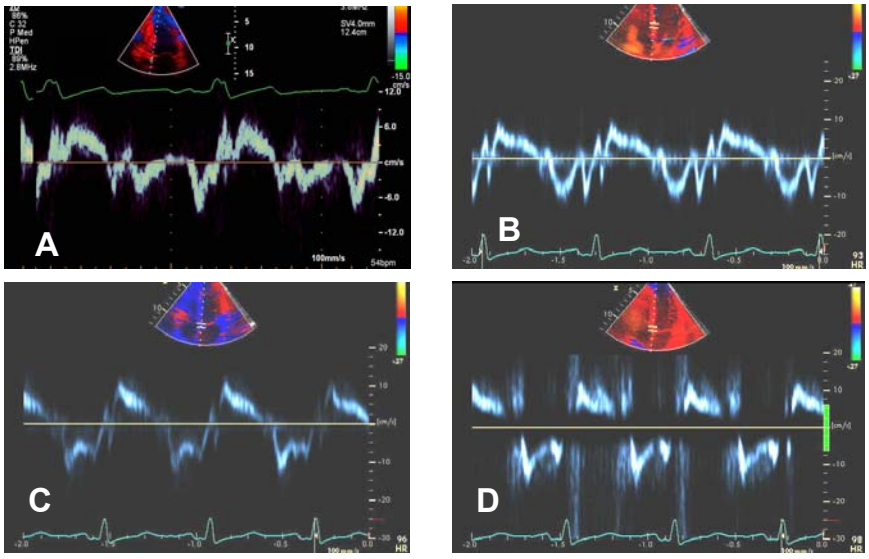
C-Grade II diastolic dysfunction

D-Grade III diastolic dysfunction

E-Cannot be determined



TD Sample Volume Location is Important



Cannot Use E/e' To Estimate LV Filling Pressure In Diseases of The Mitral Valve

- Significant MV annular calcifications
- Mitral stenosis
- Significant mitral regurgitation
- Prosthetic mitral valve

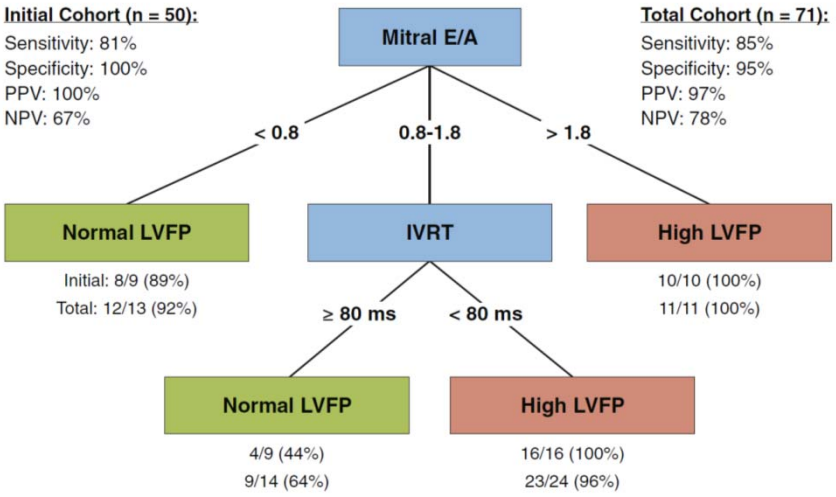
ORIGINAL RESEARCH

Doppler Echocardiography for the Estimation of LV Filling Pressure in Patients With Mitral Annular Calcification

Muaz M. Abudiab, MD, Lakshmi H. Chebrolu, MD, Robert C. Schutt, MD, Sherif F. Nagueh, MD, William A. Zoghbi, MD

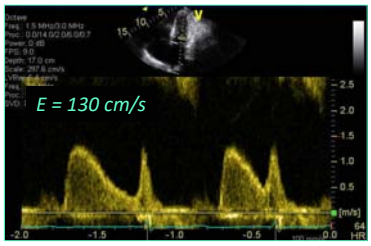
JACC CV Img 10:1411, 2017

Algorithm for LVFP in MAC



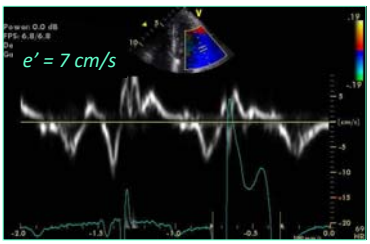
75 yo with dyspnea: Is LV Filling Pressure Elevated?

Mitral Inflow

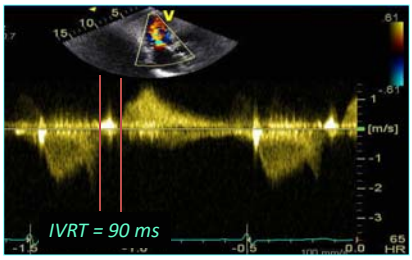


E/e' = 130/7 = 19

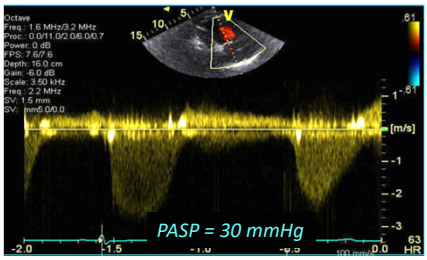
Tissue Doppler



IVRT



TR Jet



LV filling pressure is Normal.

What is Needed to Apply Guidelines Correctly

- Clinical findings collected and considered
- 2D/Doppler signals: good quality & accurately analyzed
- Recognize special situations & limitations of Doppler:
  - Special situations: A Fib, MAC, extremes of HR, high output
  - Cannot apply Doppler parameters (E/e') in significant MR, MS, Prosthetic MV