

Clinical application of Echocardiography



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1910년 광주자혜의원

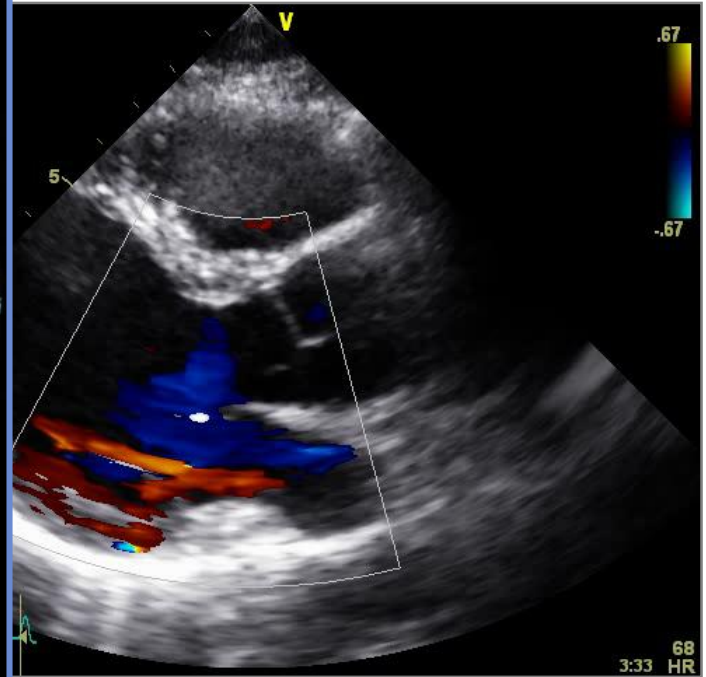
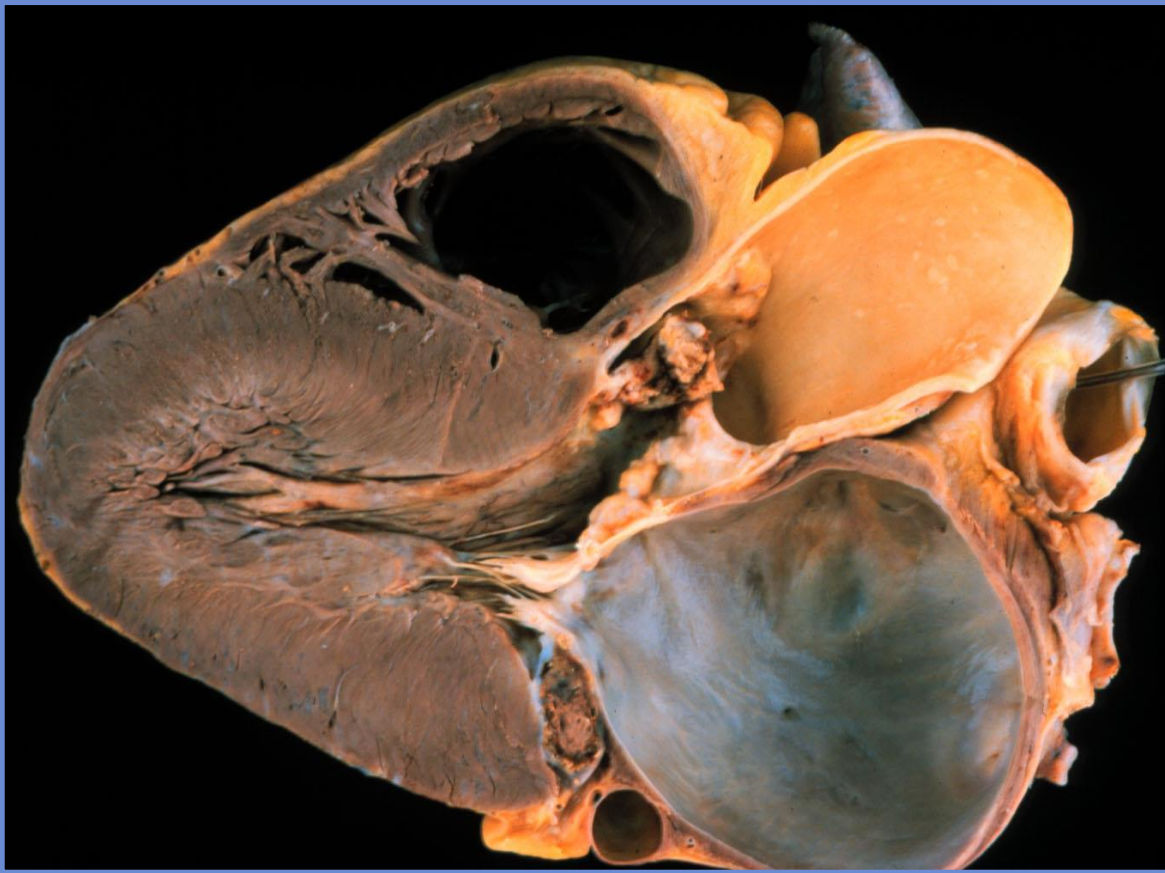
1925년 독립광주의원

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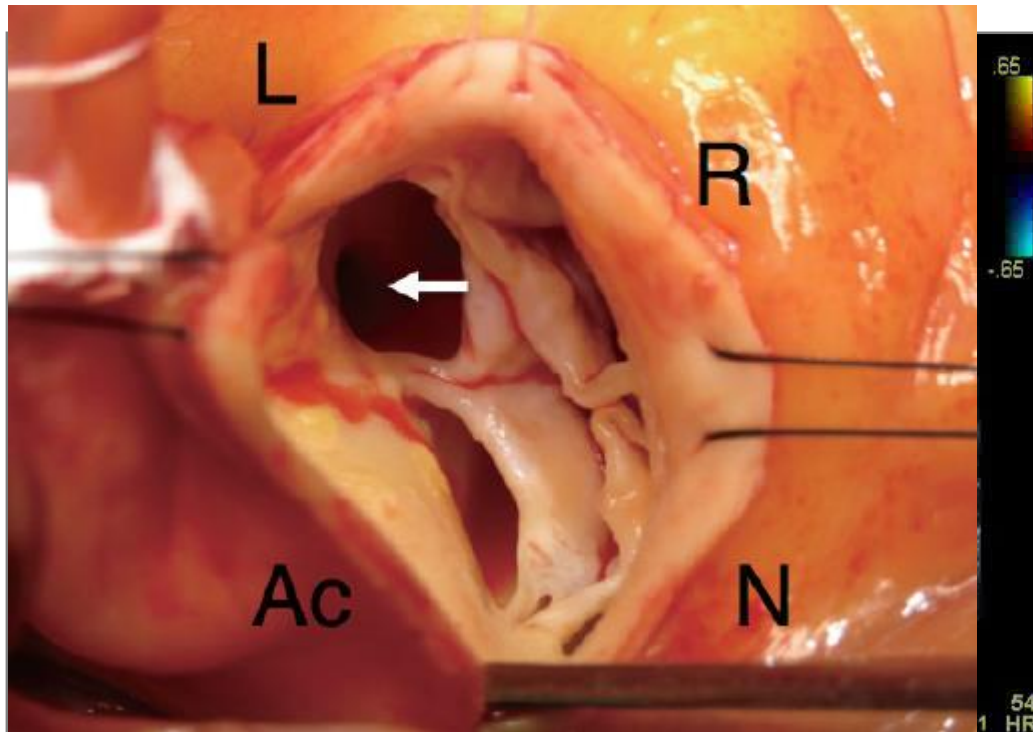
2012년 전남대학교병원



Normal valve



Pathologic?



Introduction

- Immediately intervention
 - Pericardial effusion with/or tamponade
 - Post MI infarction
 - Intra-cardiac mass
- Cardiac function
 - Systolic function
 - Diastolic function
- Guide and f/u of intervention
- Effective monitoring

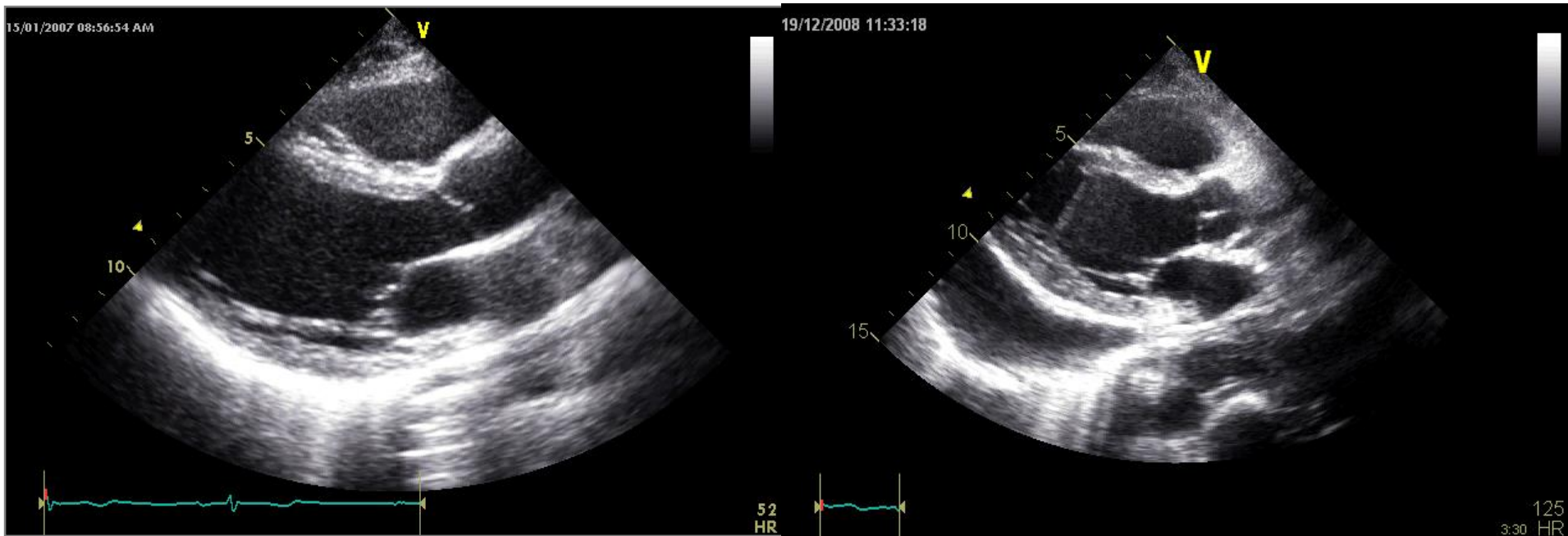
Introduction

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Pericardial effusion

- Identify pericardial effusion / thickening
- Characterize hemodynamics
 - RV diastolic collapse
 - Doppler filling patterns (tamponade vs constriction)
- Point of pericardiocentesis

D/D of pericardial effusion



Normal

**Pericardial
effusion**

Effusion (pleura or pericardium)



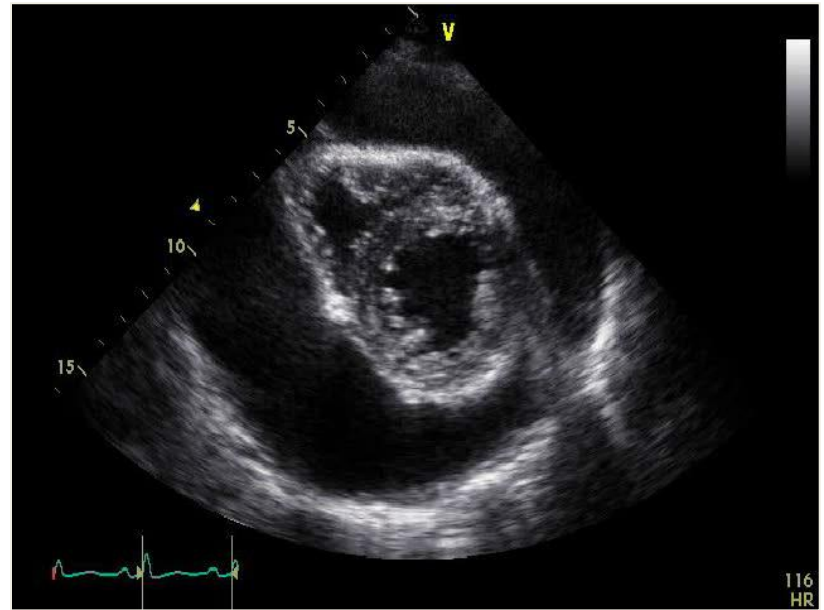
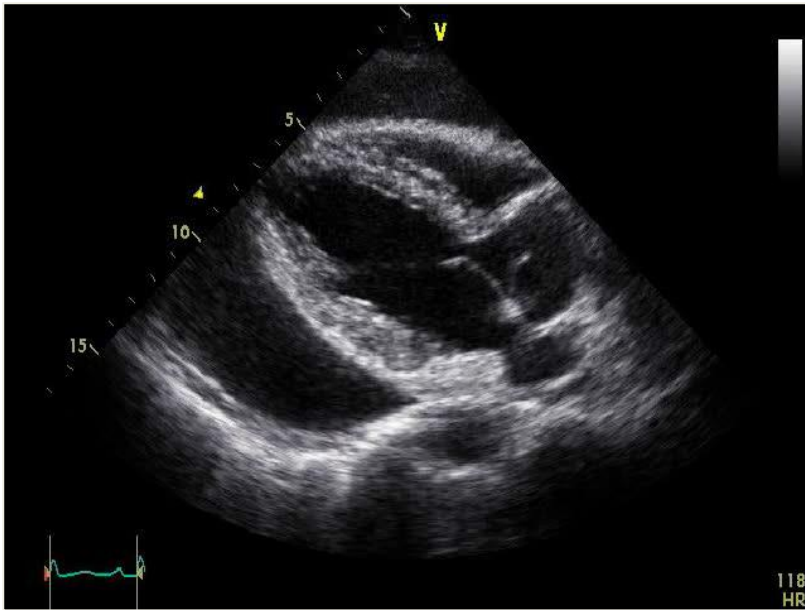
Pericardial
effusion

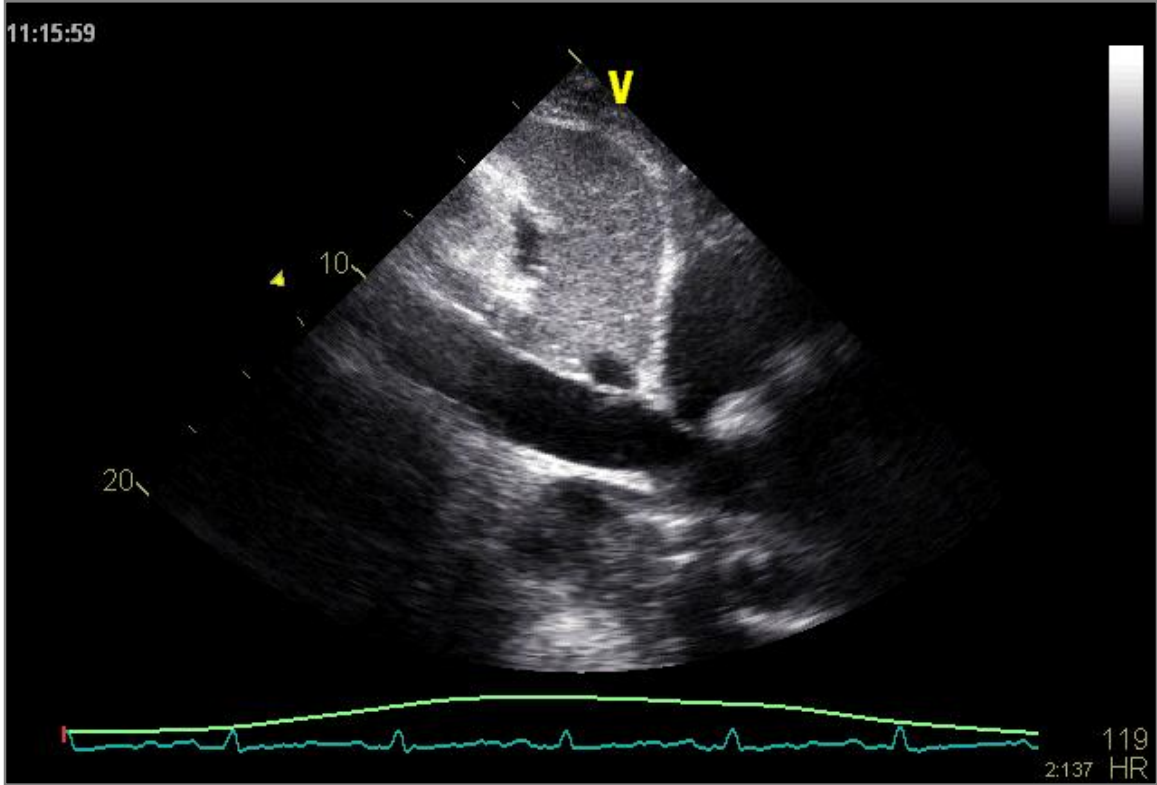
Pleural
effusion

Cardiac tamponade

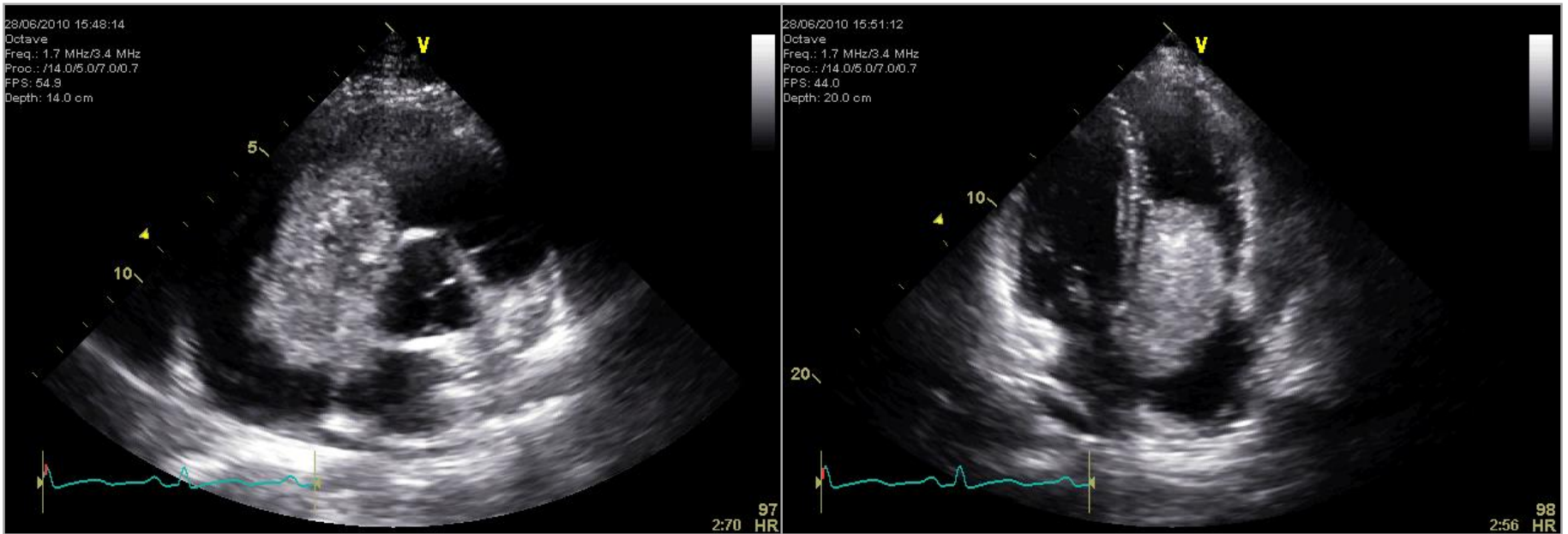
- Pericardial effusion
- RV diastolic collapse
- RA systolic collapse (1/3 over total systolic cycle)
- Respiratory variation of transmitral flow
- IVC plethora
- Inspiration
 - increase of RV filling
 - decrease of LV filling

Cardiac tamponade





Intracardiac mass



D/D with normal anatomy

- Chiari network
- Eustachian valve
- Cristia terminalis
- Catheters/pacemaker leads
- Lipomatous hypertrophy of interatrial septum
- Pectinate muscles
- Fatty material (surrounding the tricuspid annulus)
- Ridge between LUPV and LAA

Cardiac function

Systolic function	Diastolic function
Ejection fraction	dP/dt
E _{max}	LV filling pressures
Linear demension	<ul style="list-style-type: none">• PAWP• LVEDP• Mean LA pressure...
TAPSE	

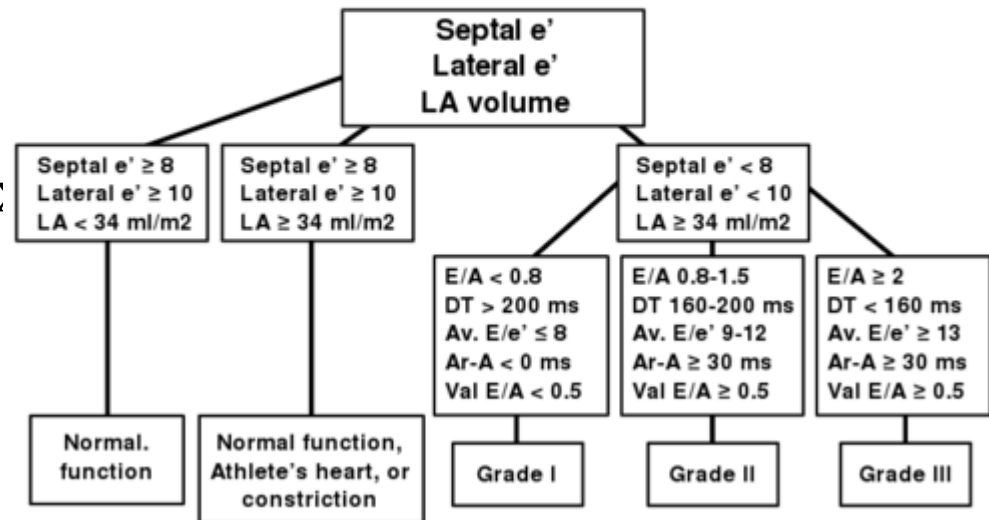
Systolic function

- Fractional shortening (FS)
- Ejection fraction (EF)
- Stroke volume / cardiac output
- dP/dt
- Mitral annular systolic wave (S_m) by TDI
- Mitral E point septal separation (EPSS)
- Tei index (Index of myocardial performance, IMP)

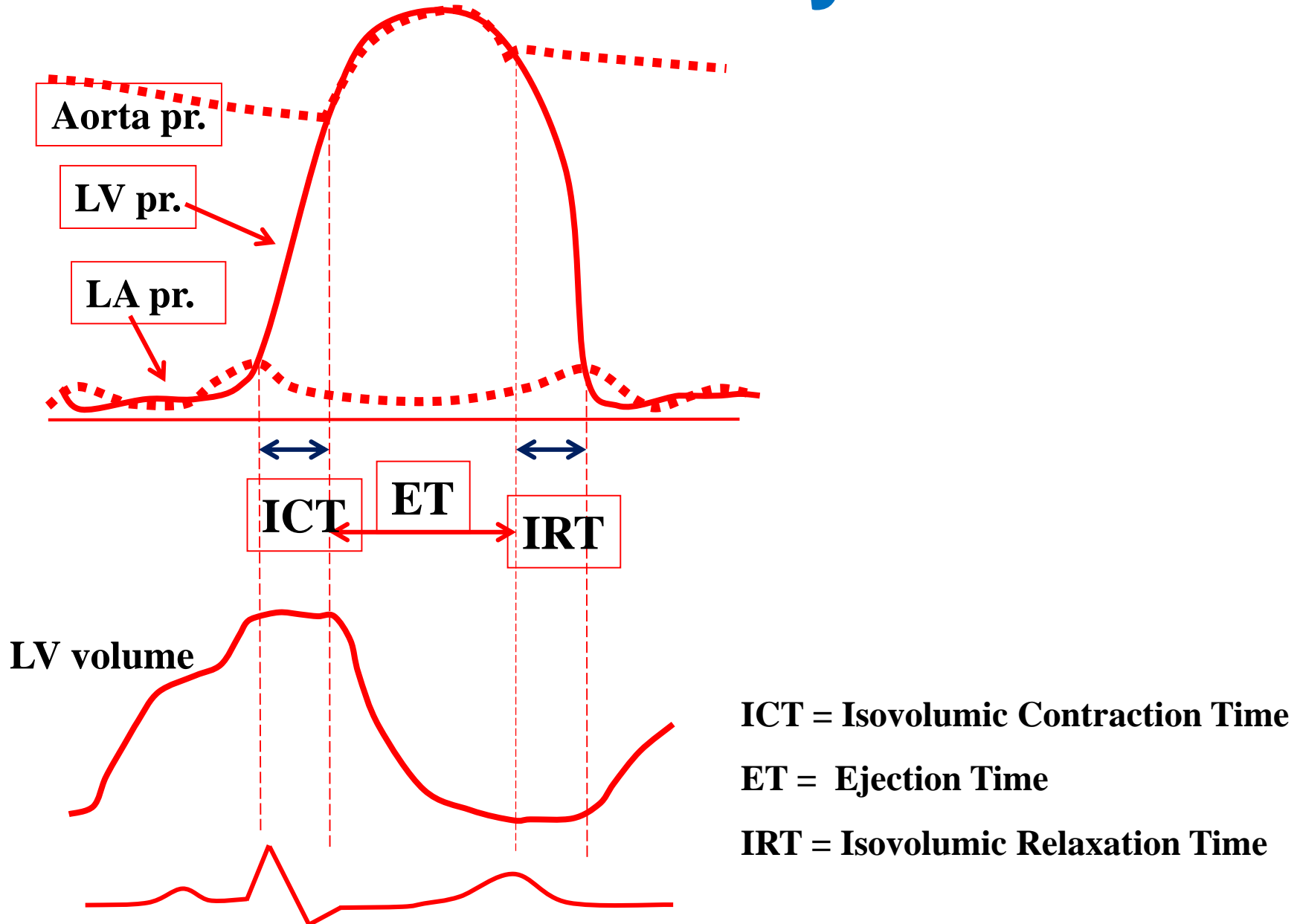
Diastolic function

- E-wave (peak early filling velocity)
- A-wave (late diastolic filling velocity)
- E/A ratio
- Deceleration time (DT)
- IVRT (Isovolumic relaxation time)
- A-wave duration

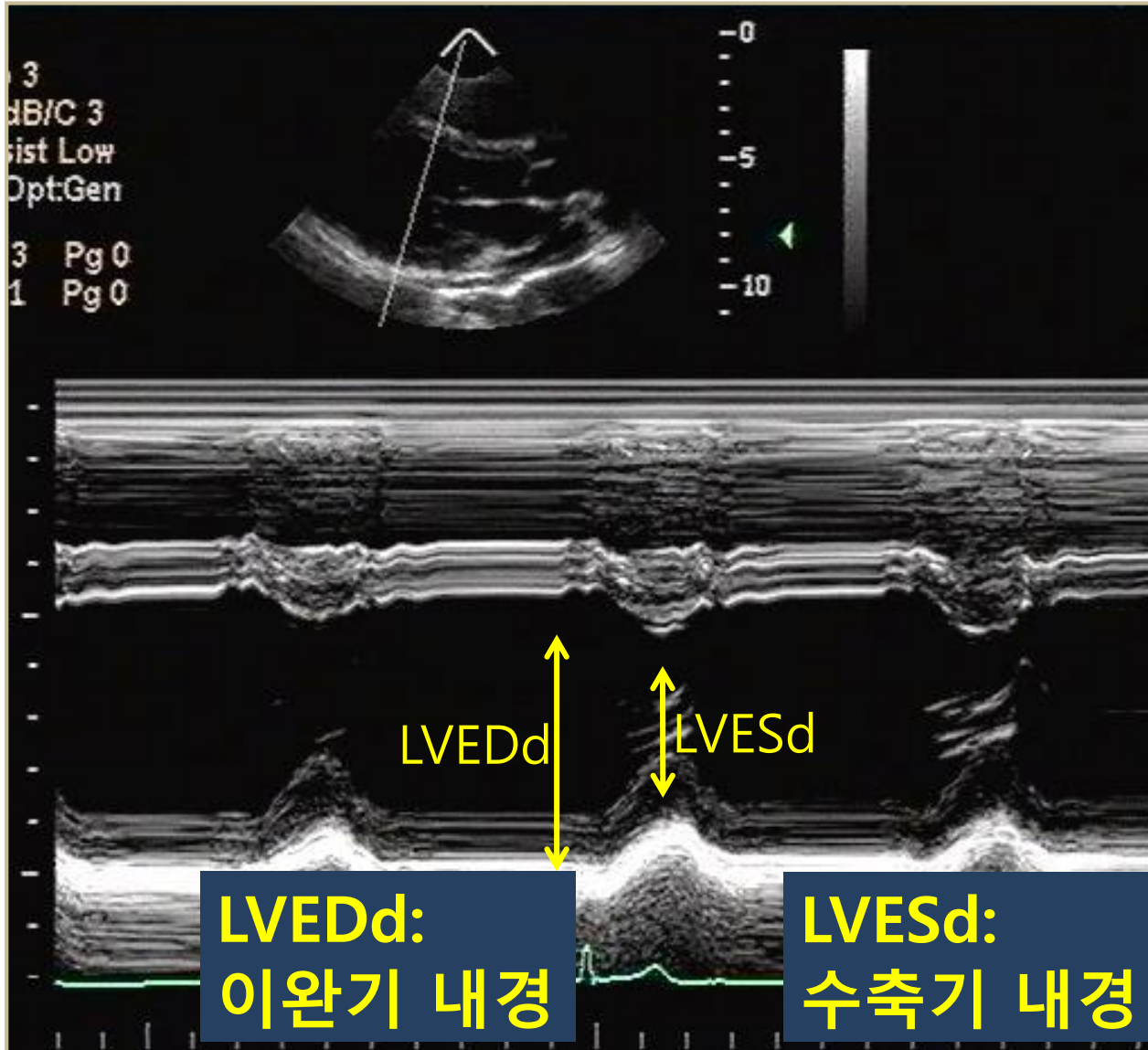
Practical Approach to Grade Diastolic Dysfunction



Cardiac cycle

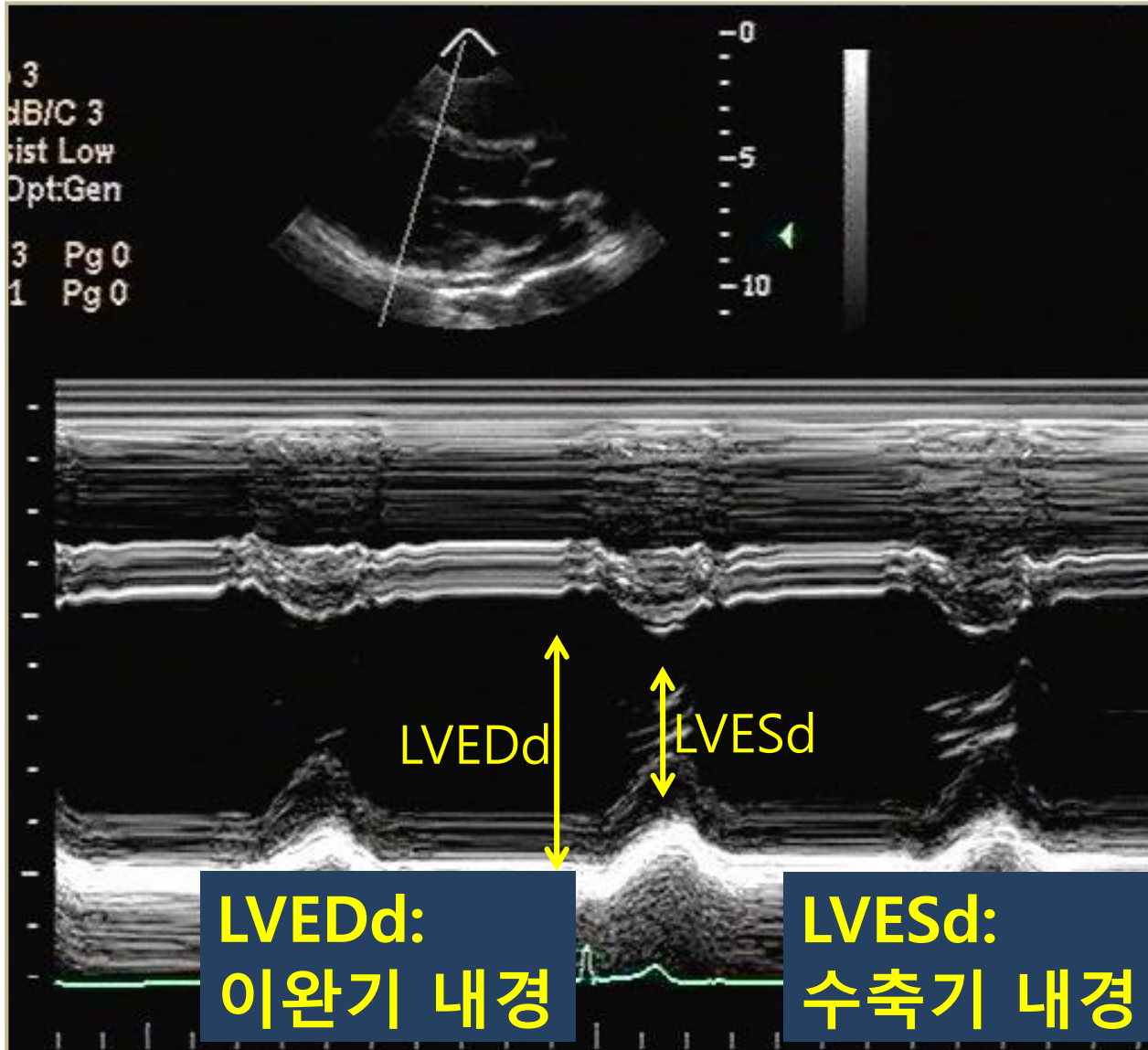


FS



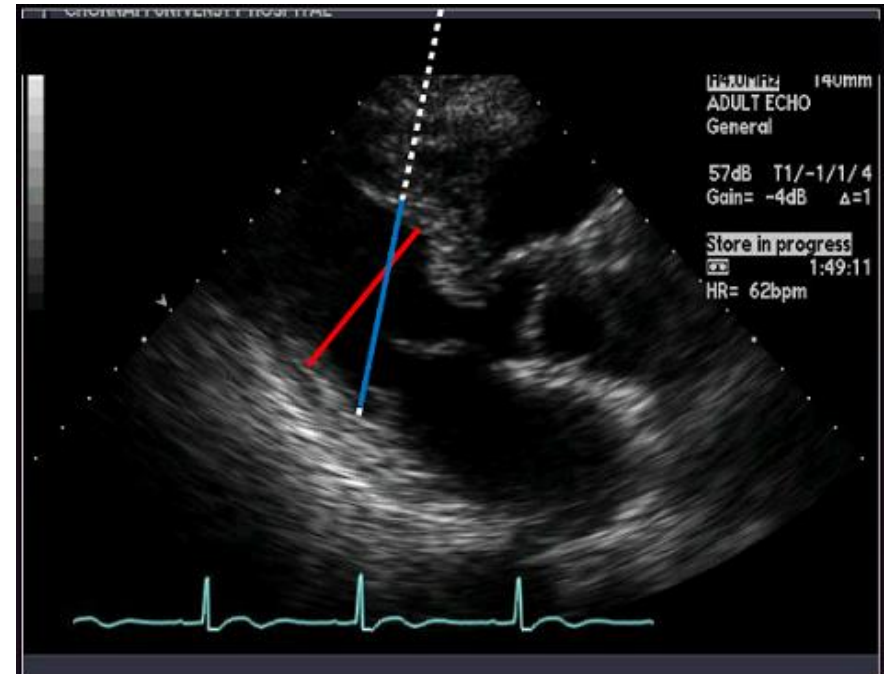
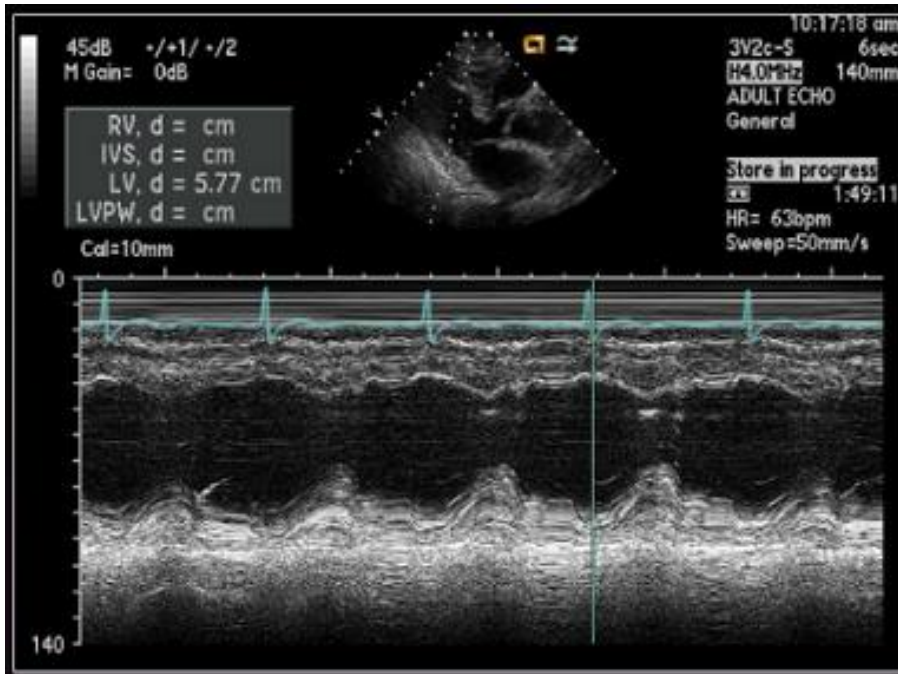
$$FS = [(LVEDd - LVESd) / LVEDd] \times 100 (\%)$$

EF : linear method



$$EF = [(LVEDd^2 - LVESd^2) / LVEDd^2] \times 100 (\%)$$

M-mode

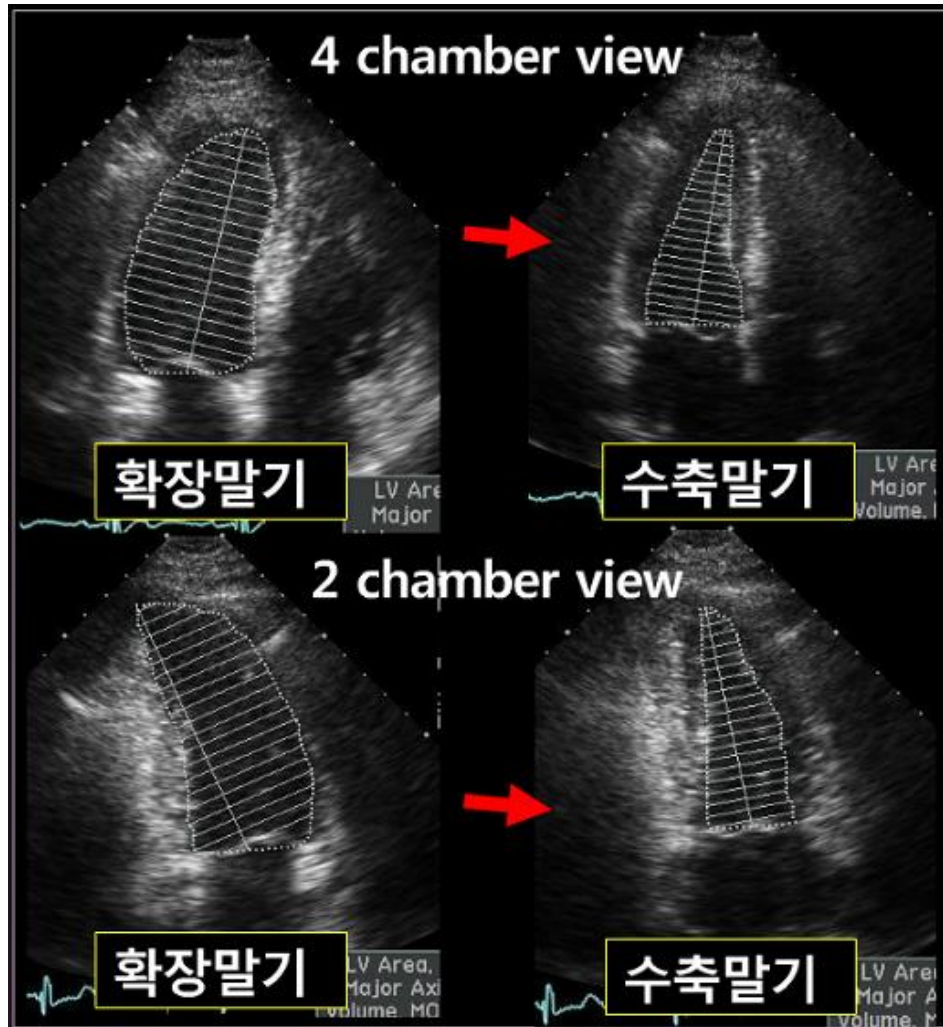


Parasternal long axis view : Avoidance of oblique imaging

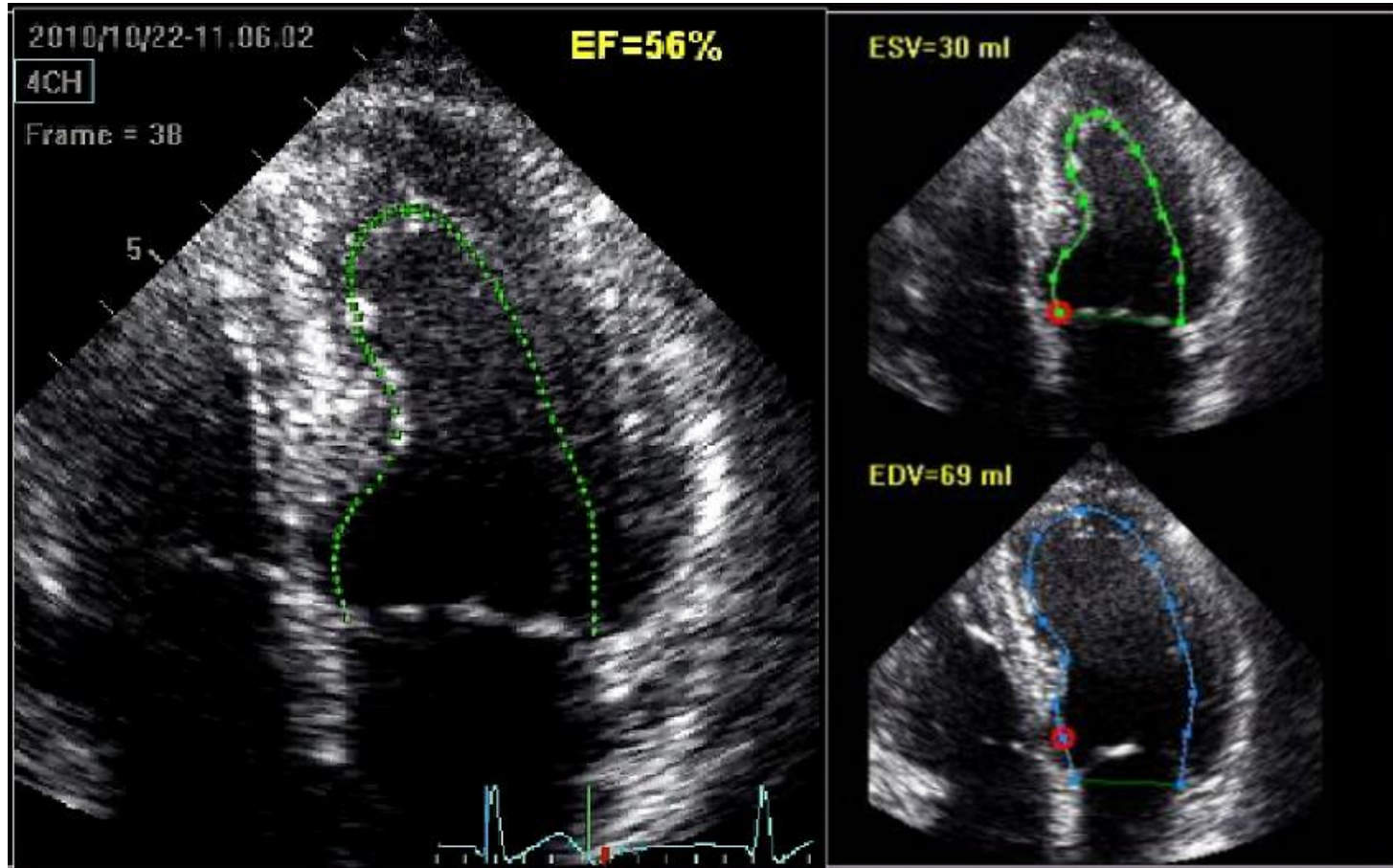
EF : Modified Simpson Method

- Manual measurement
 - Mid-papillary short axis view
 - **A4C** and A2C view
 - Endocardial border
- End diastole
 - QRS wave, before MV closure
- End systole
 - before MV opening

EF : Modified Simpson Method

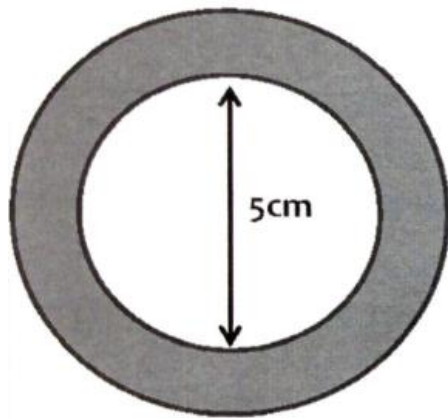


Automated EF

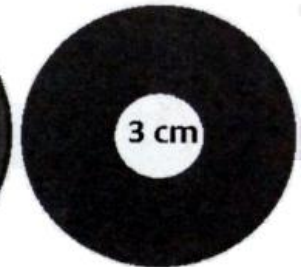
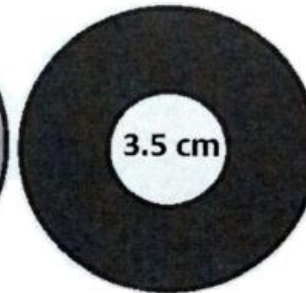
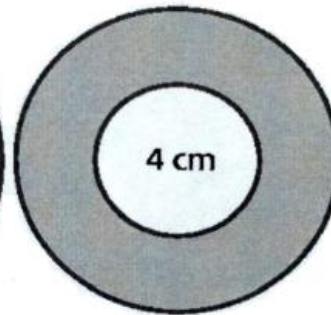
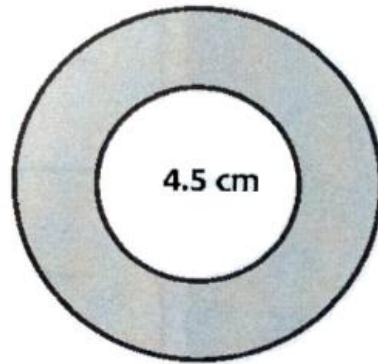


EF : Visual Estimation

Diastole



Systole. w/o RWMA



Fractional shortening	10%	20%	30%	40%	
Fractional area change	20%	42%	52%	70%	
Calculated volume (Teicholz)		$V=(7.0/2.4+D) \times D^3$			
118cc	92cc	70cc	51cc	34cc	
Calculated SV	26cc	48cc	67cc	84cc	
EF	22%	40%	57%	71%	

(Emergency Cardiac Sonography Primary cardiac 3Es)

RWMA

Segmental motion	LV wall thickening	Score
Normokinesia	> 35-40% wall thickening in systole	1
Hypokinesia	10-30% wall thickening in systole	2
Akinesia	< 10% wall thickening in systole or no inward movement	3
Dyskinesia	Moving outward in systole	4
Aneurysm	Bulging outward in systole & diastole	5

Endocardial motion + **Systolic thickening**

RWMA & EF



No RWMA with normal LVEF (70%)

RWMA & EF



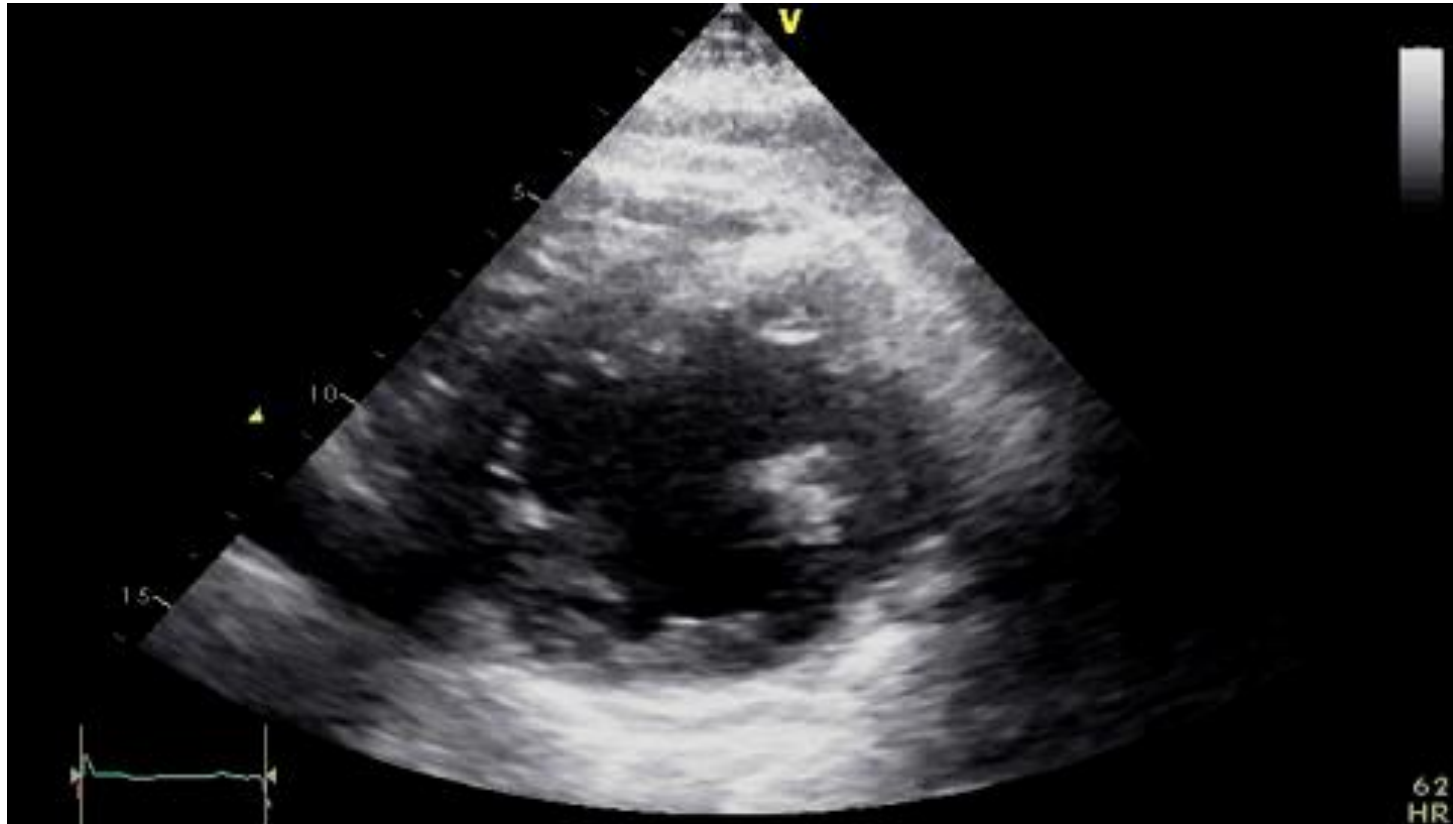
LAD & RCA territory RWMA with normal LVEF (54%)

RWMA & EF



LCx or RCA territory RWMA with LVEF 45%

RWMA & EF



LAD territory RWMA with LVEF 24%

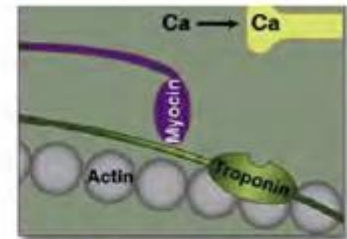
Function grading

- Grade 1 Impaired Relaxation (normal LVEDP)
 - 1a Impaired Relaxation (elevation LVEDP)
- Grade 2 Pseudonormal
- Grade 3 Restrictive (reversible)
- Grade 4 Restrictive (irreversible)

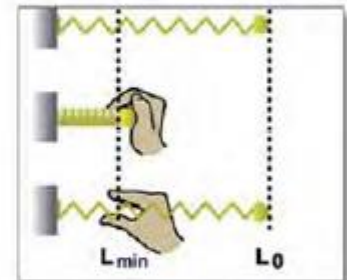
Diastolic function

- RV dimension $<$ LV dimension (in end-diastolic phase)
- Elastic recoil
- Active relaxation
- Atrial contraction

Active relaxation

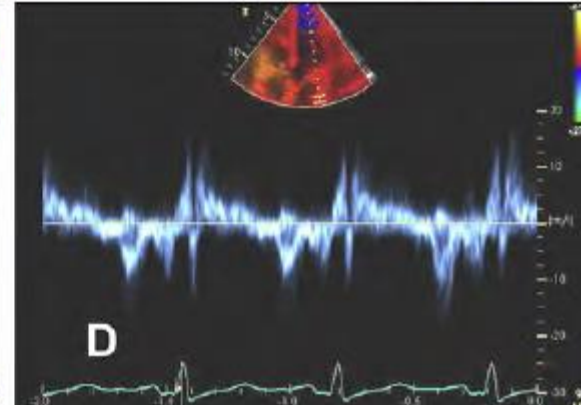
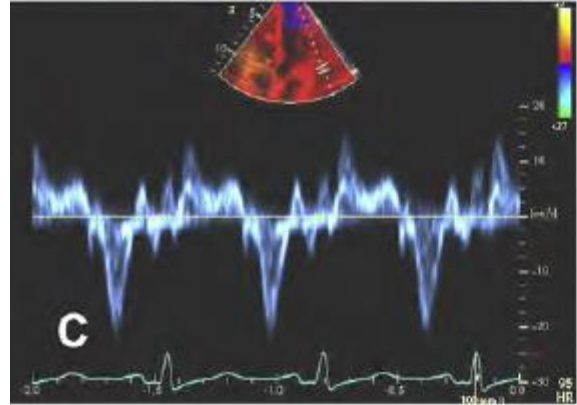
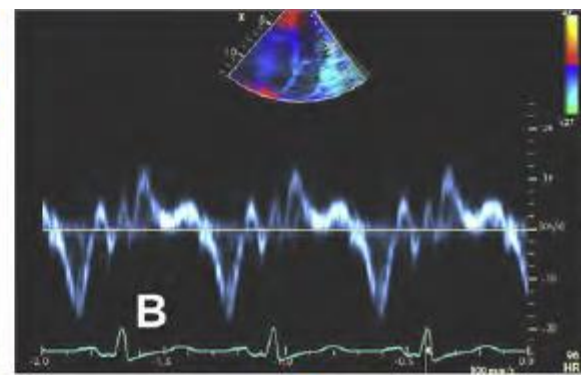
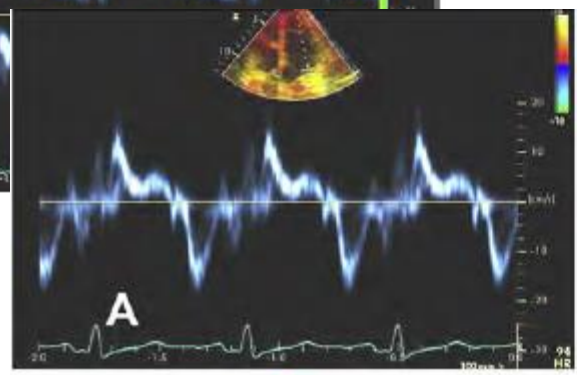
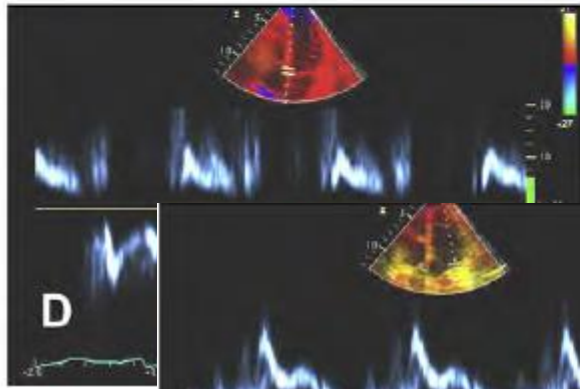
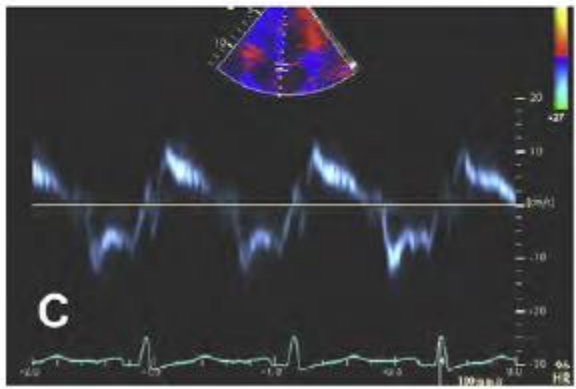
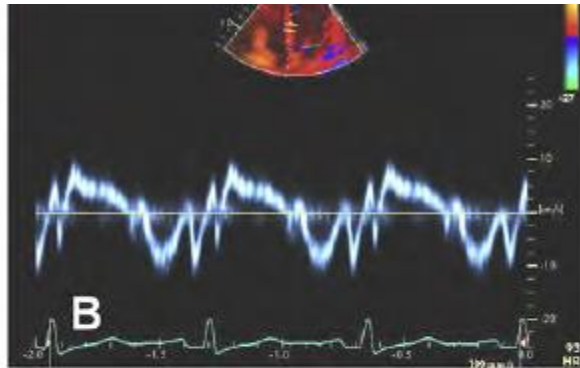
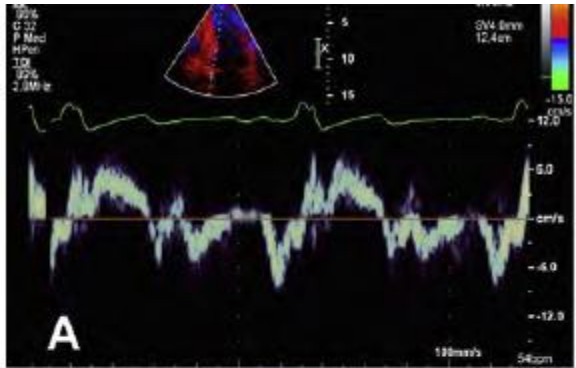


Restoring forces



Lengthening load





RUSH exam

	Hypovolemia	Distributive	Obstructive	Cardiogenic
Pump	Hyperdynamic heart	Hyperdynamic heart Poor contractility	Tamponade RV strain Poor contractility	Poor contractility
Tank	Collapsing IVC Peritoneal/pleural fluid	Normal IVC Peritoneal/pleural fluid	Large IVC	Large, non-collapsing IVC Pleural effusion
Pipe	Aorta dissection/aneurysm	Normal	DVT	Normal

Decision making process

Clinical symptom

Selecting the solution

Echocardiography

Point of care

Follow up of desicions

Take home message

- Echocardiography : routine approach tool in evidence based medicine
- Management of real-time crisis
- Indispensable technique from bedside assessment to facilitate intervention
- Allows quickly approach of cardio-thoracic disorders
- The future of ultrasound appears as Almighty decision tool