



APIL
Advanced
Perioperative
Imaging Lab

In cooperation with:



OBJECTIVES FACULTY PROGRAM 3D TEE WORKSHOPS THE CITY REGISTRATION

Sunday, November 11th, 2018

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Jacobo.Moreno@uhn.ca

Presented by the Department of Anesthesiology
and Division of Cardiac Surgery
Peter Munk Cardiac Centre
Toronto General Hospital
University Health Network

Sixteenth Annual Toronto Perioperative TEE Symposium

Toronto – November 10-11, 2018

MaRS Auditorium

101 College St.
Toronto, M5G 1L7

CONSTRICTIVE PERICARDITIS PBL

Problem Based Learning Discussions:

Workshops • Multi-vendor • Hands-on 3D TEE • Basic TEE



CASE 1



FR 39Hz
16cm

2D
47%
C 56
P Off
Gen



M3



PAT T: 37.0C
TEE T: 37.6C

JPEG

55 bpm



CASE 2

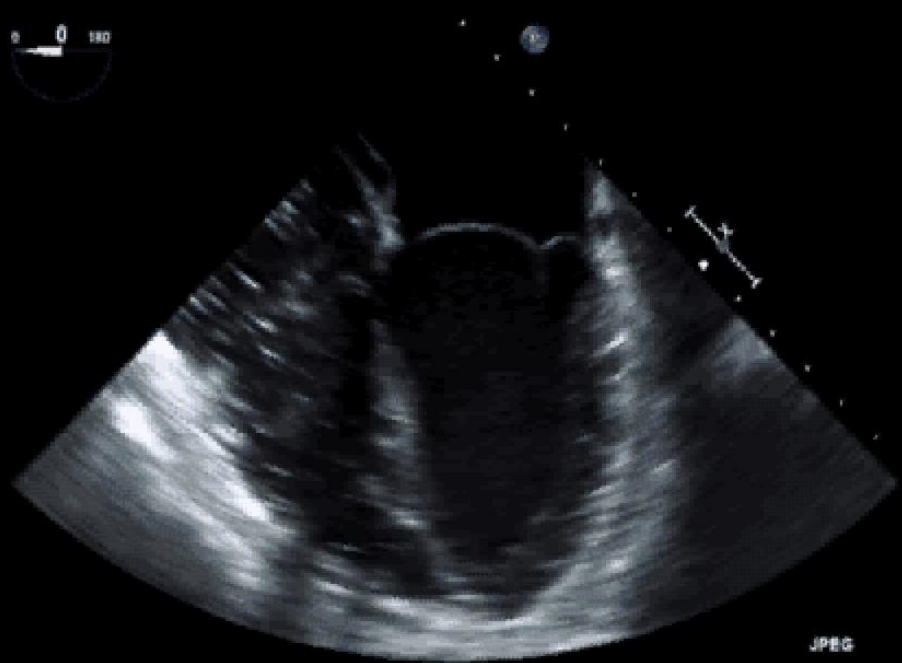


FR 50Hz
13cm

2D
65%
C 48
P Off
Gen



MA



JPEG

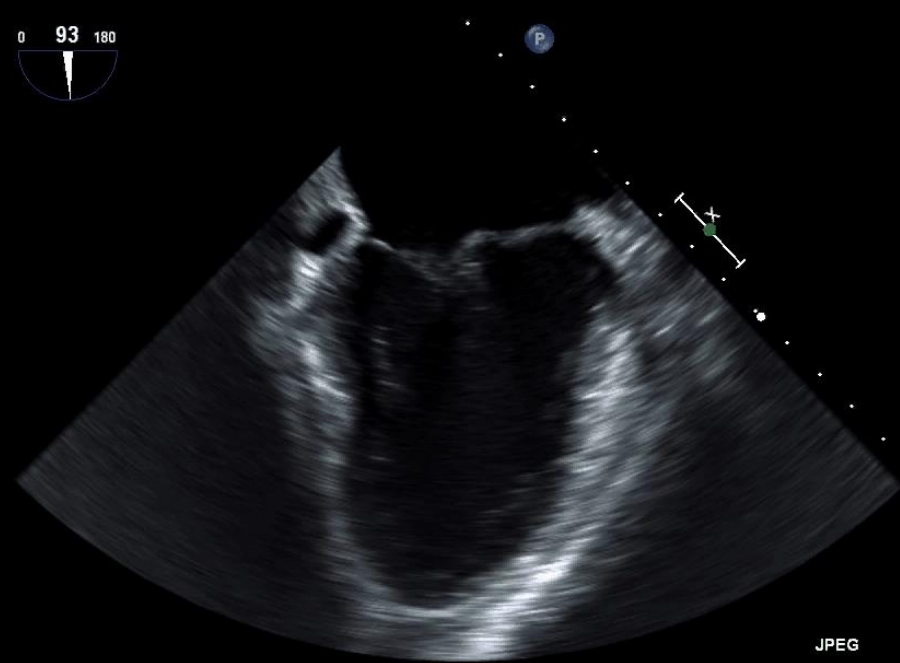
73 bpm

FR 50Hz
14cm

2D
66%
C 48
P Off
Gen



M4

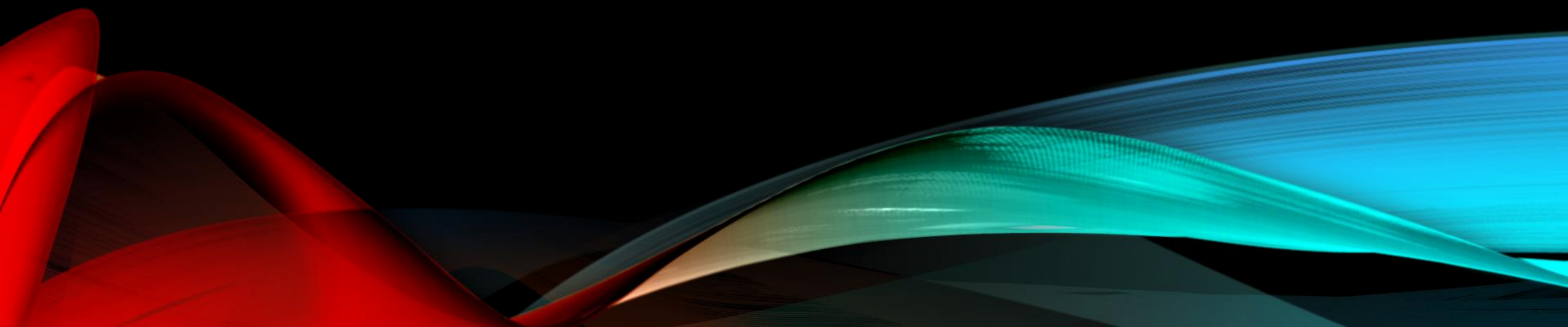


JPEG

79 bpm



DIAGNOSIS?





CASE 1



FR 39Hz
16cm

2D
47%
C 56
P Off
Gen



M3



PAT T: 37.0C
TEE T: 37.6C

JPEG

55 bpm

Thickened Pericardium



CASE 2



FR 50Hz
13cm

2D
65%
C 48
P Off
Gen



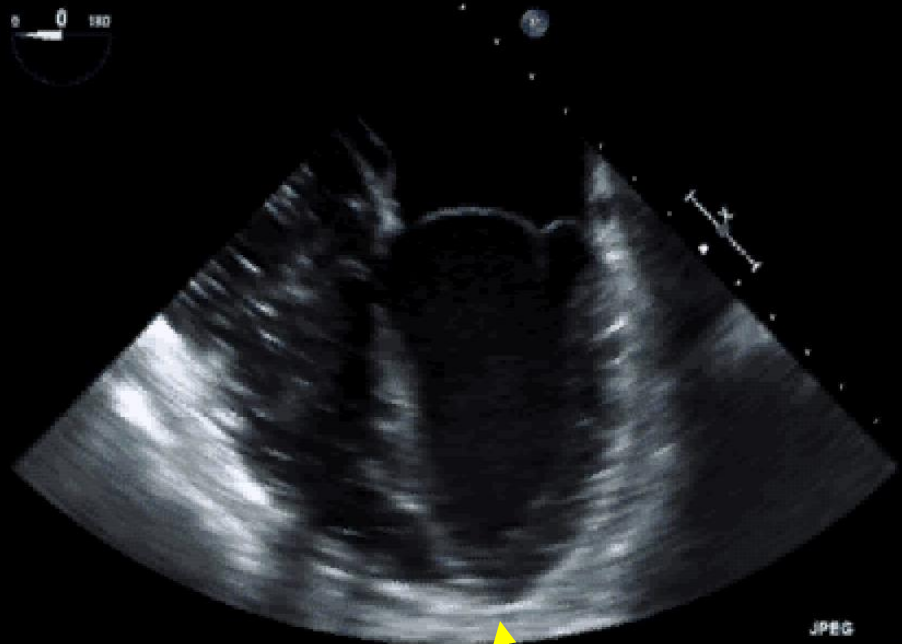
MA

FR 50Hz
14cm

2D
66%
C 48
P Off
Gen

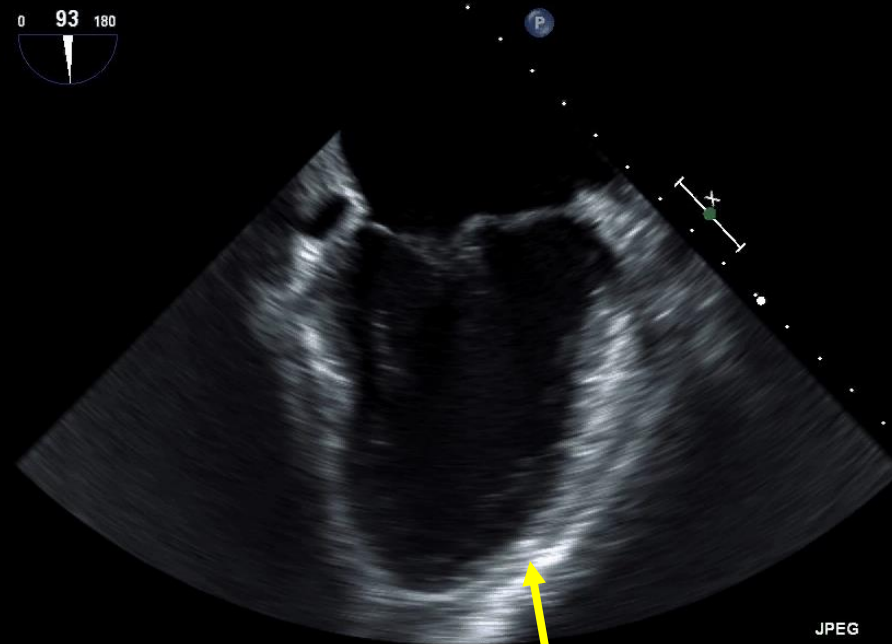


M4



JPEG

73 bpm



JPEG

79 bpm

Thickened Pericardium

Thickened Pericardium



CONSTRUCTIVE PERICARDITIS



ASE EXPERT CONSENSUS STATEMENT

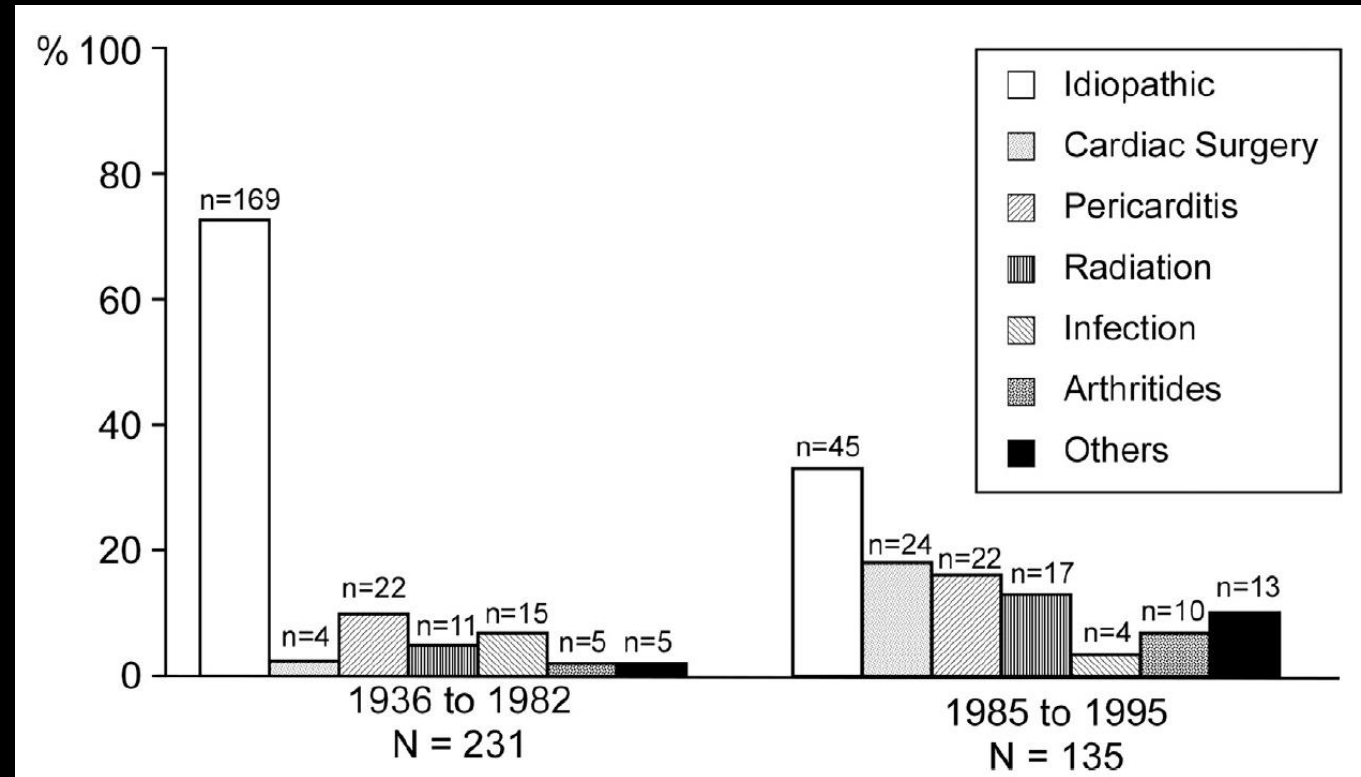
American Society of Echocardiography Clinical Recommendations for Multimodality Cardiovascular Imaging of Patients with Pericardial Disease

Endorsed by the Society for Cardiovascular Magnetic
Resonance and Society of Cardiovascular Computed Tomography

Allan L. Klein, MD, FASE, Chair, Suhny Abbara, MD, Deborah A. Agler, RCT, RDCS, FASE,
Christopher P. Appleton, MD, FASE, Craig R. Asher, MD, Brian Hoit, MD, FASE, Judy Hung, MD, FASE,
Mario J. Garcia, MD, Itzhak Kronzon, MD, FASE, Jae K. Oh, MD, FASE, E. Rene Rodriguez, MD,
Hartzell V. Schaff, MD, Paul Schoenhagen, MD, Carmela D. Tan, MD, and Richard D. White, MD, *Cleveland and
Columbus, Ohio; Boston, Massachusetts; Weston, Florida; Scottsdale, Arizona; Rochester, Minnesota; Bronx and
New York, New York*

ETIOLOGIES OF CP

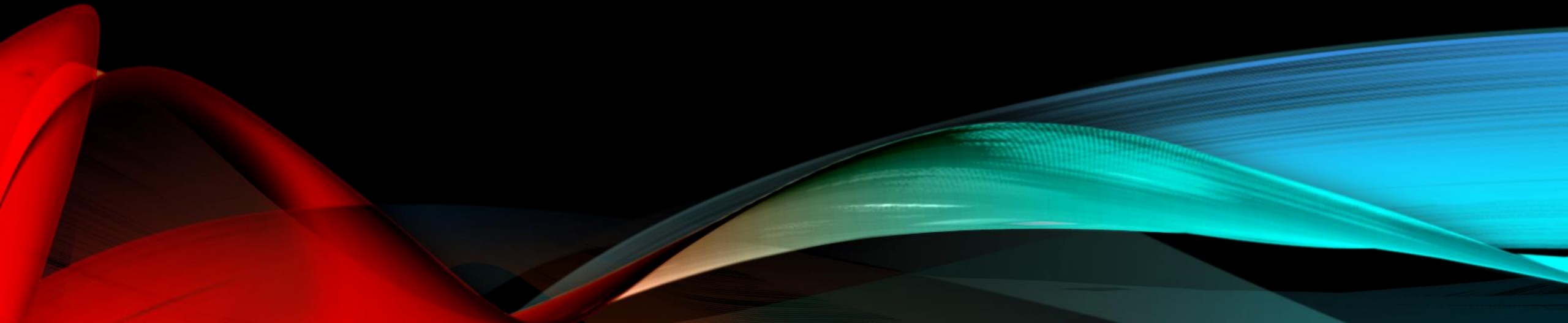
- Idiopathic
- **Cardiac surgery**
- Viral pericarditis
- Radiation
- Infection
- Arthritides
- Collagen vascular disease
- Tuberculosis

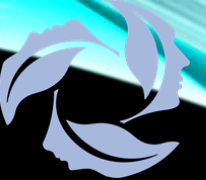


(J Am Soc Echocardiogr 2013;26:965-1012.)



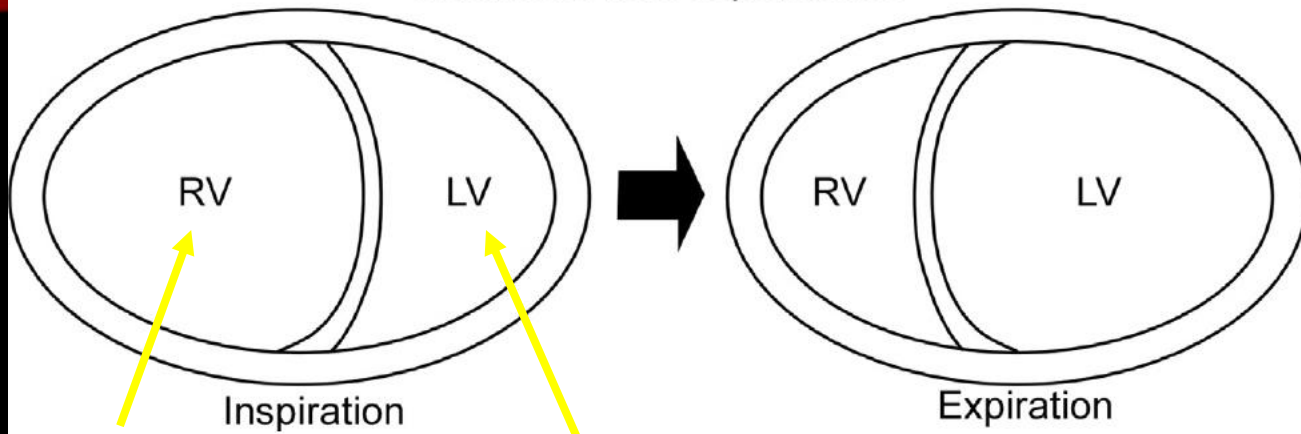
WHAT CAN WE DO WITH ECHO?





VENTRICULAR INTERDEPENDENCE

Ventricular Interdependence



Spontaneous breathing.
Opposite during mechanical ventilation.

Negative inspiratory pressure facilitates R sided filling

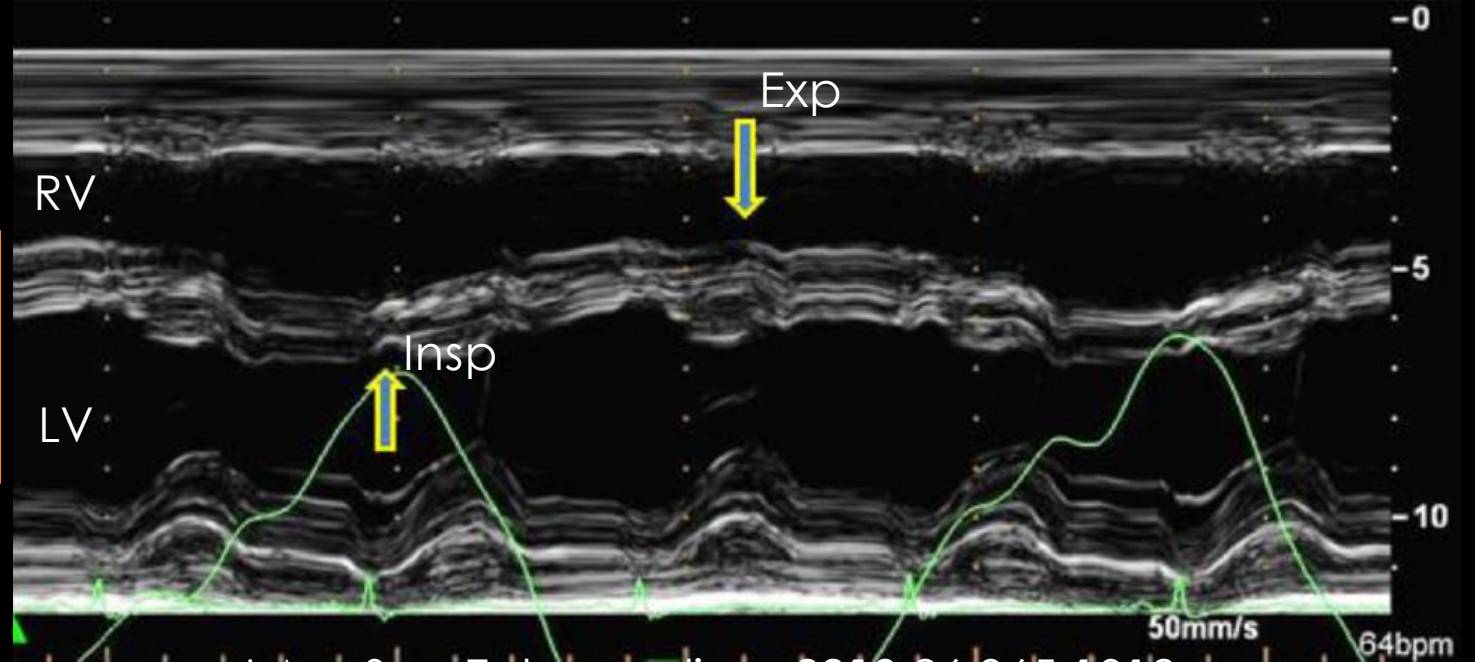
Trans-TV Doppler velocity **increases by 40%**

HV D wave increases

Pooling of RV output in pulmonary circulation **decreases** L sided filling during **inspiration**

Trans-MV Doppler <25%

PV D wave decreases



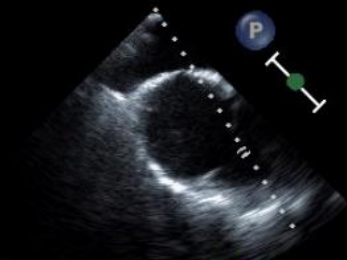


CASE 1: TV INFLOW



FR 44Hz
16cm

2D
55%
C 50
P Off
Pen

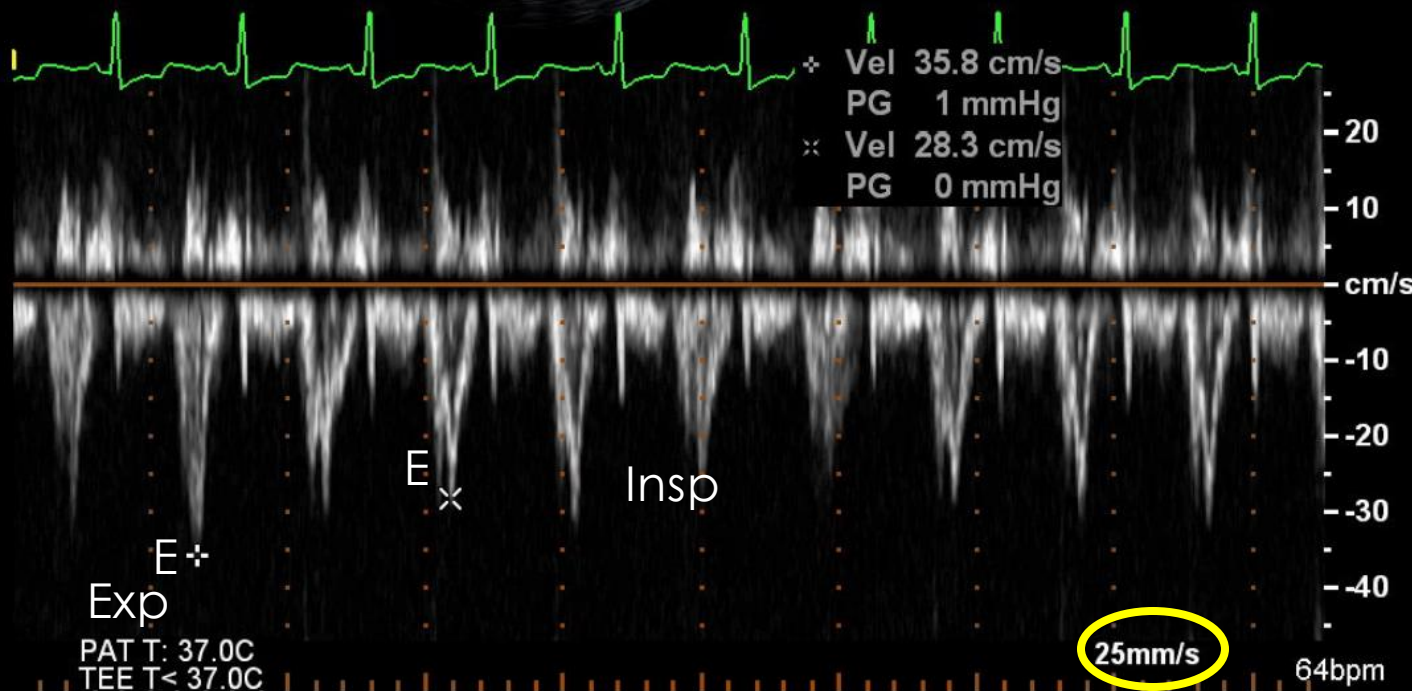


Mechanical
Ventilation

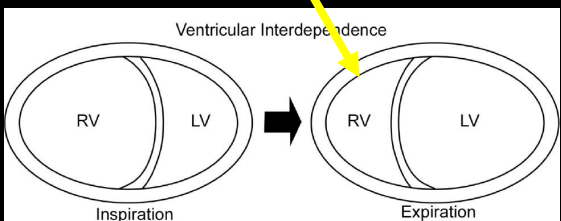
PW
50%
4.1MHz
WF 125Hz
SV4.0mm
9.8cm

M3

During spontaneous **expiration**:
TV E inflow **drops**,
at the time of
Hepatic vein
atrial reversal.



Peak tricuspid
E inflow
usually
**exceeds
40%**
respiratory
variation.



During insp:
TV E inflow increase

Restrictive RV diastolic **filling** pattern

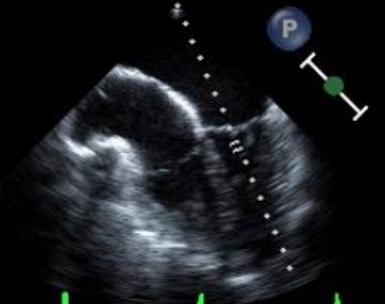


CASE 1: MV INFLOW



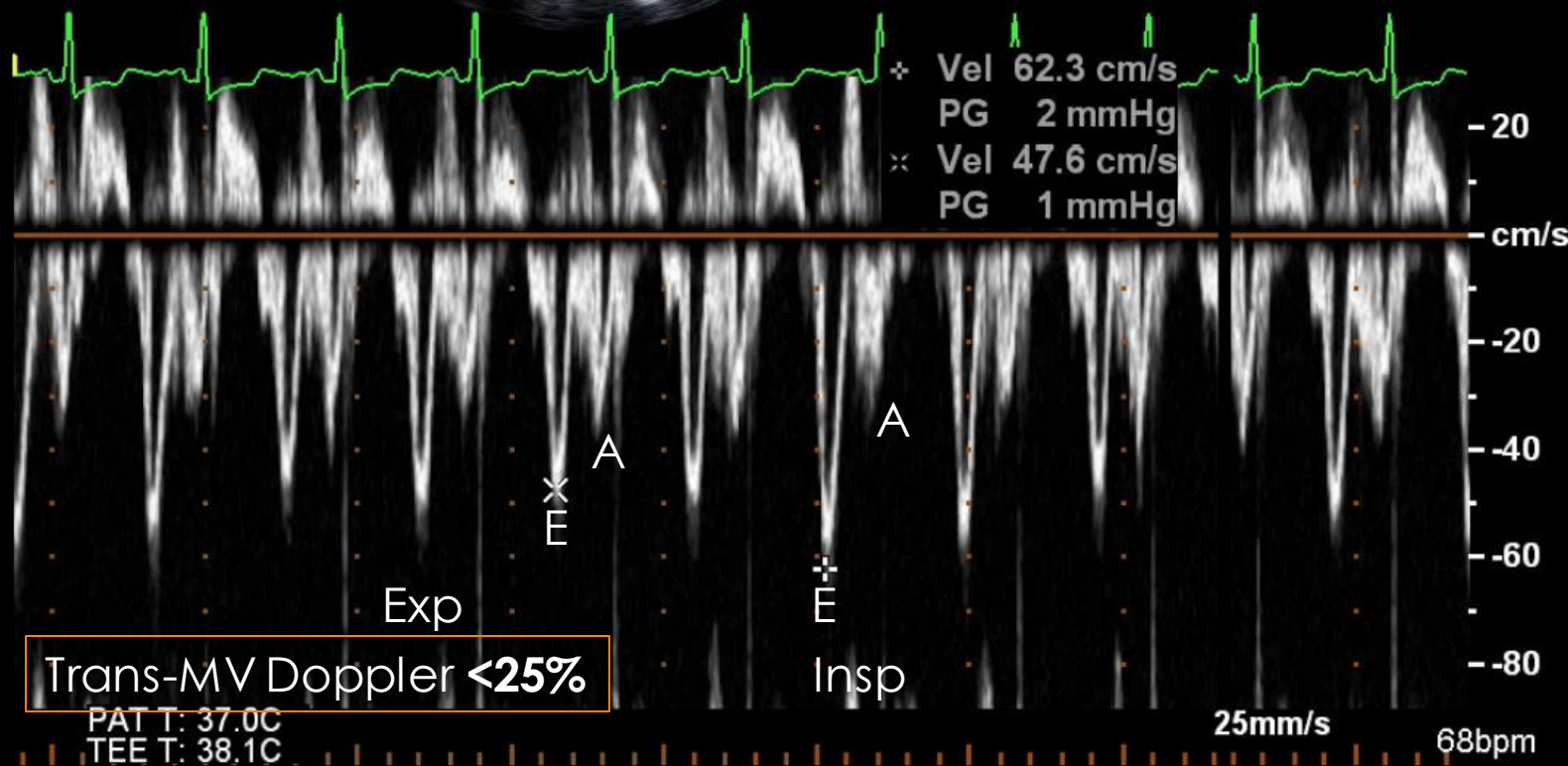
FR 44Hz
16cm

2D
55%
C 50
P Off
Pen



Mechanical
Ventilation

PW
50%
4.1 MHz
WF 150Hz
SV4.0mm
8.0cm



Restrictive LV diastolic filling pattern (high early (E) velocity, shortened deceleration time, and reduced atrial (A) wave)

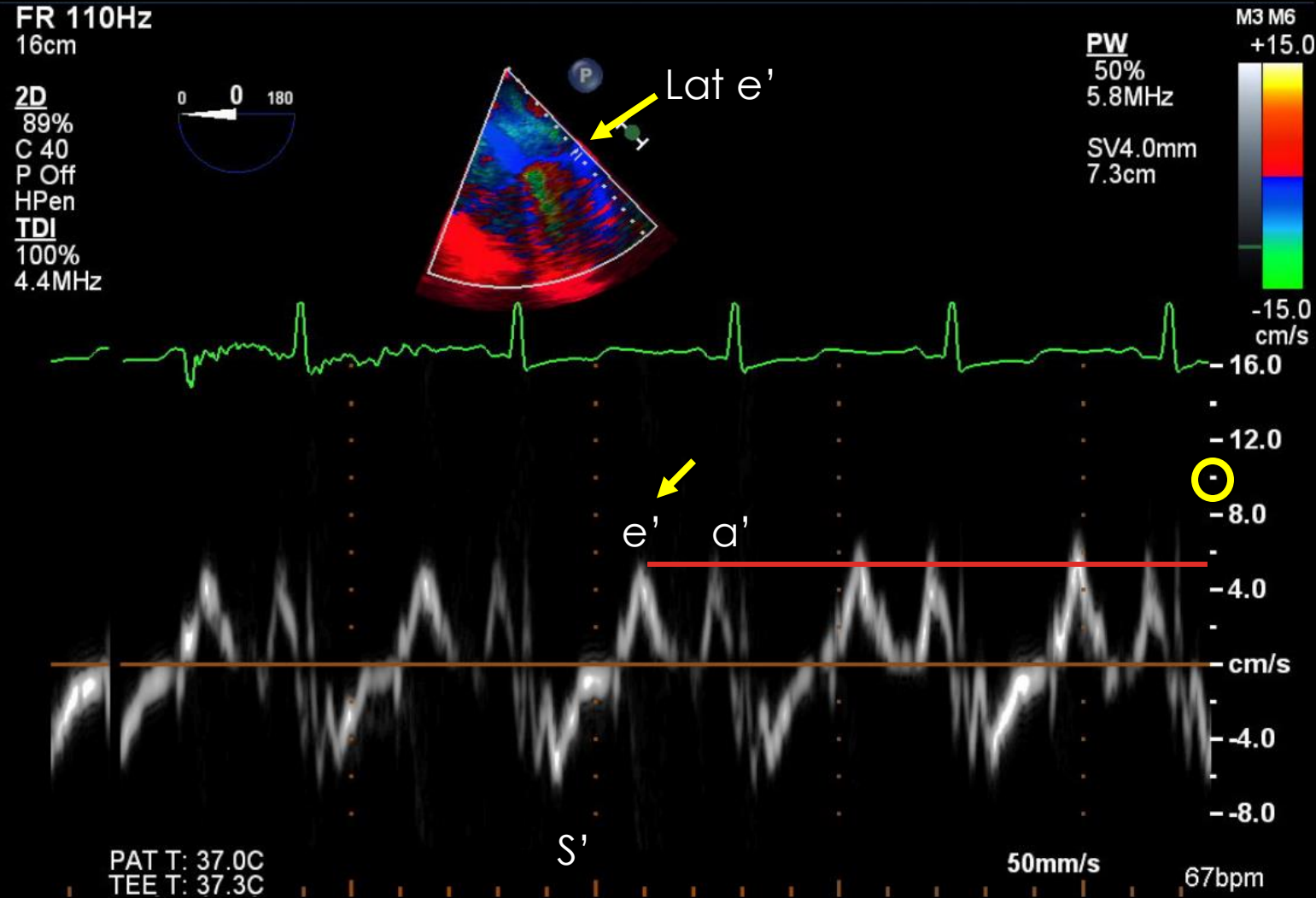
÷ Vel 62.3 cm/s
PG 2 mmHg
× Vel 47.6 cm/s
PG 1 mmHg

Peak mitral E inflow usually **exceeds 25%** respiratory variation.

Trans-MV Doppler <25%



CASE :1 TISSUE DOPPLER



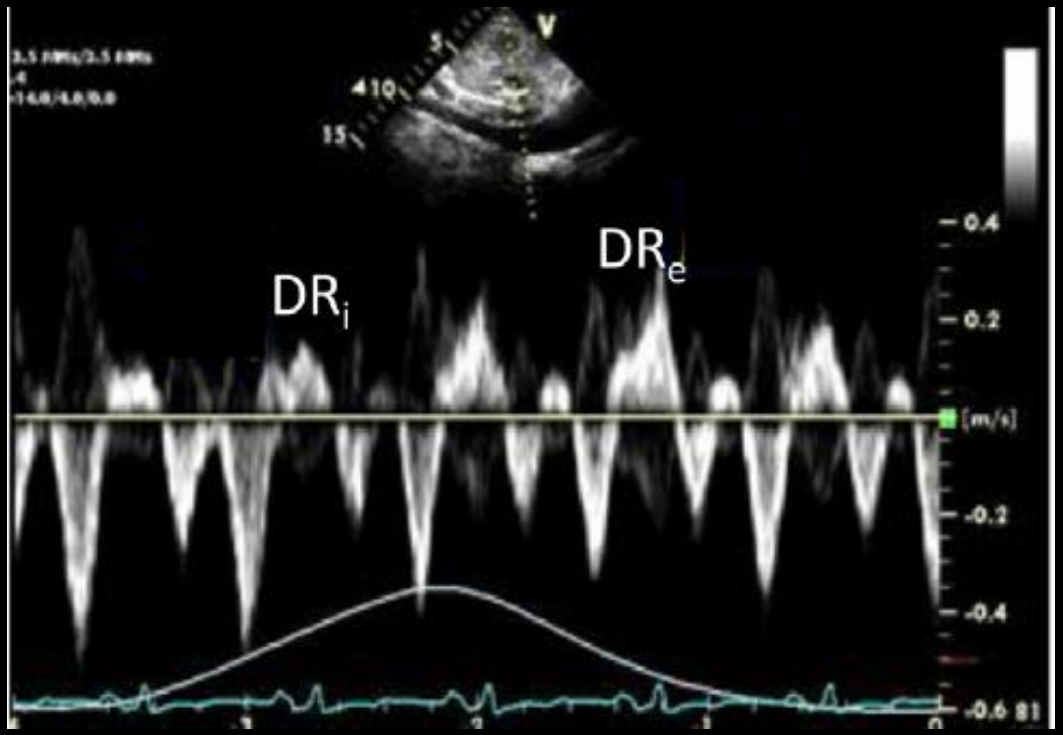
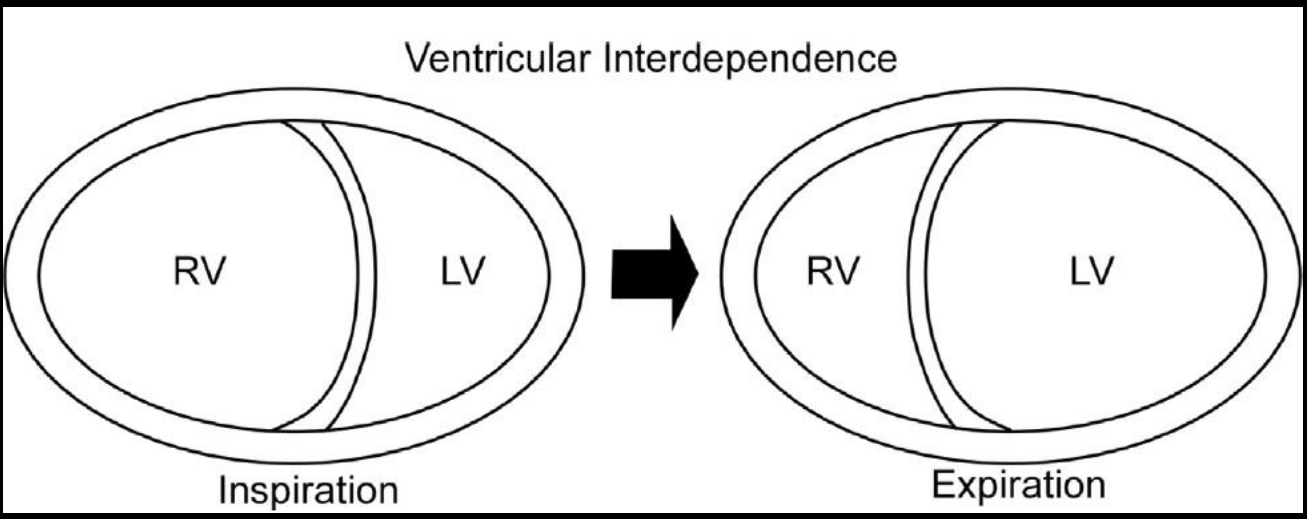
Prominent early diastolic velocity (e') from the medial mitral annulus.

Medial e' increases progressively as the severity of constriction becomes worse.

Lateral e' is usually lower than medial e' ("annulus reversus") due to tethering of the lateral mitral annulus to the thickened pericardium.

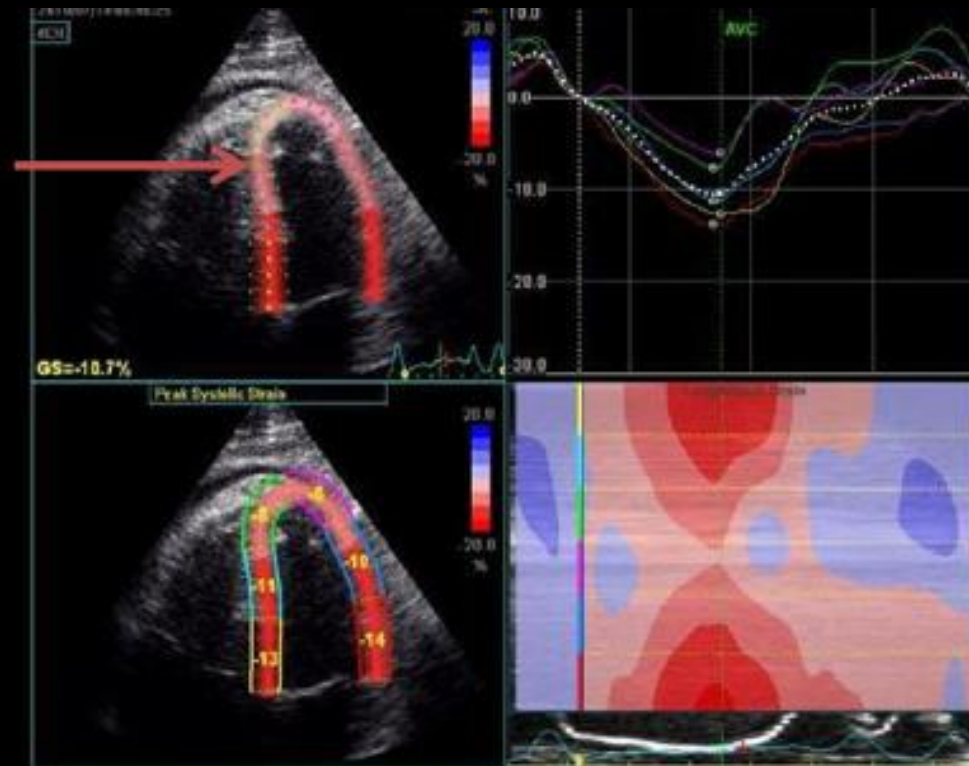
HV DOPPLER FLOW VELOCITY RECORDS

- Hepatic vein diastolic **flow reversal increases with expiration**, reflecting the ventricular interaction and the dissociation of intracardiac and intrathoracic pressures.



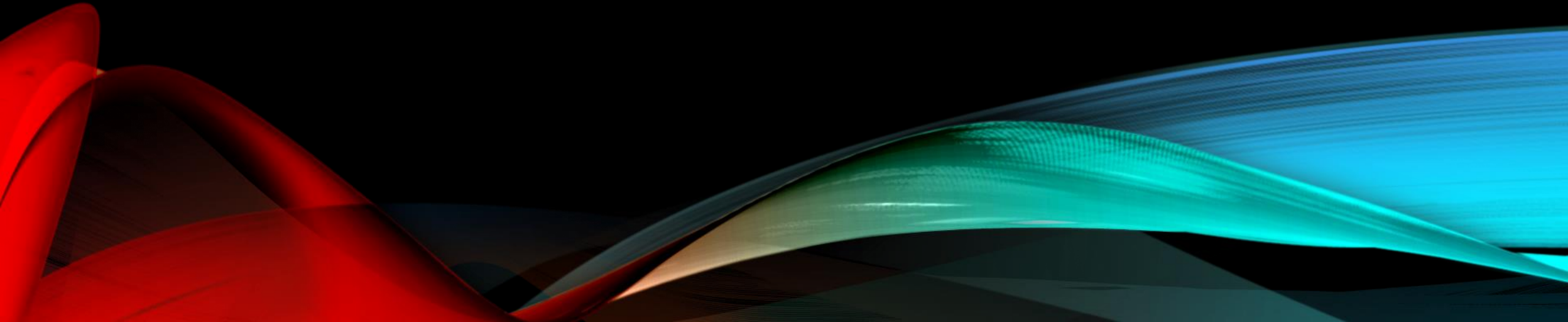
STRAIN IMAGING

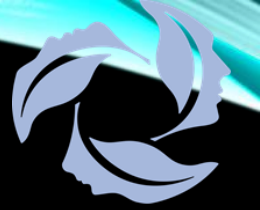
- **Circumferential strain**, torsion, and early diastolic untwisting are **reduced**.
- Global longitudinal strain, displacement, and early diastolic tissue velocities are unchanged.





DIFFERENTIAL DIAGNOSIS





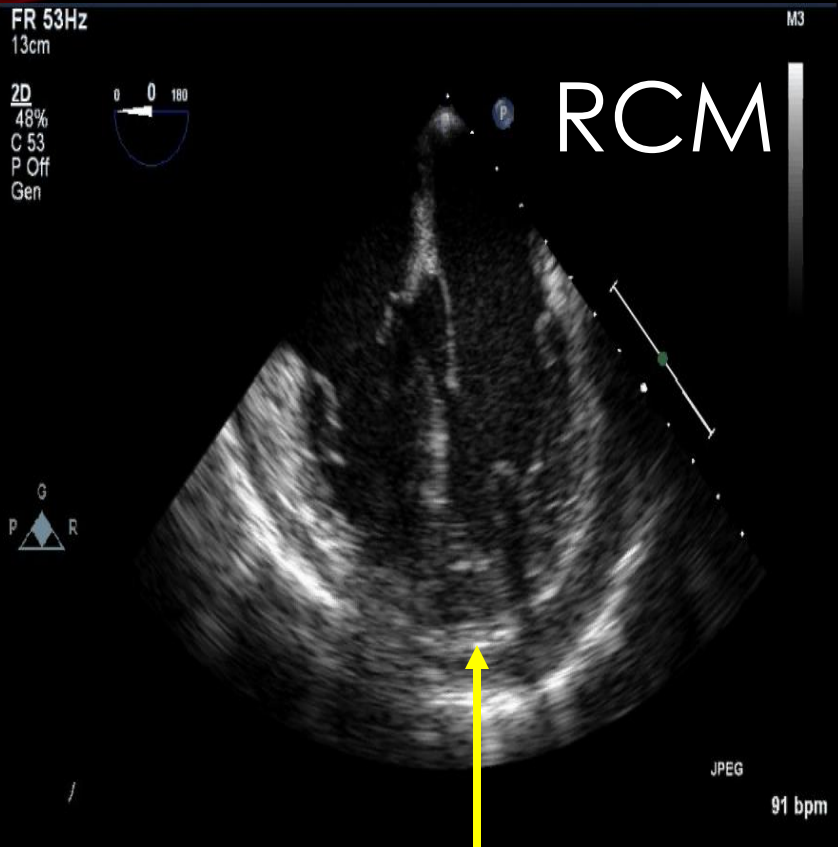
RESTRICTIVE VS CONSTRICTIVE

RP

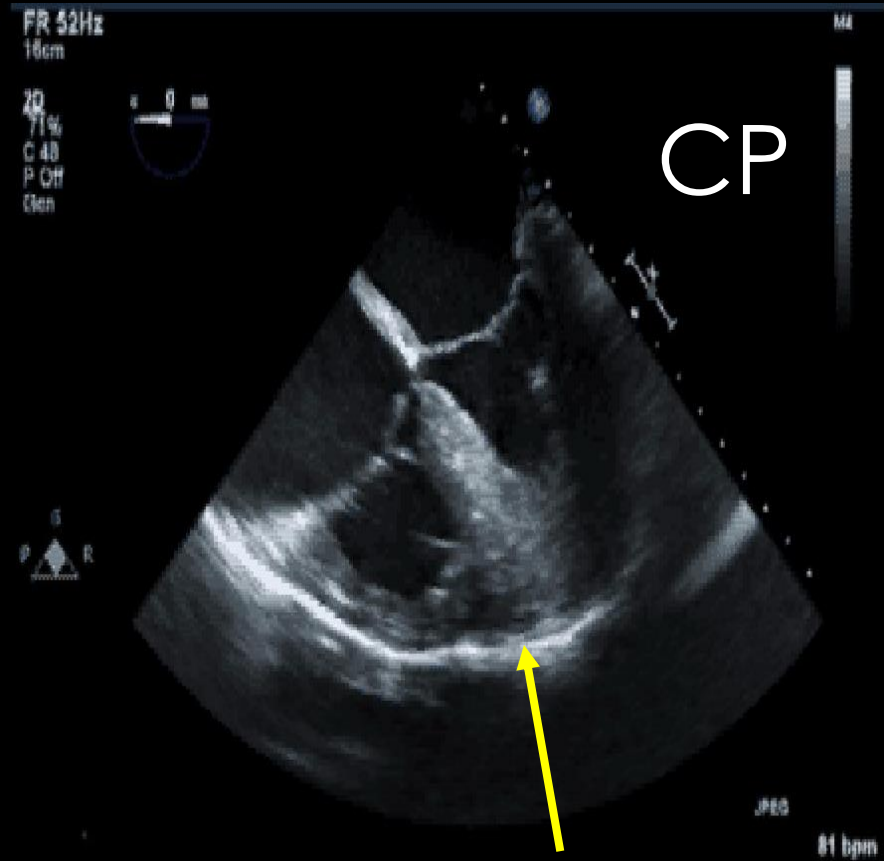
- **Granular Myocardium**
- Normal Pericardium
- **Septal $e' < 8\text{cm/s}$**
- MV inflow: Restrictive
- **No respiratory variation**
- **Biatrial enlargement**
- **Decreases systolic function**
- **HVF: Inspiratory** HV diastolic flow reversal.
- **Longitudinal** strain is reduced.

CP

- Normal Myocardium
- **Thickened Pericardium**
- TDI MV annulus reversus: Lat $e' < \text{Med } e'$
- MV inflow: Restrictive
- **Respiratory Variation**
- Normal Atrium
- Normal EF
- **HVF: Expiratory** HV diastolic reversal.
- **Circumferential** strain reduced.



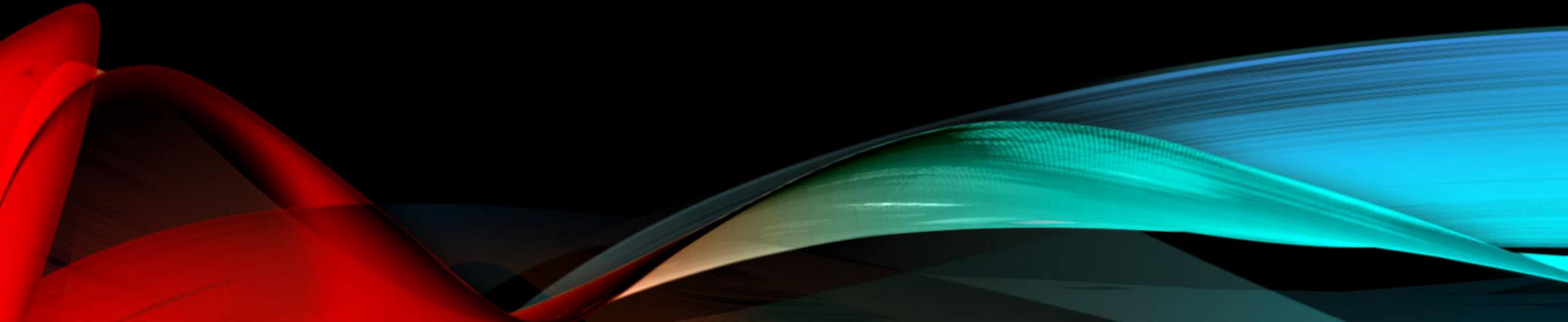
Granular Myocardium



Thickened Pericardium



POST SURGERY





FR 44Hz
16cm

2D
56%
C 50
P Off
Pen



Post-CPB

M3



PAT T: 37.0C
TEE T: 40.1C

JPEG

92 bpm

Post Surgery



TV INFLOW

MV INFLOW

FR 44Hz
16cm

2D
56%
C 50
P Off
Pen

0 110 180
Post-CPB



PW
50%
4.1MHz
WF 150Hz
SV4.0mm
9.0cm

M3

FR 44Hz
16cm

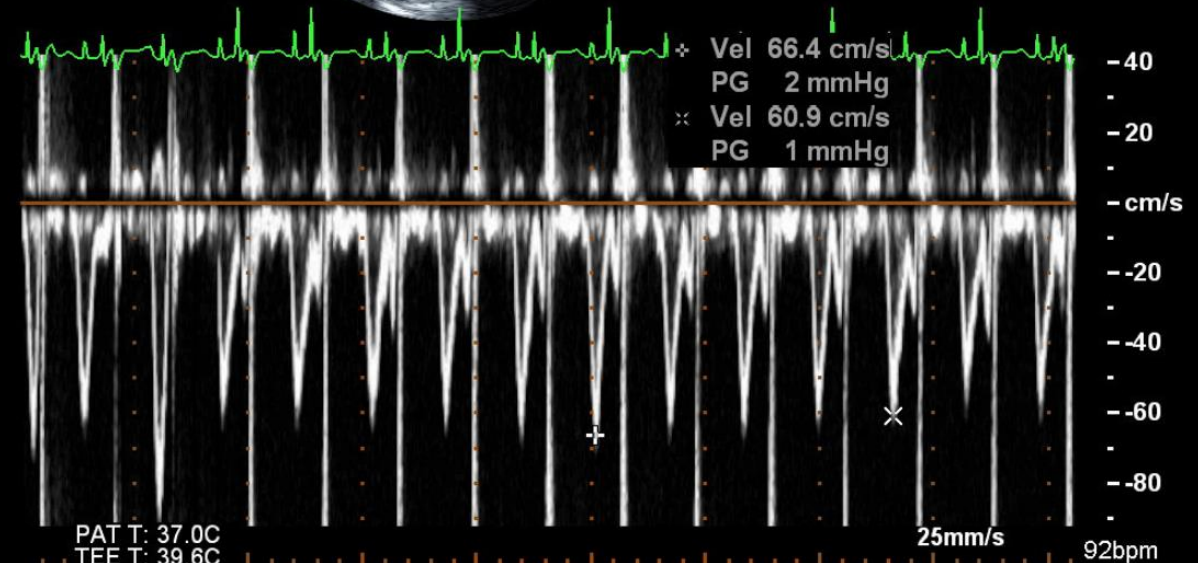
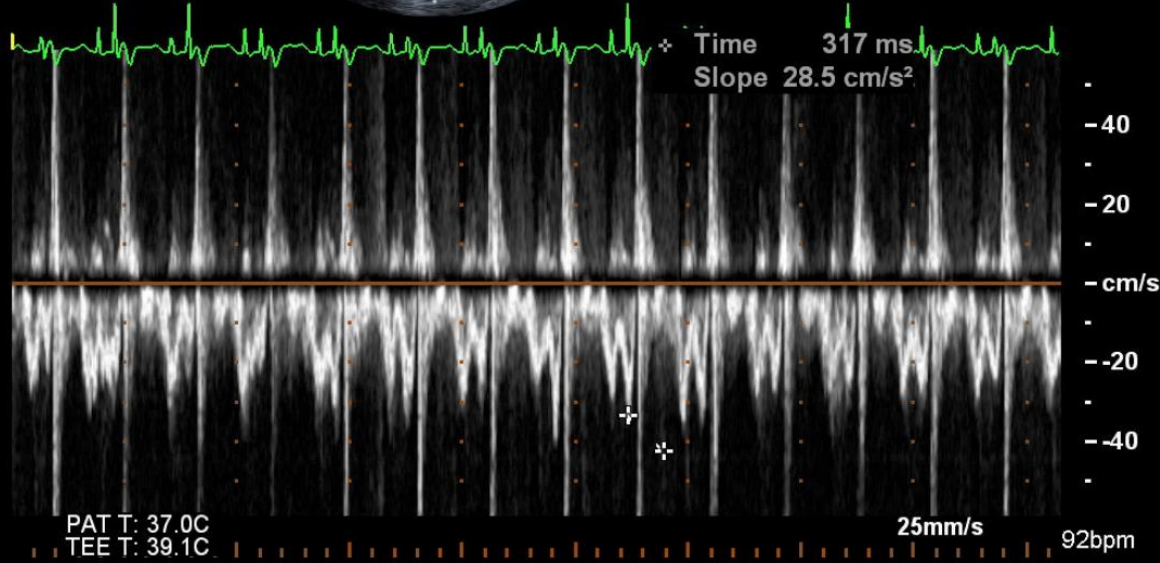
2D
56%
C 50
P Off
Pen

0 0 180
Post-CPB



PW
50%
4.1MHz
WF 150Hz
SV4.0mm
6.6cm

M3



Post Surgery

Virtual Transesophageal
 Echocardiography

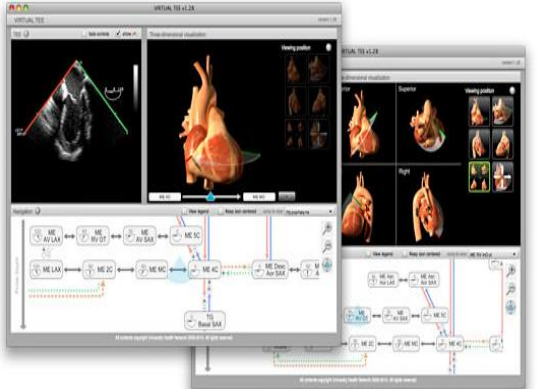
Toronto General Hospital Department of Anesthesia
 Perioperative Interactive Education

Peter Munk
 Cardiac Centre UHN

Site Menu

- Home
- 3D TEE
- Alternative Views
- Assessment of Cardiac Valves
- Colour Doppler
- Pathology
- Spectral Doppler
- Standard Views
- TEE Exam Study Notes
- TEE Handbooks
- TEE Simulation
- Virtual TEE

VIRTUAL TEE



[Click here to open the VIRTUAL TEE application.](#)

Other PIE sites

External Links



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