BASIC TEE IN ER

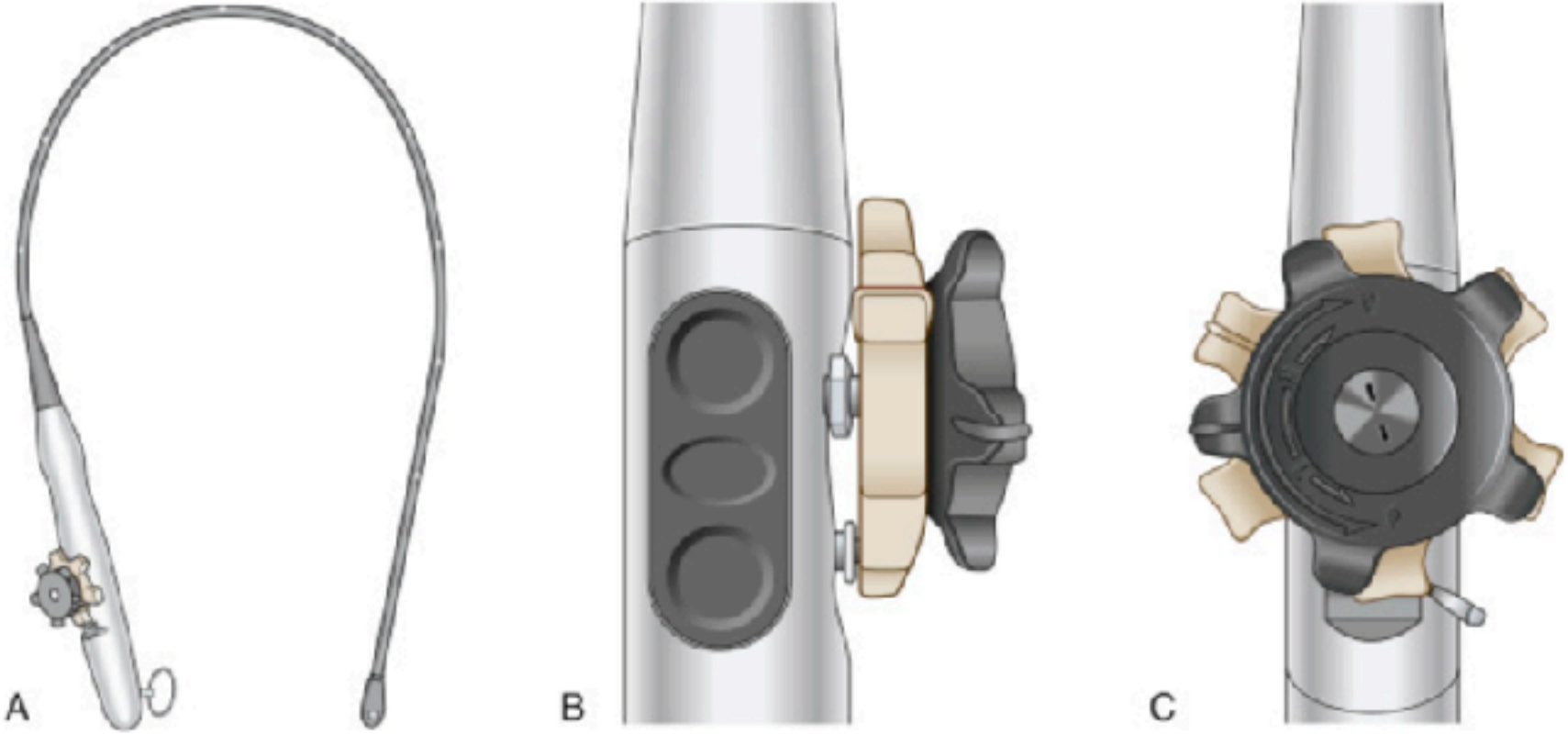
Resuscitative TEE Project
https://www.resuscitativetee.com/

錫昌科技CAE Vimedix

20221123 TE7 & TEE

TransEsophageal Echocardiography

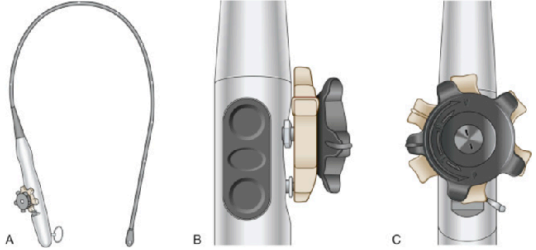
TransEsophageal Echocardiography

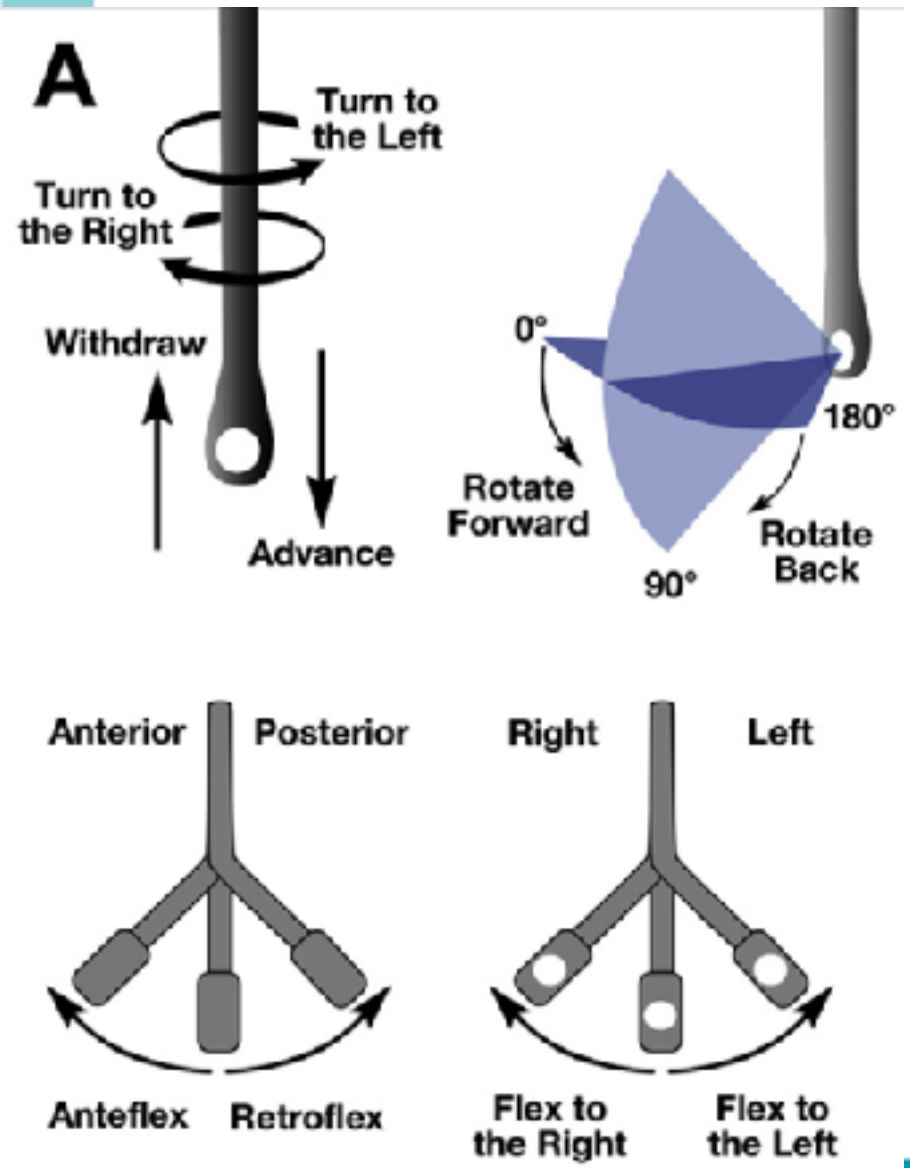


1主線: 前進後退加順逆轉動
2轉輪: 控制前後左右彎曲
2按鈕: 調節晶體角度 (0~180)

~ Radiology Key

How to perform TEE ?





面朝前

進和退

順逆轉

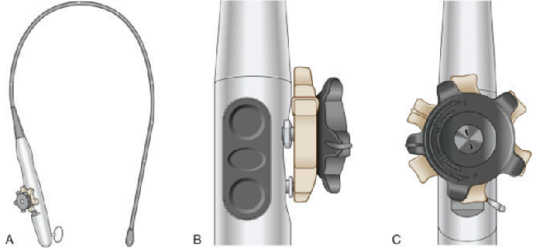
晶體旋

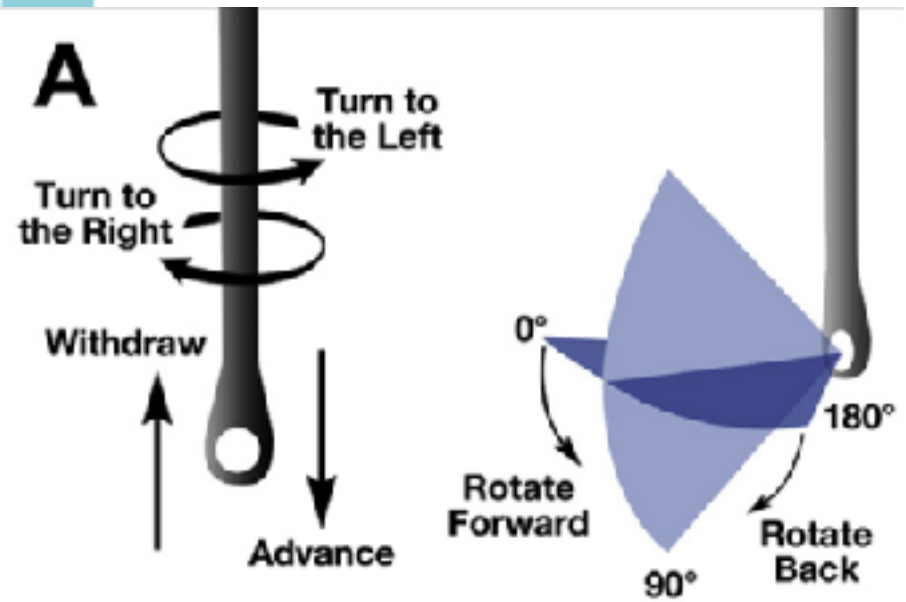
前後彎

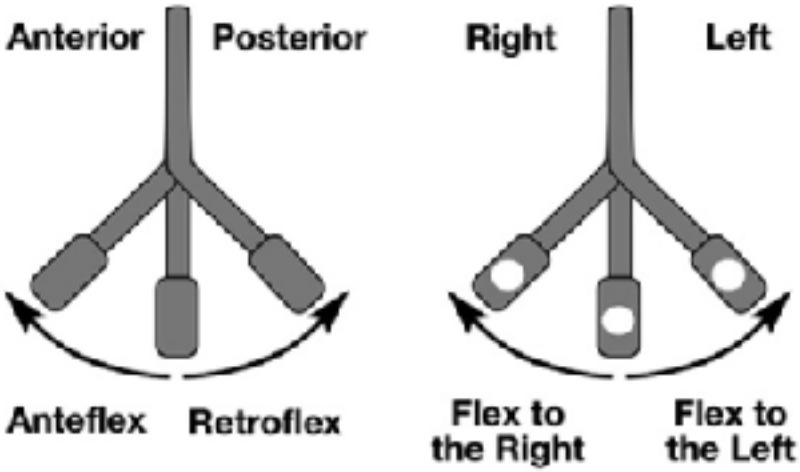
左右彎

ASE TEE guidelines 2019

How to perform TEE ?







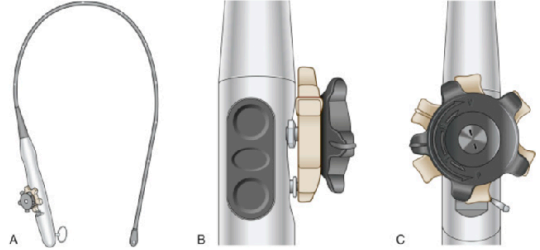
主幹線順時鐘: 看腔靜脈

大轉輪順時鐘: 向前彎曲

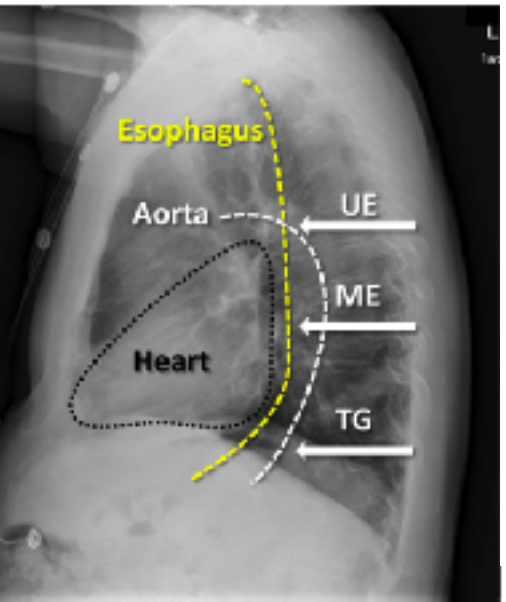
小轉輪順時鐘: 向右彎曲

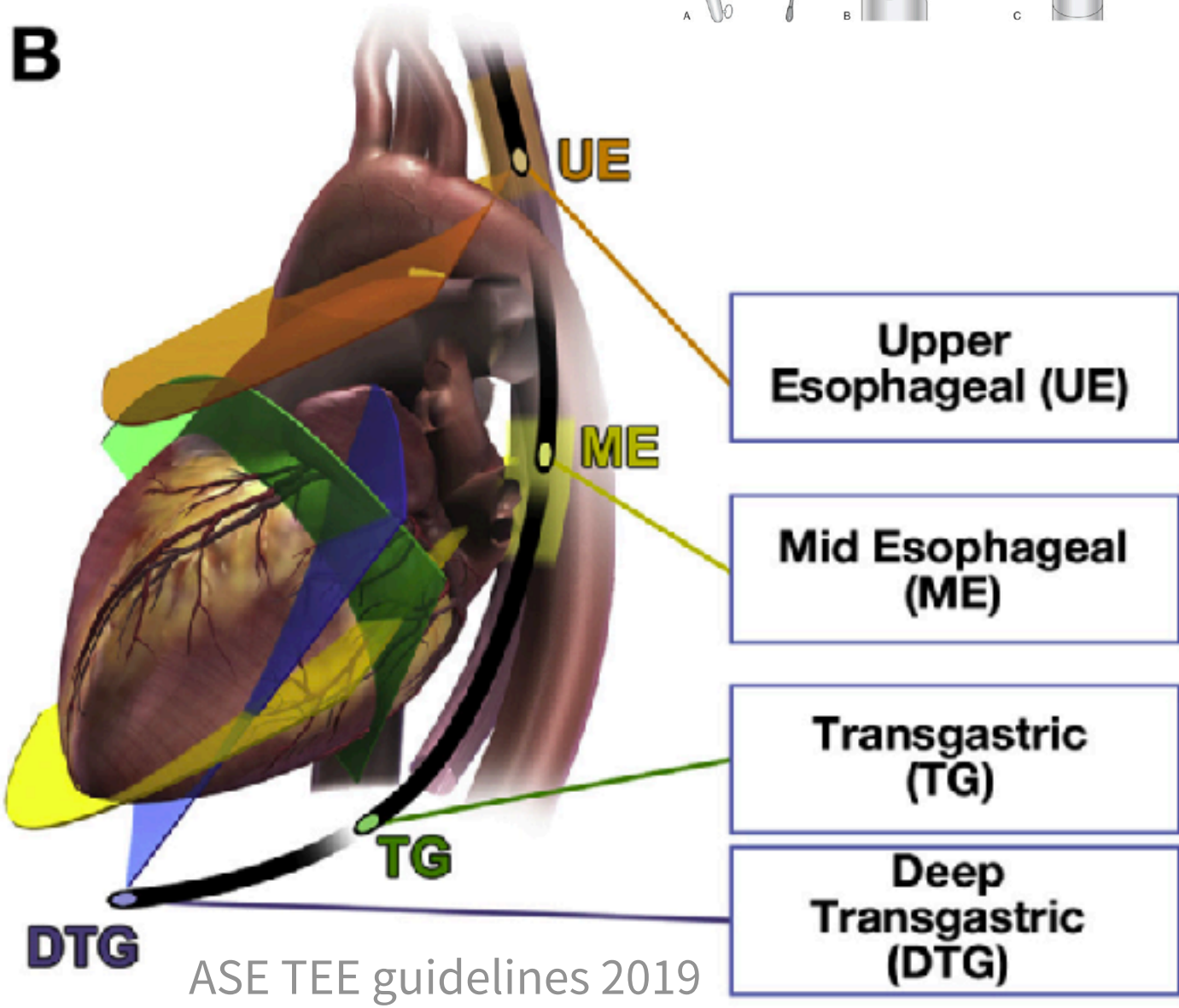
ASE TEE guidelines 2019

How deep should we go ?



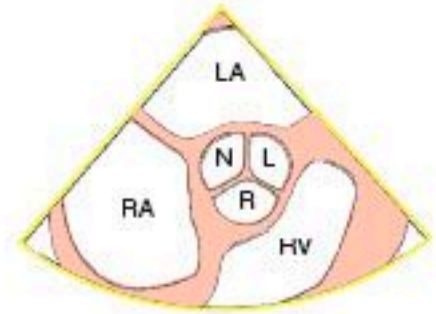
4



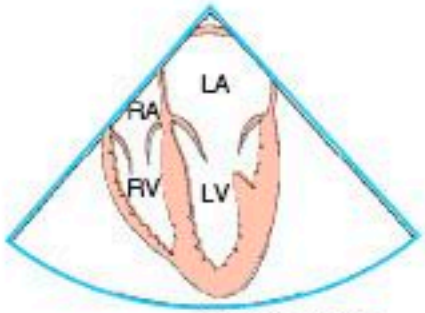


ASE TEE guidelines 2019

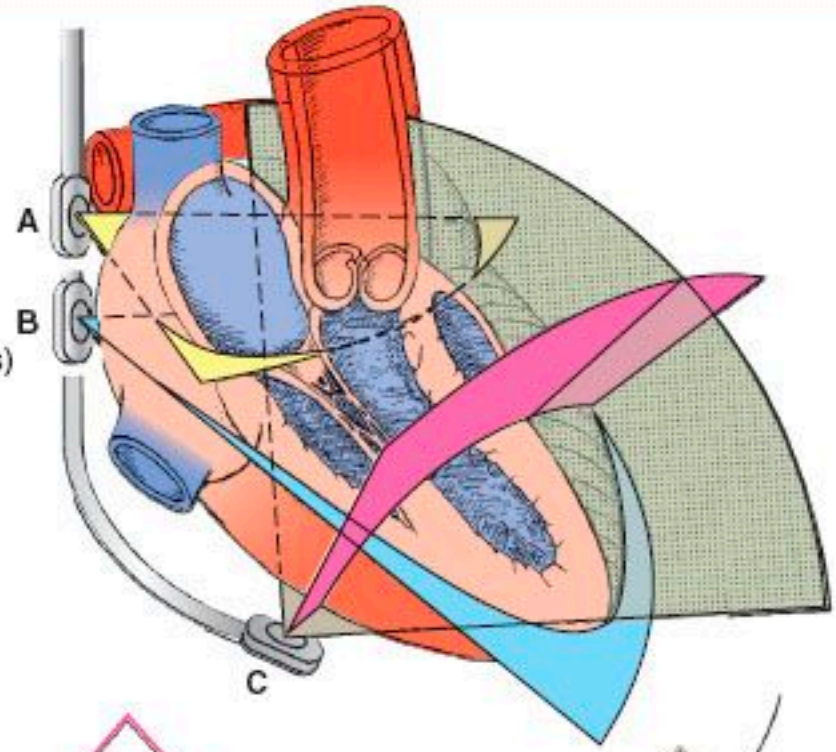
TEE Basic Views at different levels

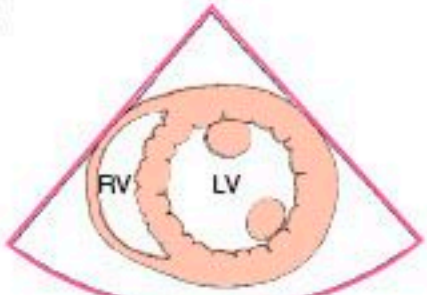


A (0–45 degrees)

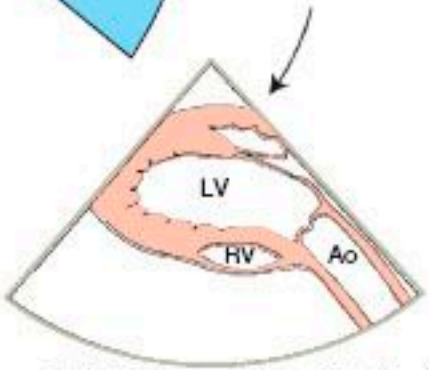


B (0 degree)





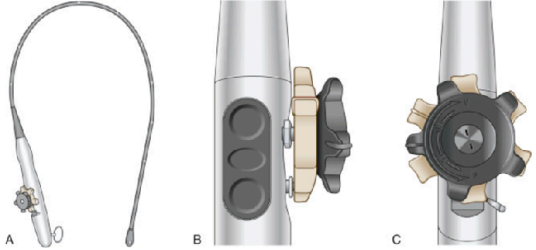
C (0 degree) Transverse plane



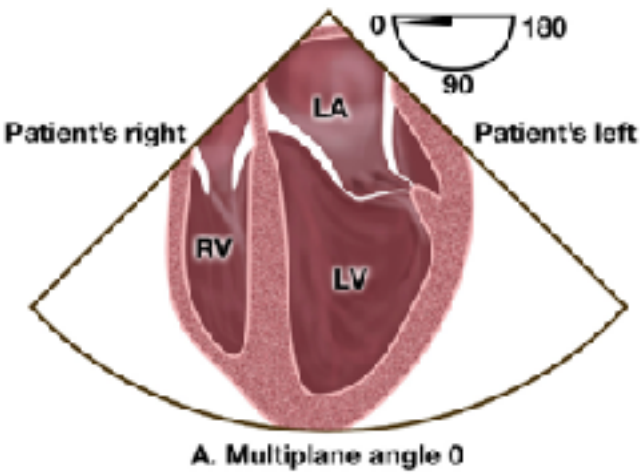
C (120 degree) Longitudinal plane

~ Radiology Key

How to define degree ?

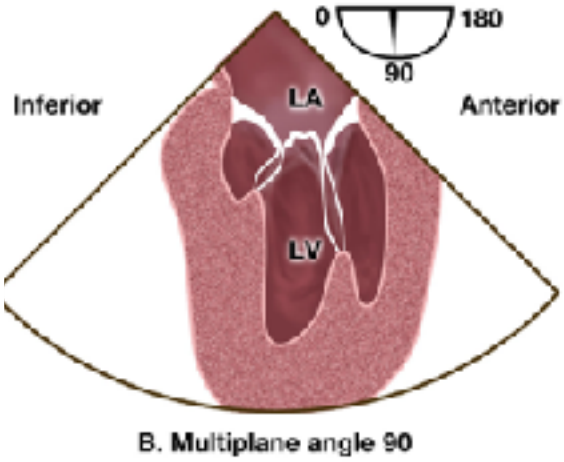


0°



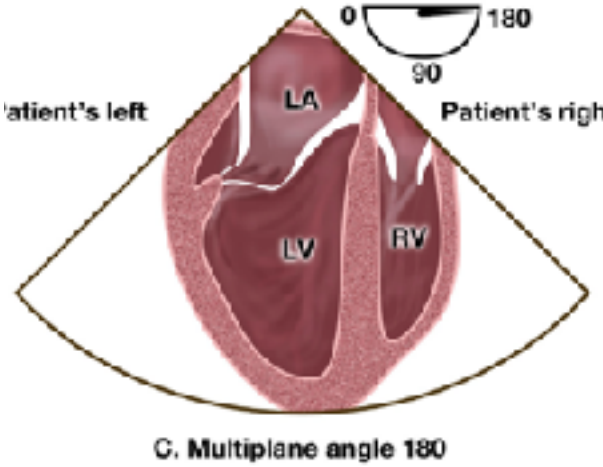
A. Multiplane angle 0

90°



B. Multiplane angle 90

180°

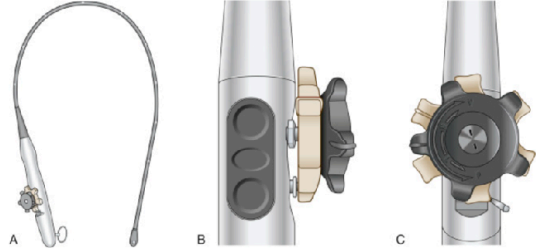


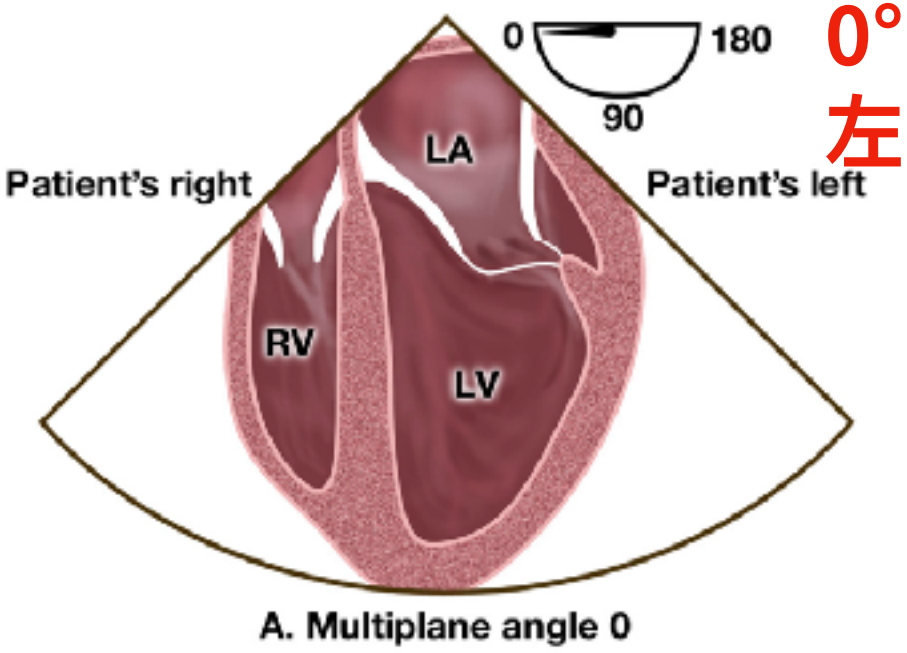
C. Multiplane angle 180

最接近TEE的腔室為 LA

ASE TEE guidelines 2019

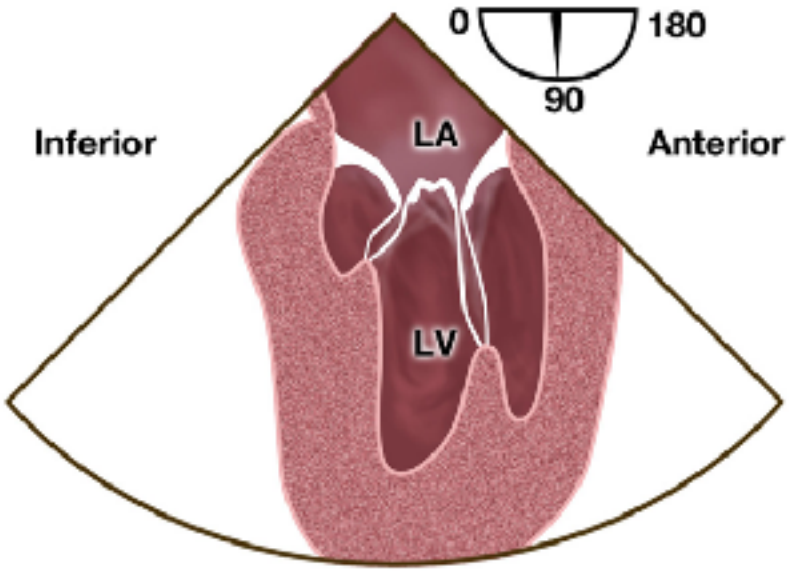
確認0°和90°的定位





0°
左

A. Multiplane angle 0

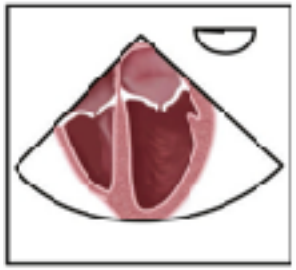


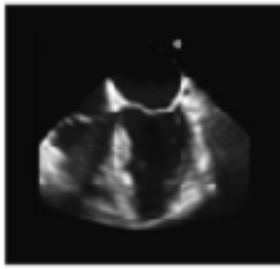
90°
頭
前

B. Multiplane angle 90

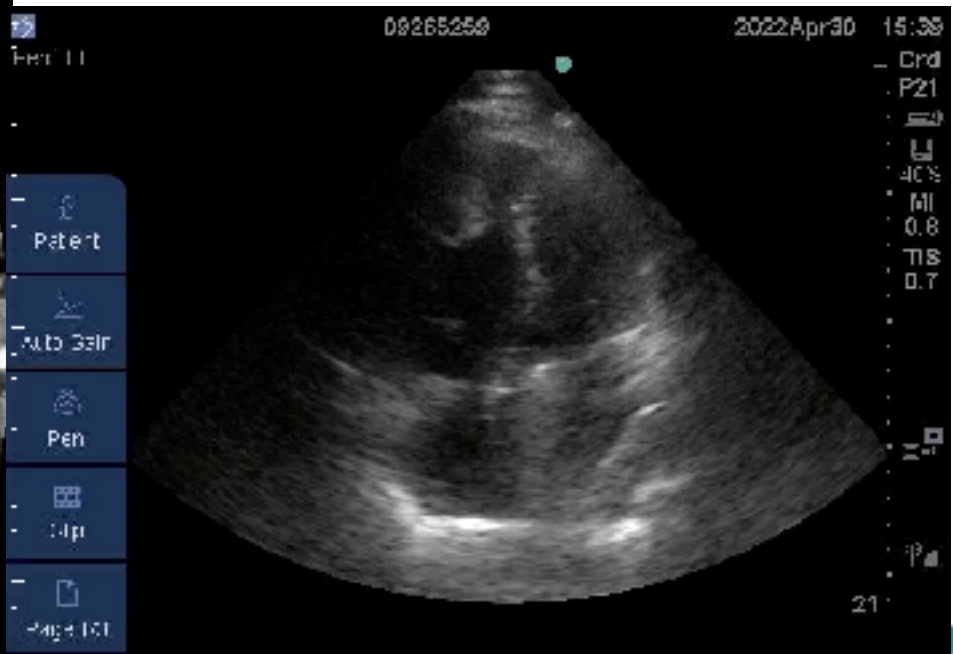
TEE: ME-4C (0°)

ME 4-Ch





TTE: A4C



WHY TEE IN ER ?

Resuscitative TEE Project
https://www.resuscitativetee.com/

American College of Emergency Physicians®

ADVANCING EMERGENCY CARE

POLICY STATEMENT

Approved April 2017

Guidelines for the Use of Transesophageal Echocardiography (TEE) in the ED for Cardiac Arrest

補足TTE不完美之處

中斷　壓胸　骨頭　肺臟　血管

American College of Emergency Physicians®

ADVANCING EMERGENCY CARE

POLICY STATEMENT

Guidelines for the Use of Transesophageal Echocardiography (TEE) in the ED for Cardiac Arrest

對象: 急救 / 插管患者

禁忌: 食道、氣管、頸部損傷

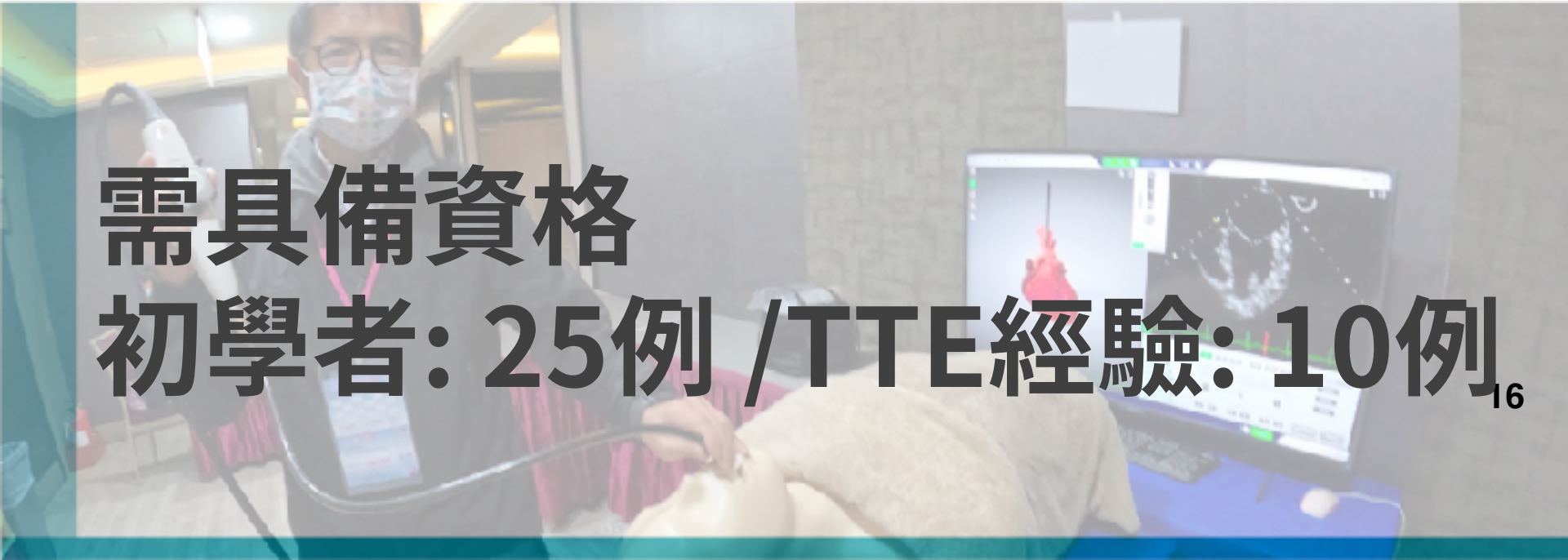
American College of Emergency Physicians®

ADVANCING EMERGENCY CARE

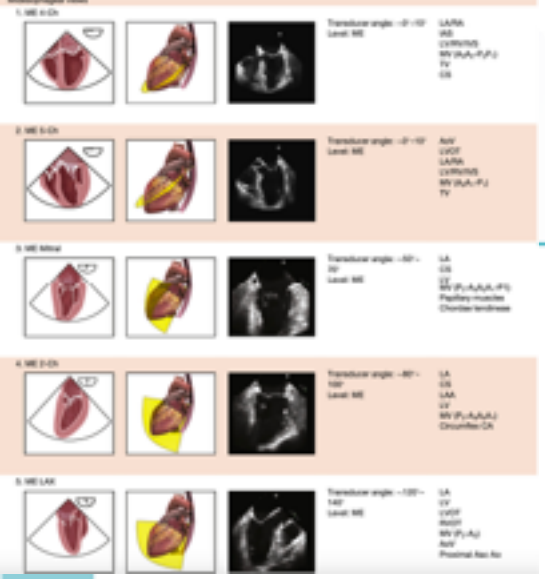
POLICY STATEMENT

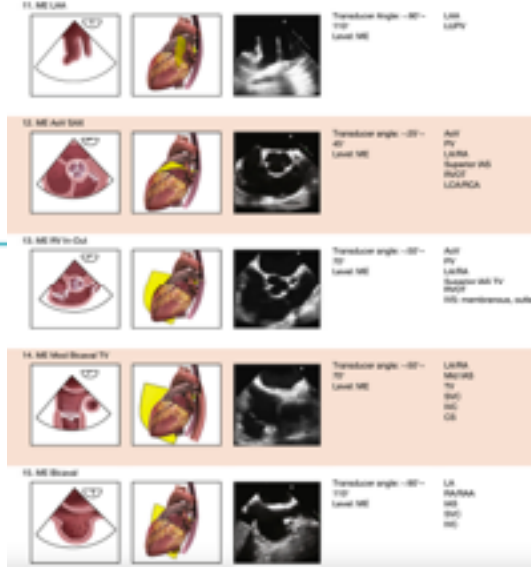
Approved April 2017

Guidelines for the Use of Transesophageal Echocardiography (TEE) in the ED for Cardiac Arrest



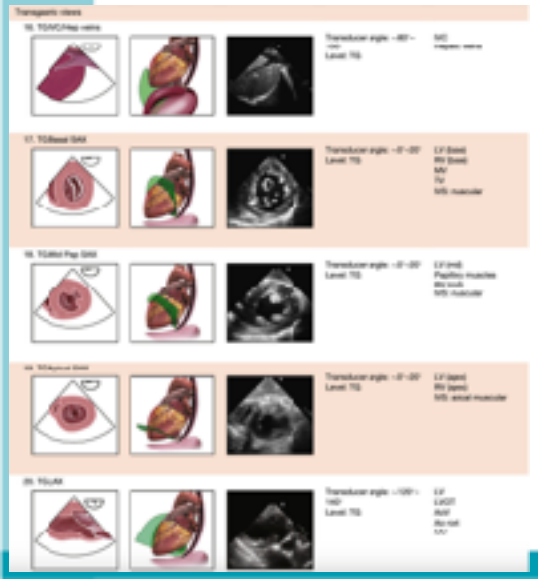
需具備資格
初學者: 25例 /TTE經驗: 10例

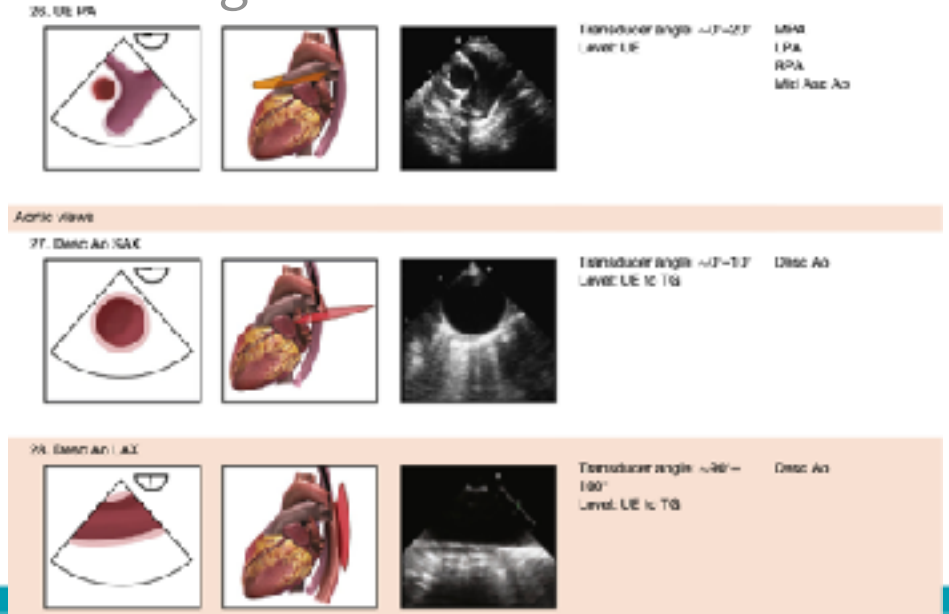




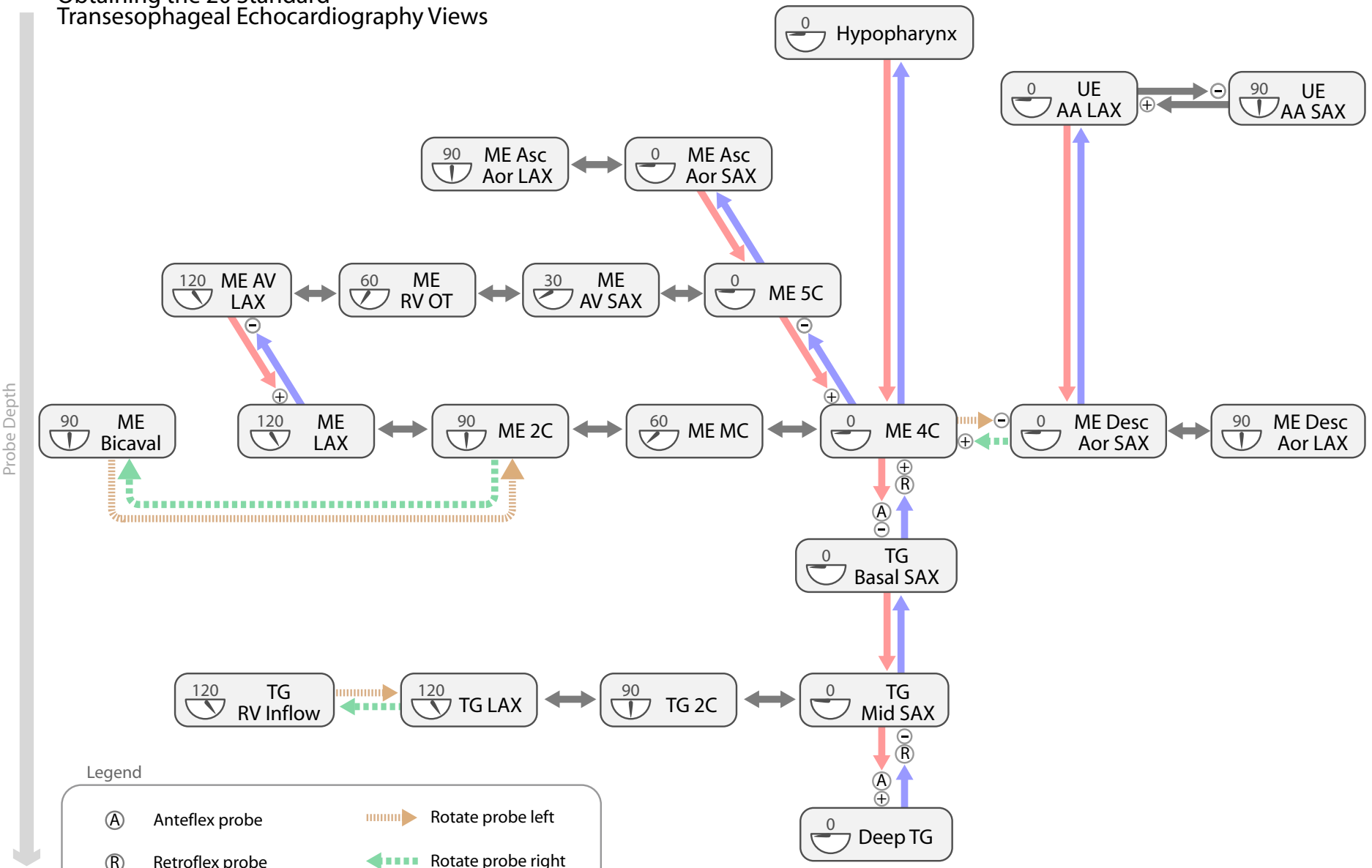
完整TEE 28 Views

ASE TEE guidelines 2019

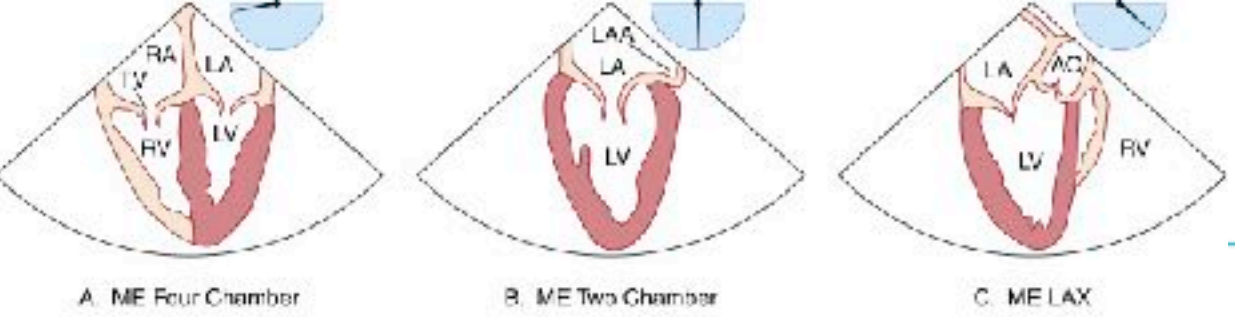




Obtaining the 20 Standard Transesophageal Echocardiography Views



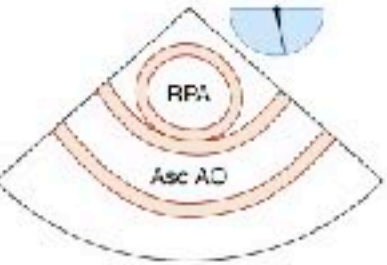
2C - Two Chamber
4C - Four Chamber
5C - Five Chamber
AA - Aortic Arch
AV - Aortic Valve
Asc Aor - Ascending Aortic
Desc Aor - Descending Aortic
OT - Outflow Tract (Inflow-Outflow)
LAX - Long Axis
MC - Mitral Commissural
ME - Mid Esophageal
RV - Right Ventricle
SAX - Short Axis
TG - Transgastric
UE - Upper Esophageal



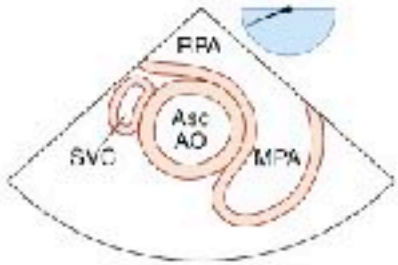
A. ME Four Chamber

B. ME Two Chamber

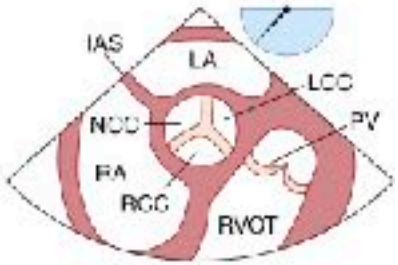
C. ME LAX



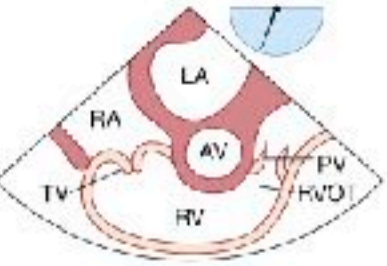
D. ME Asc Aortic LAX



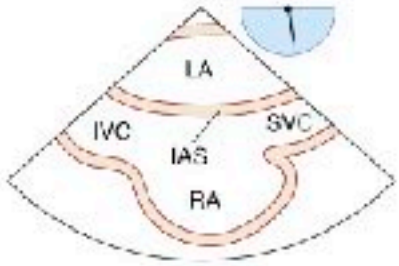
E. ME Asc Aortic SAX



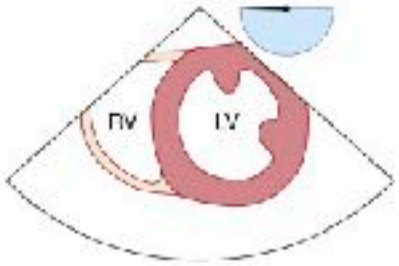
F. ME AV SAX



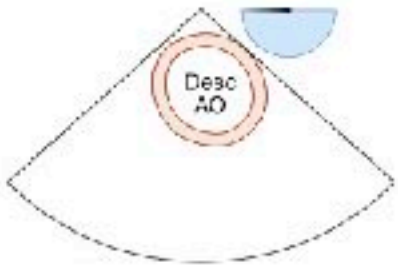
G. ME RV Inflow–Outflow



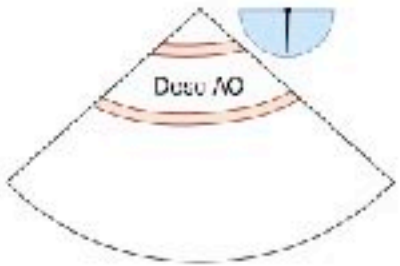
H. ME Bicaval



I. TG Mid SAX



J. Desc Aortic SAX



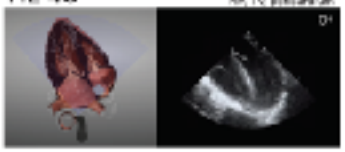
K. Desc Aortic LAX

ASE/SCA 11 Basic Peri-OP Views

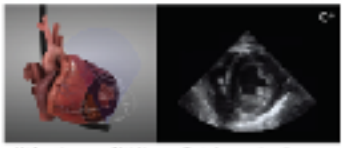
~ Radiology Key

RESUSCITATIVE TEE VIEW GUIDE

ME 4C



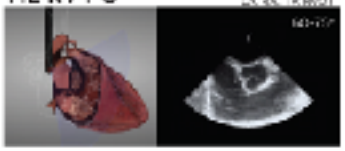
TG SAX PAP



ME 2C

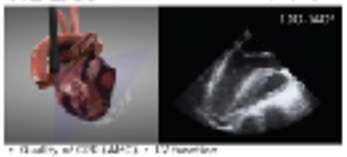
ME Asc Ao SAX

ME RV I-O

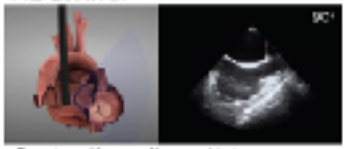


ME DTA LAX

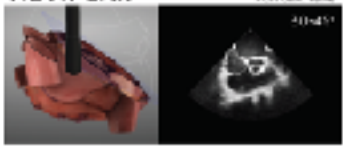
ME LAX



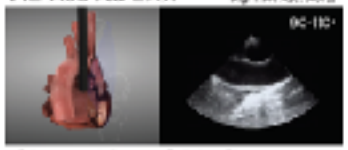
ME Bicaval



ME AV SAX



ME Asc Ao LAX



ME DTA SAX

Deep TG SC

TEE-GUIDED CARDIAC ARREST RESUSCITATION

NON-SHOCKABLE RHYTHM
1. Epinephrine
2. Perform Cardiac Arrest Ultrasound

SHOCKABLE RHYTHM
1. Defibrillate / Cardiovert
2. Continue ACLS

TEE — **CPR IN PROGRESS – PRIMARY SURVEY**

- TEE Mid Esophageal 4c / Trans-Gastric Short Axis → Pericardial Effusion / Tamponade → Pericardiocentesis
- TEE Mid-Esophageal Long Axis → Inadequate LV compression / Obstruction LVOT → Reposition ACC

TEE — **RHYTHM CHECK 1**

- TEE Mid-Esophageal 4c → Ventricular Fibrillation → Defibrillate
- Pseudo-PEA → Hs and Ts / Consider treating as profound shock

US — **CPR IN PROGRESS - SECONDARY SURVEY**

- ABDOMINAL FREE FLUID → Free Fluid in Chest or Abdomen → Consider surgical etiology
- AORTA → AAA > 4 cm → Consider ruptured AAA
- FEMORAL VEINS → DVT → Consider thrombolysis for PE

US **TEE** — **RHYTHM CHECK 2**

- PLEURA → Pneumothorax → Thoracostomy
- Mid Esophageal 4c → ROSC → Post Cardiac Arrest Care
- Mid Esophageal 4c → Cardiac Standstill & $EtCO_2$ <20 mmHg after 20 minutes → Terminate Resuscitation

TEE — **ADDITIONAL VIEW**

- Mid Esophageal Bicaval → Procedural Guidance

TEE: Transesophageal Echocardiography

AMC: Area of Maximal Compression

US: Transthoracic / Transabdominal Ultrasound (i.e. Phased Array Probe)

RESUSCITATIVE TEE WORKSHOP

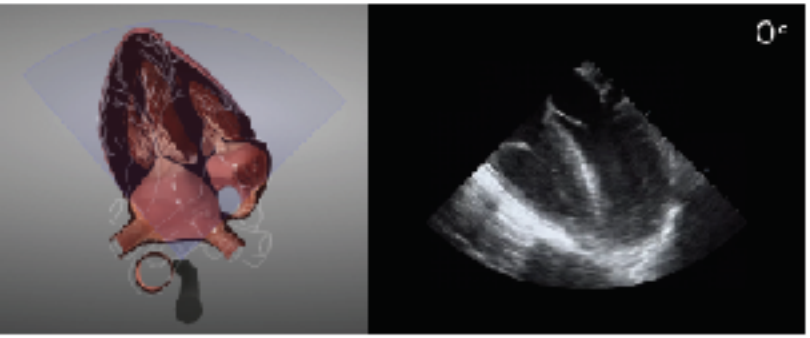
www.resuscitativetee.com

INTELLIGENT ULTRASOUND

RESUSCITATIVE TEE VIEW GUIDE

ME 4C

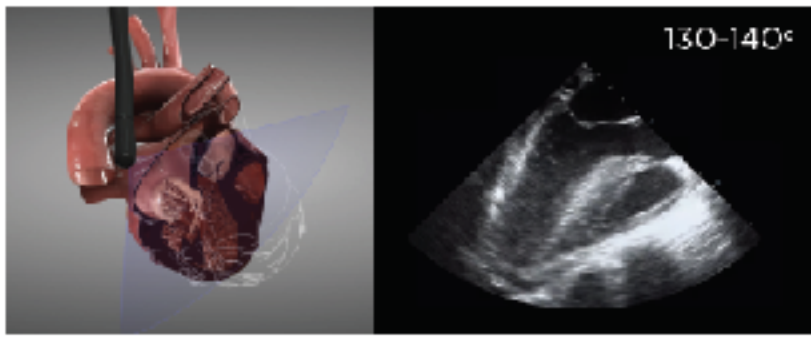
RA, LA, RV, LV
MV, TV, pericardium



- Pathology pericardium
- RWMA
- LV/RV size & function
- Valvular pathology

ME LAX

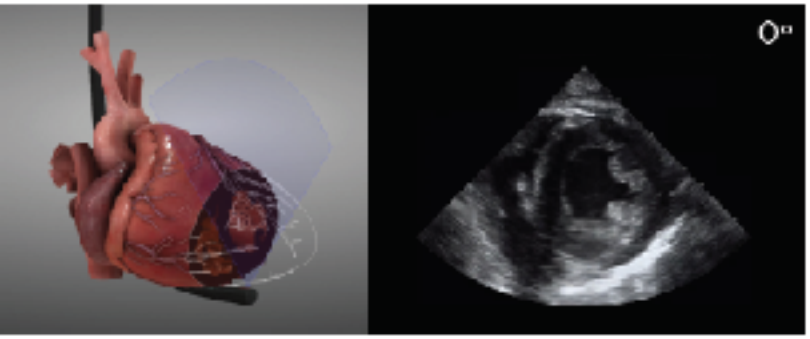
LV, LA, MV, AV



- Quality of CPR (AMC)
- LV function
- Pathology MV
- Pathology AV

TG SAX PAP

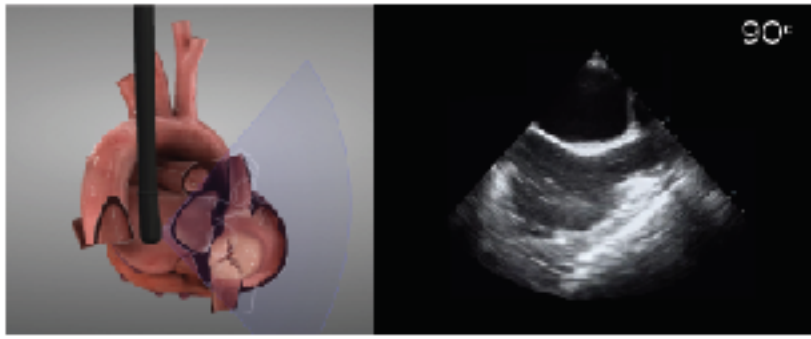
LV, RV



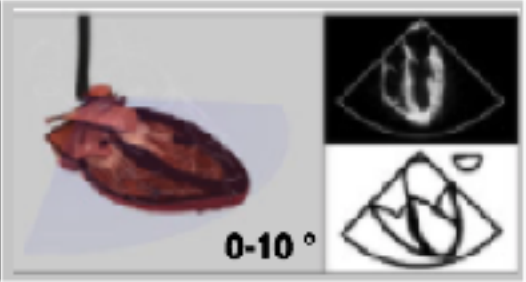
- LV function
- RWMA
- Pathology pericardium

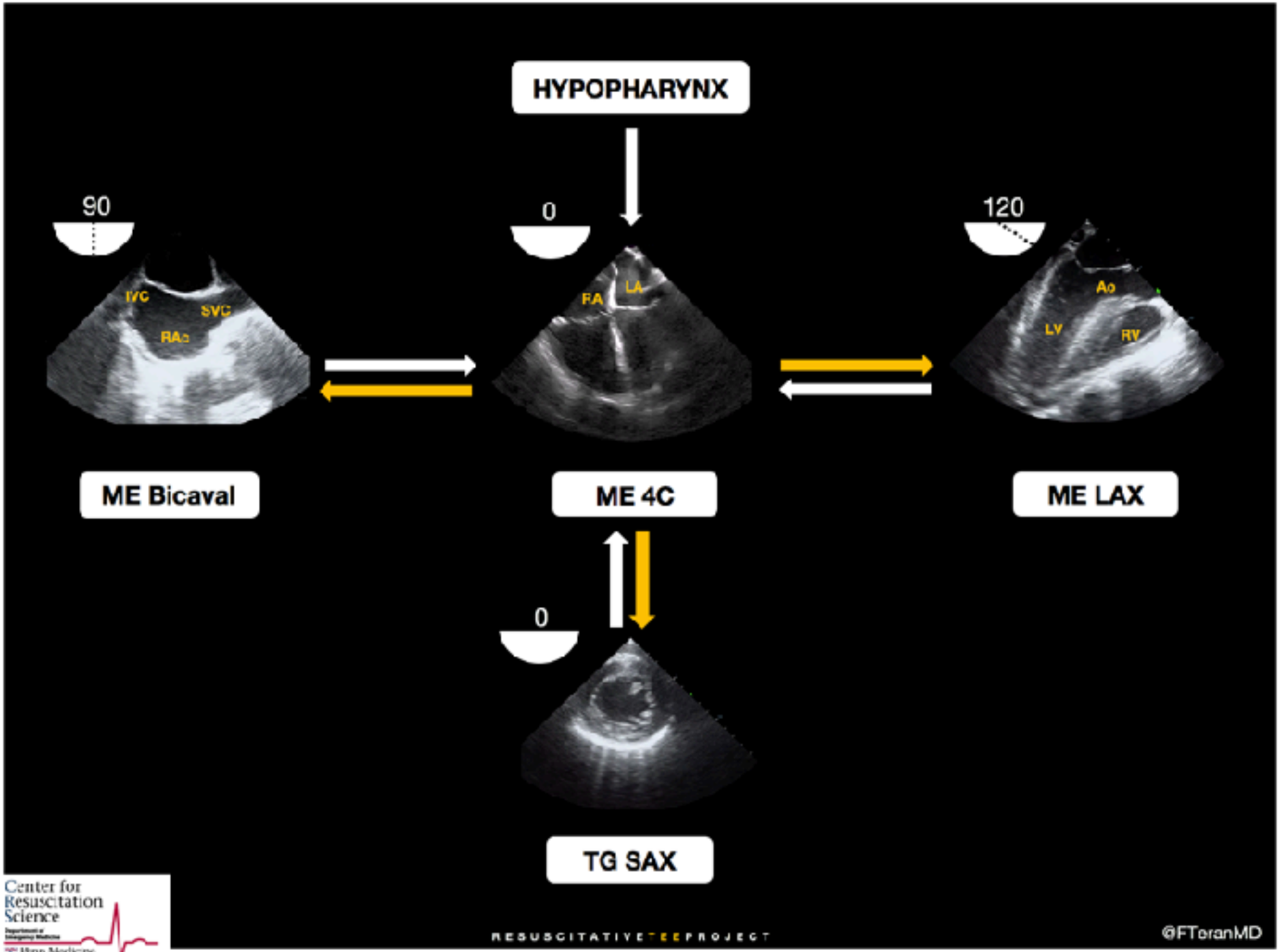
ME Bicaval

IVC, RA, SVC

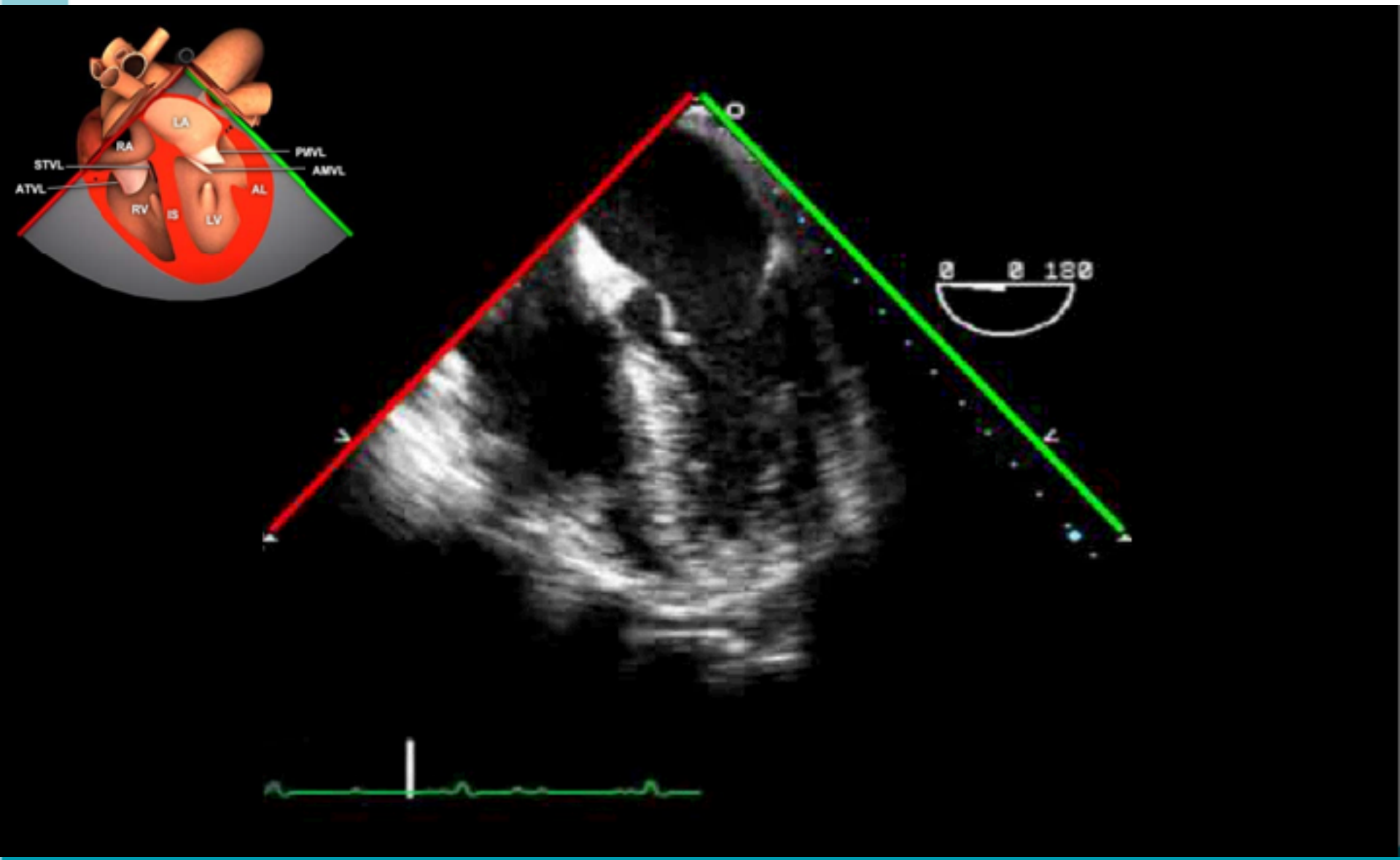


- Procedure guidance
- Venous guidewire
- ECMO
- Volume responsiveness

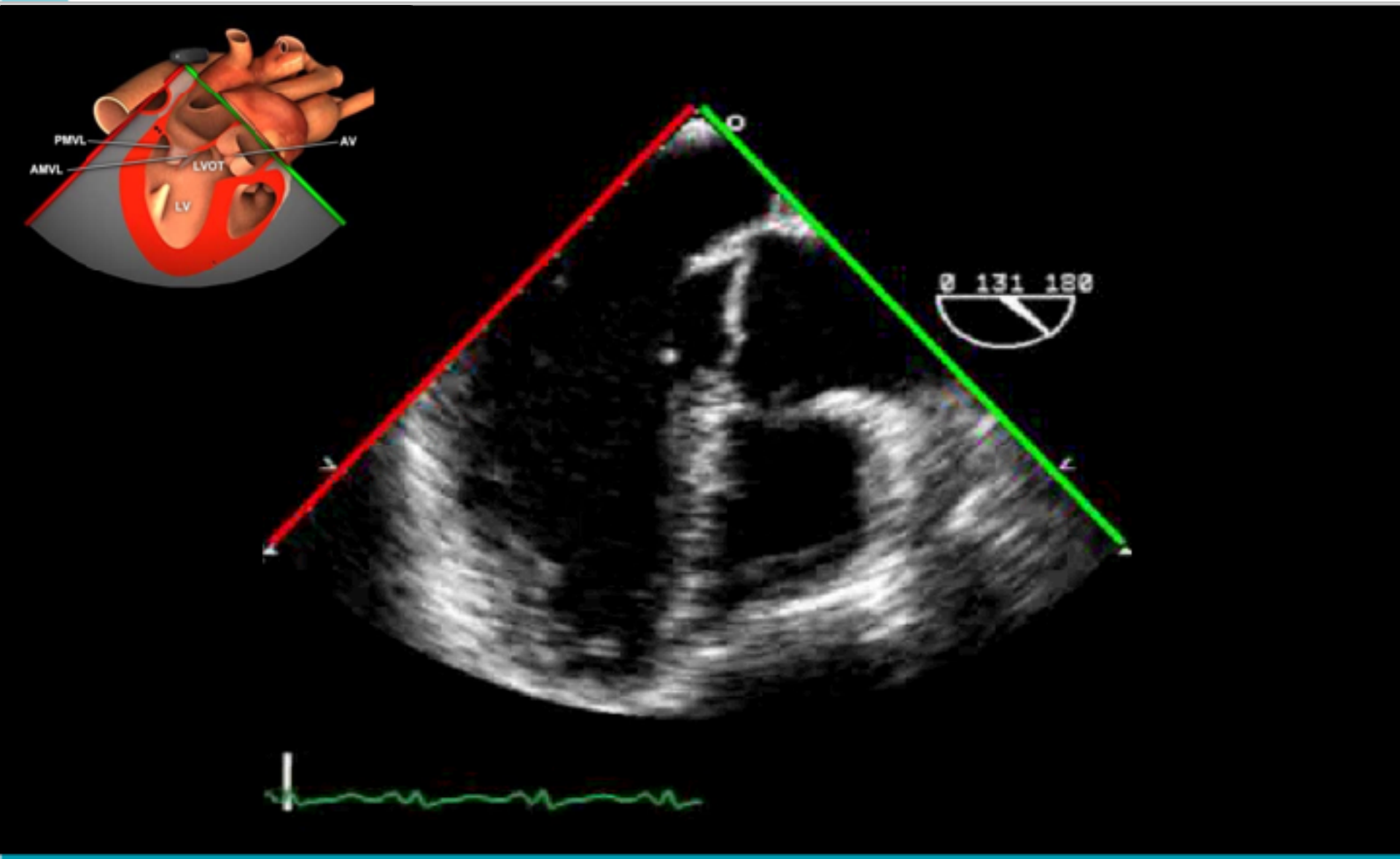
RESUSCITATIVE TEE views		Cardiac structures	TTE equivalent	Clinical Application
Mid-esophageal 4 chamber (ME4C)		Four chambers, mitral and tricuspid valves and pericardium	Apical four chamber	Pericardial effusion Intra ventricular thrombus LV/RV function Valve lesions and dysfunction
Mid-esophageal long axis (MELAX)		Left ventricle, left atrium, mitral and aortic valves	Parasternal long axis	Quality of CPR LV function Pericardial effusion Mitral / aortic valve dysfunction
Transgastric short (TG)		Left ventricle	Parasternal short axis	Left ventricular function (RWMA) Pericardial effusion
Mid-esophageal Bicaval (ME Bicaval)		Simultaneous view of IVC, RA and SVC	N/A	Procedural guidance Volume responsiveness


HYPOPHARYNX
90
0
120
IVC
SVC
RA
FA
LA
Ao
LV
RV
ME Bicaval
ME 4C
ME LAX
0
TG SAX
RESUSCITATIVETEEPROJECT
@FTeranMD
Center for Resuscitation Science
Penn Medicine

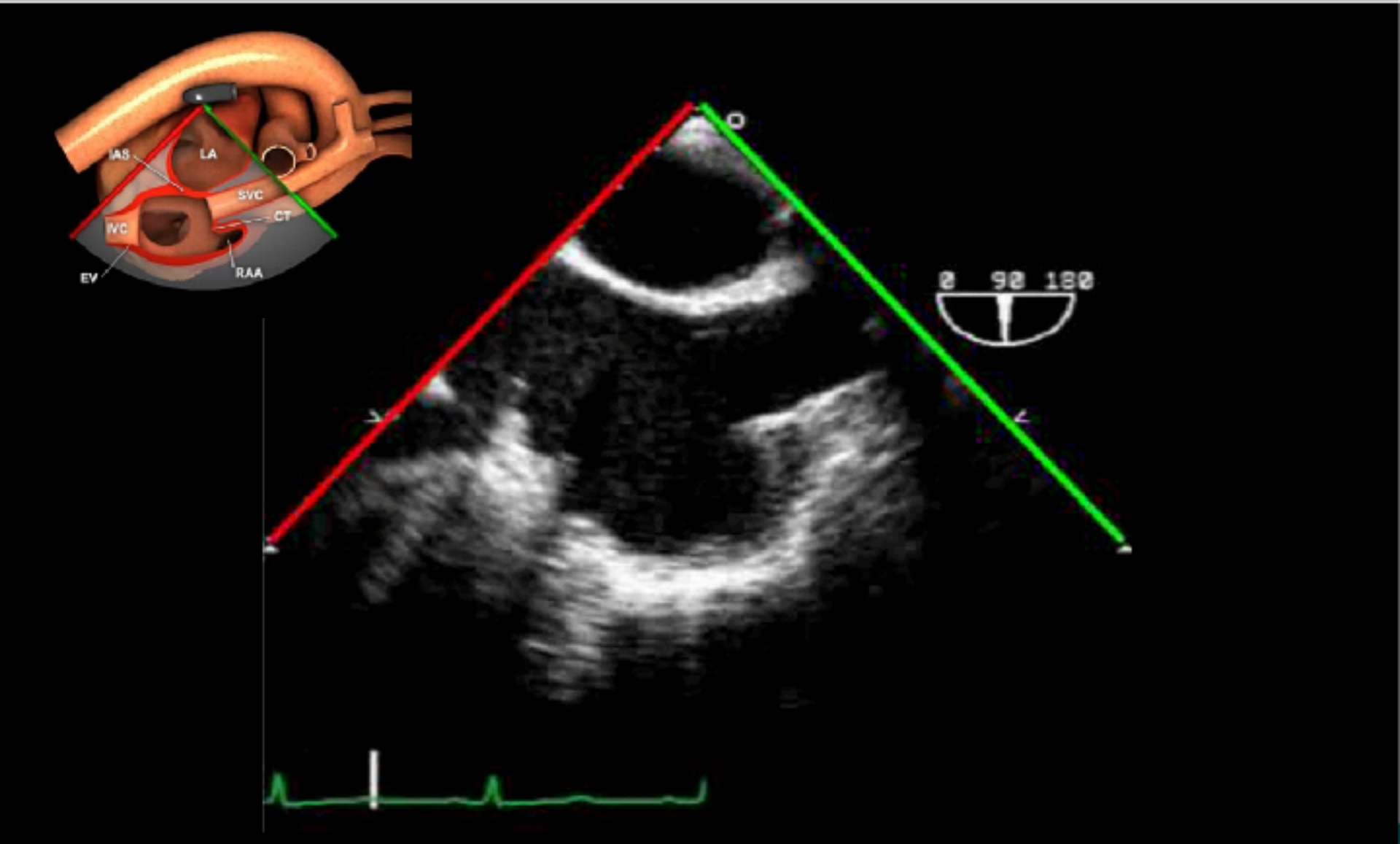
ME 4C view (0°)



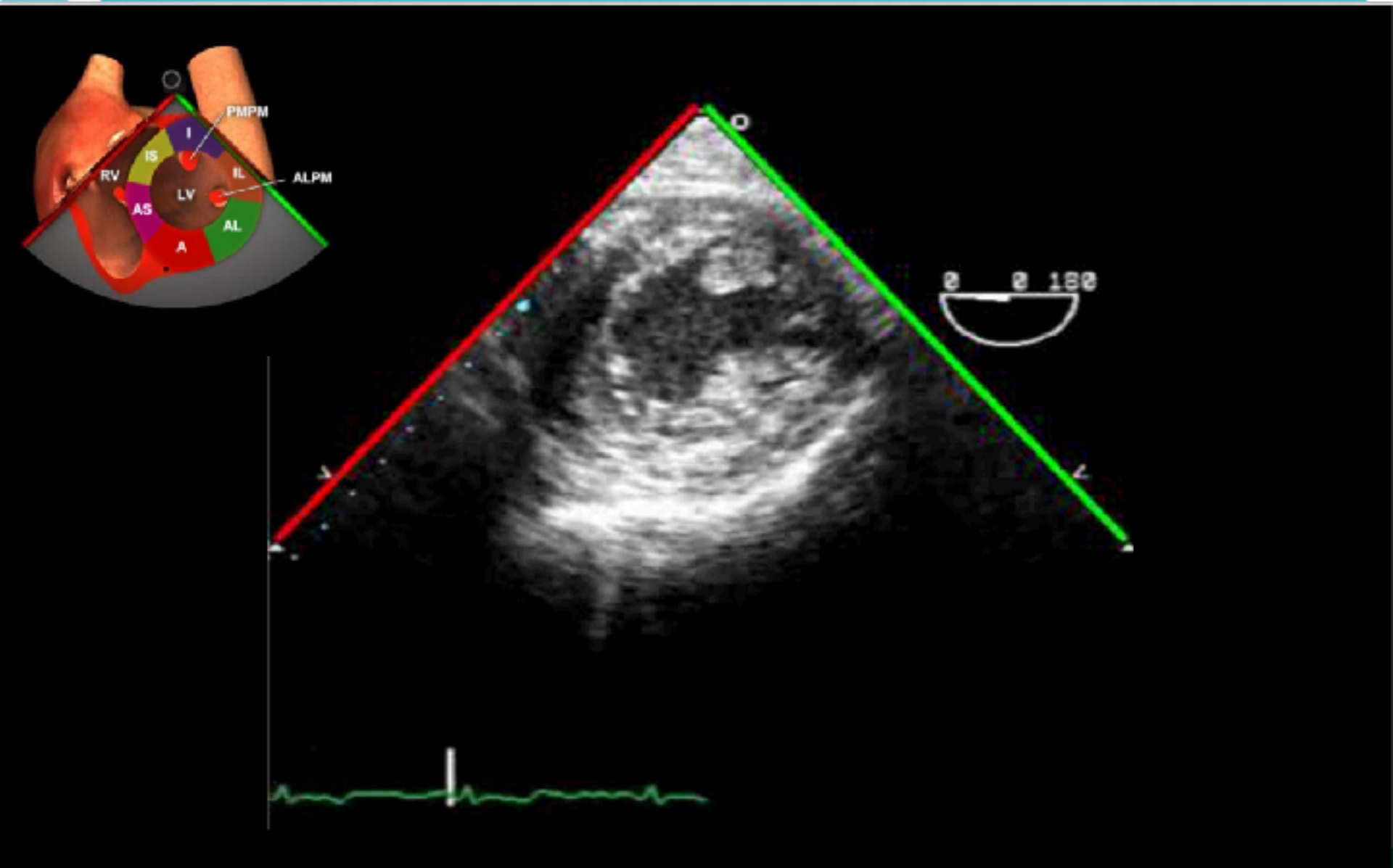
ME LAX view (120°)



ME Bicaval view (90°)

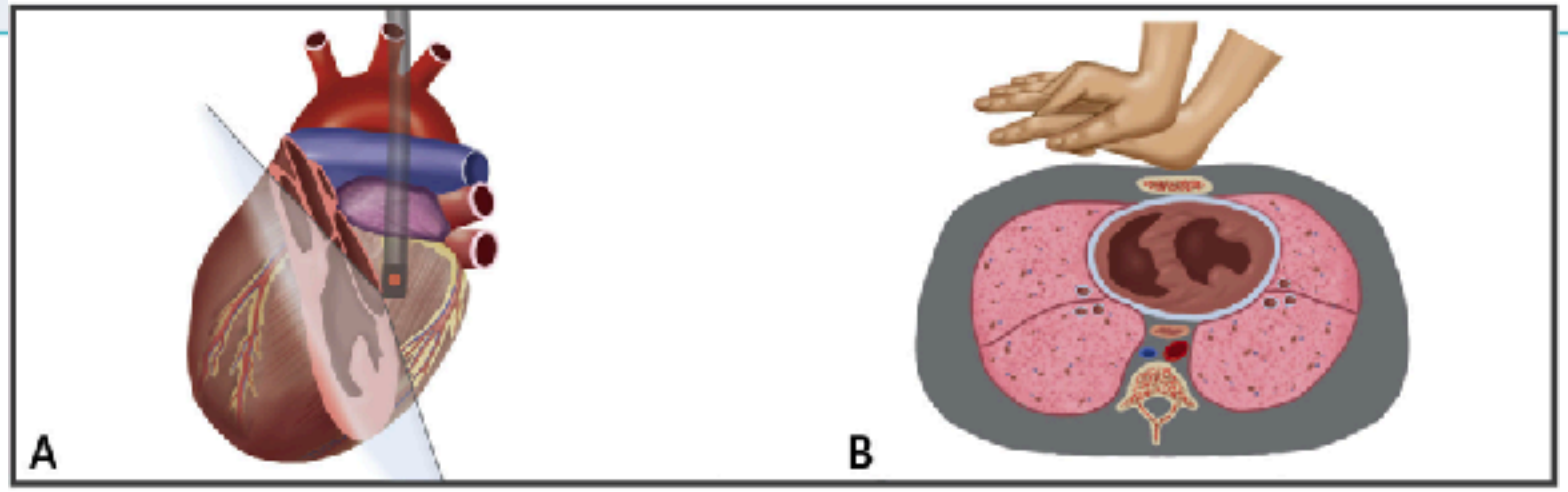


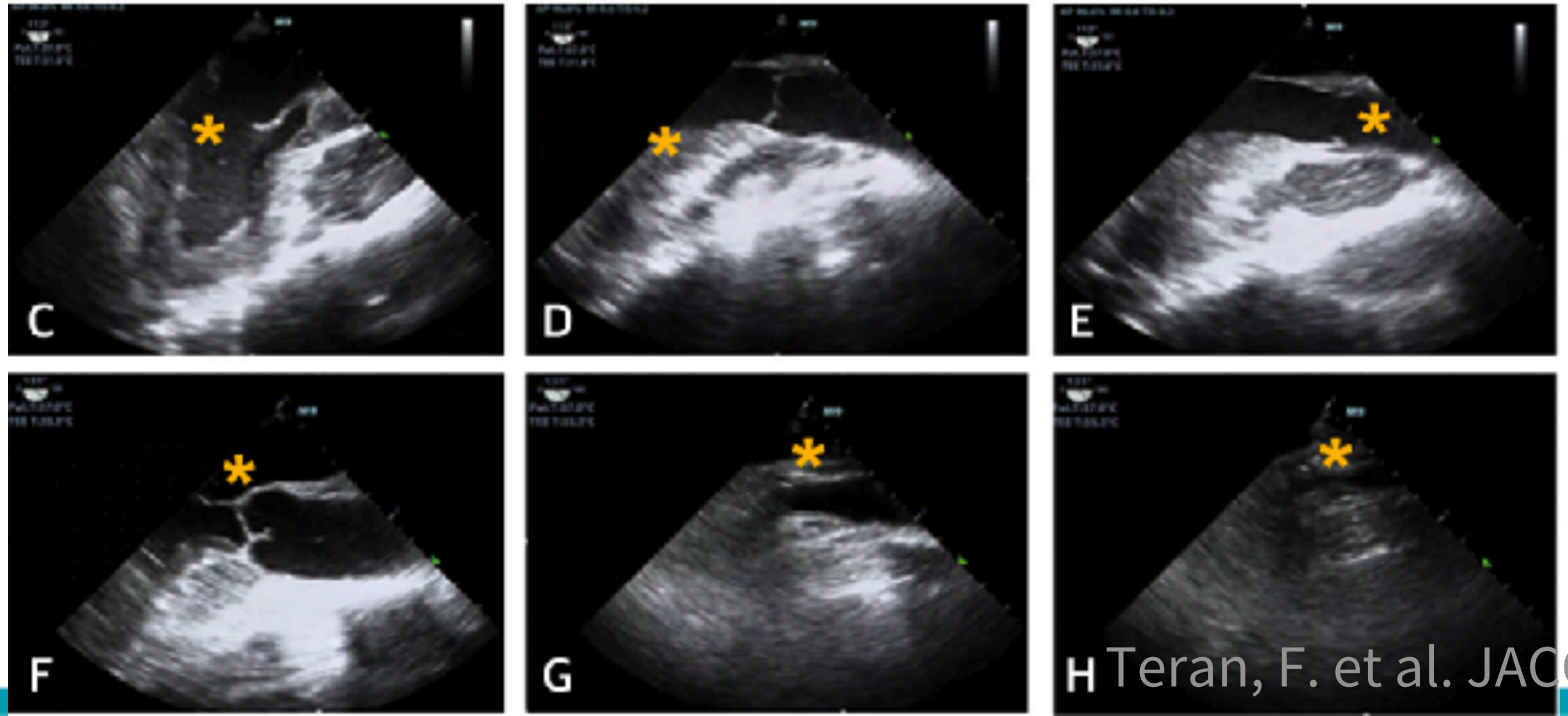
TG Mid SAX view (0°)



Enhancing Quality of CPR

- Minimize interruptions of CPR
- Allow real-time feedback of quality of chest compressions (i.e., obstruction of LVOT/Ao)

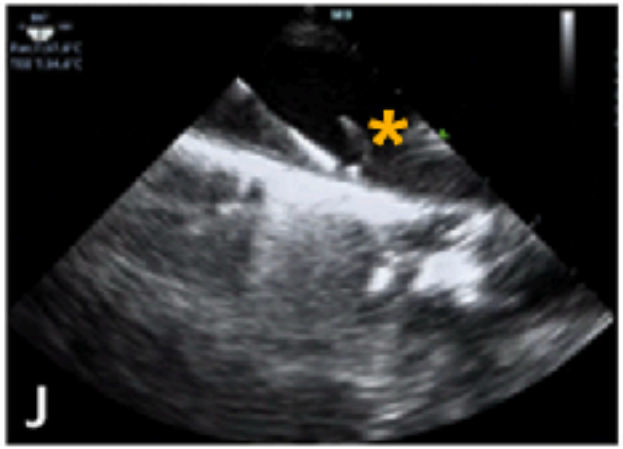




Teran, F. et al. JACC. 2020

Diagnostic Role/Procedural Guidance

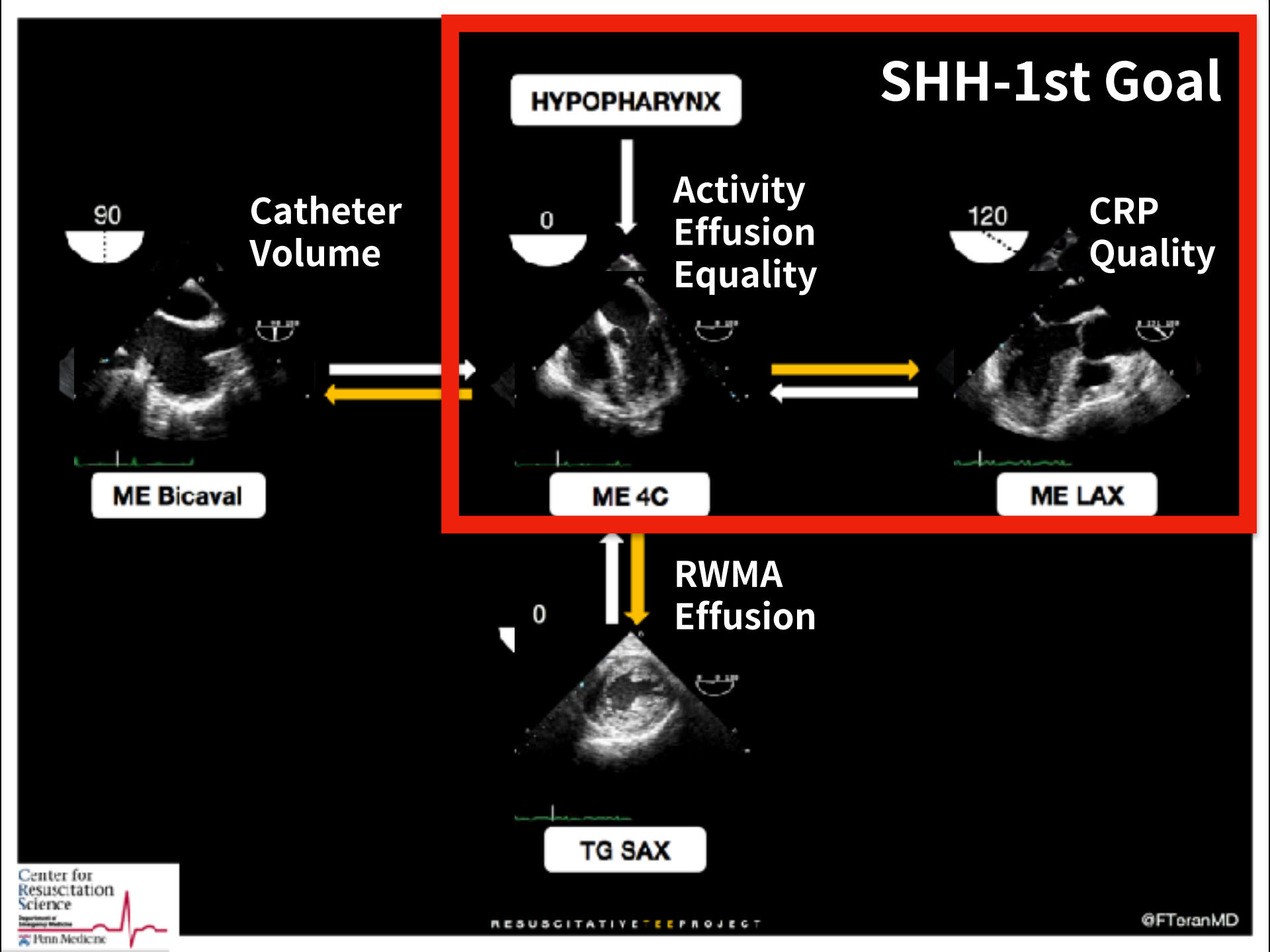
- Identification of potentially treatable pathologies (i.e., cardiac tamponade)
- Intra- or peri-arrest procedural guidance (i.e., ECMO)



Prognostic Role

- Characterization of myocardial activity (i.e., cardiac standstill, organized vs. disorganized contractions)
- Continuous imaging of cardiac function

Teran, F. et al. JACC. 2020


SHH-1st Goal
HYPOPHARYNX
Activity
Effusion
Equality
90
Catheter
Volume
0
120
CRP
Quality
ME Bicaval
ME 4C
ME LAX
RWMA
Effusion
0
TG SAX
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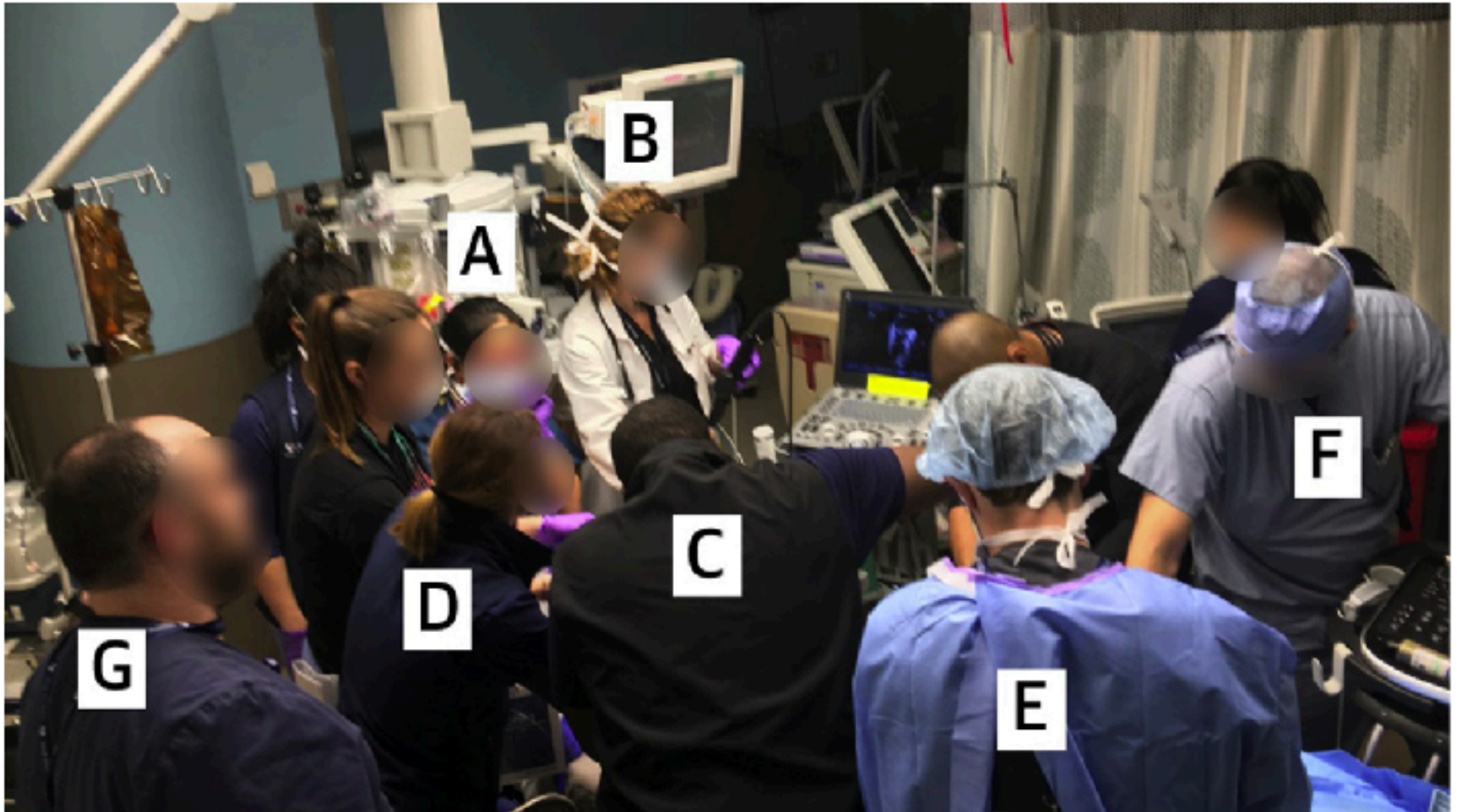
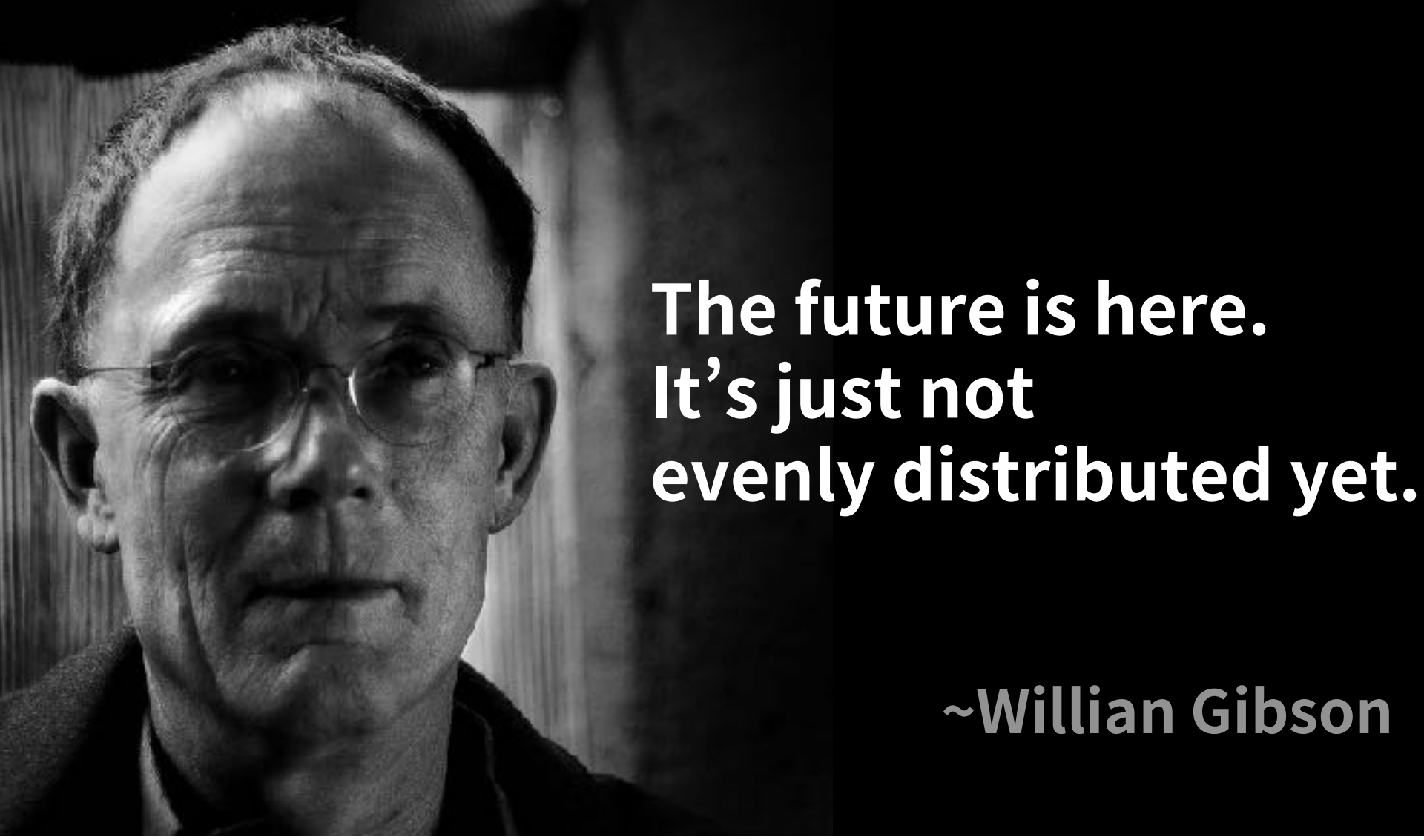
TEAM

FIGURE 2 Incorporation of Focused TEE During Cardiac Arrest Resuscitation Care



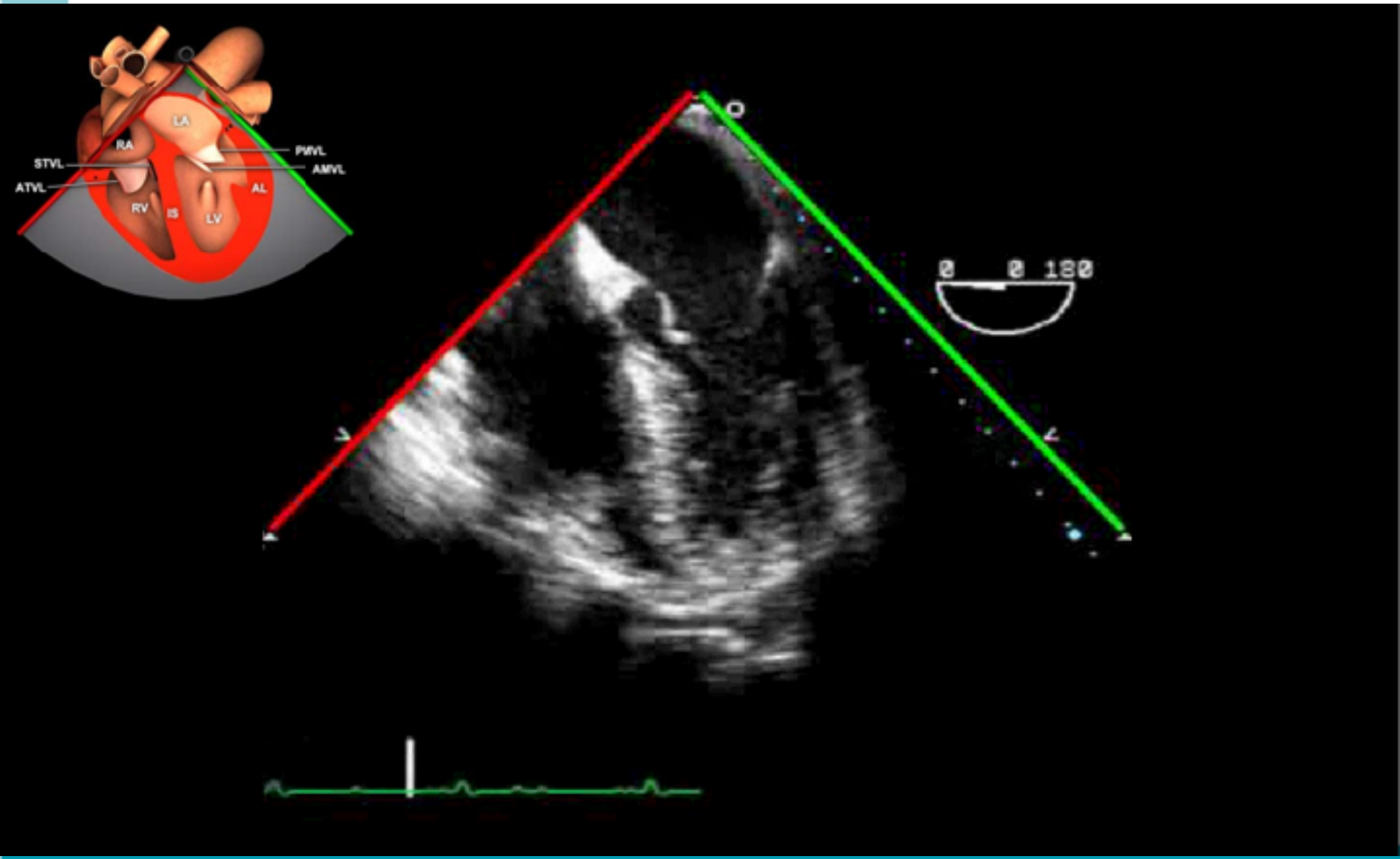


How to Perform Resuscitative Transesophageal Echocardiography in the Emergency Department

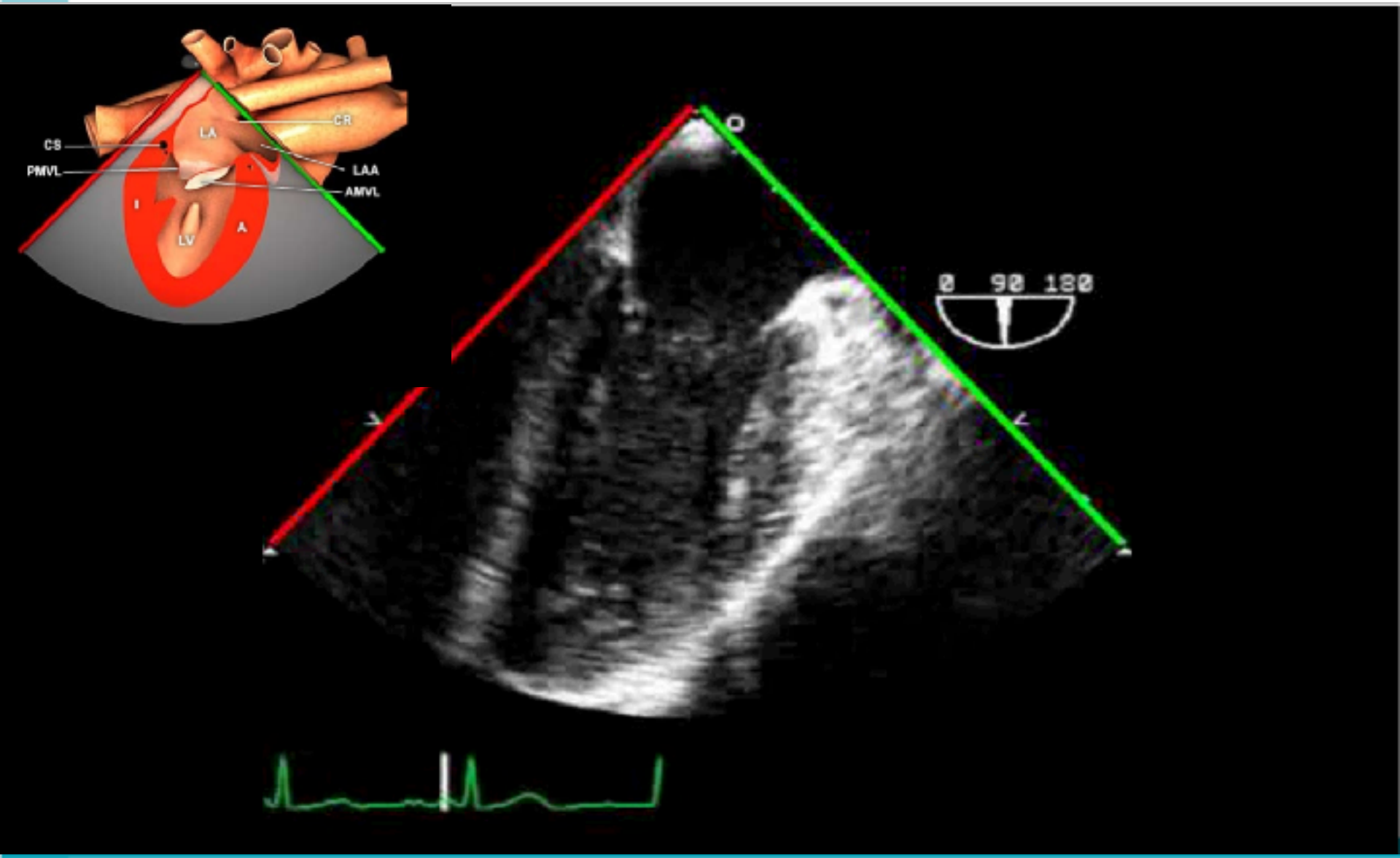
By Michael O'Neil, MD; Arun Nagdev, MD; and Felipe Teran, MD | on July 21, 2020 | 0 Comment

TEE RESOURCES

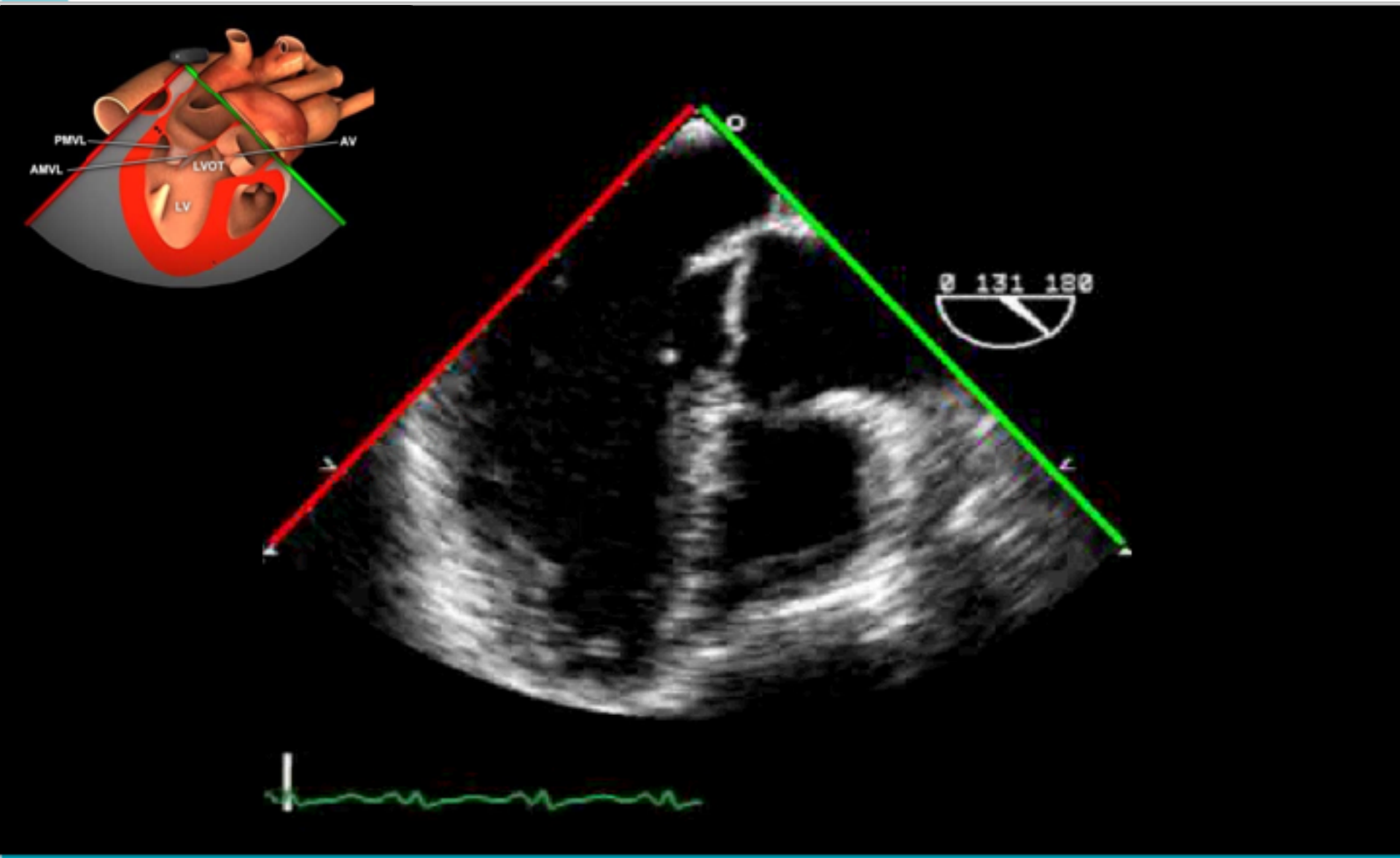
ME 4C view (0°) (定位點)



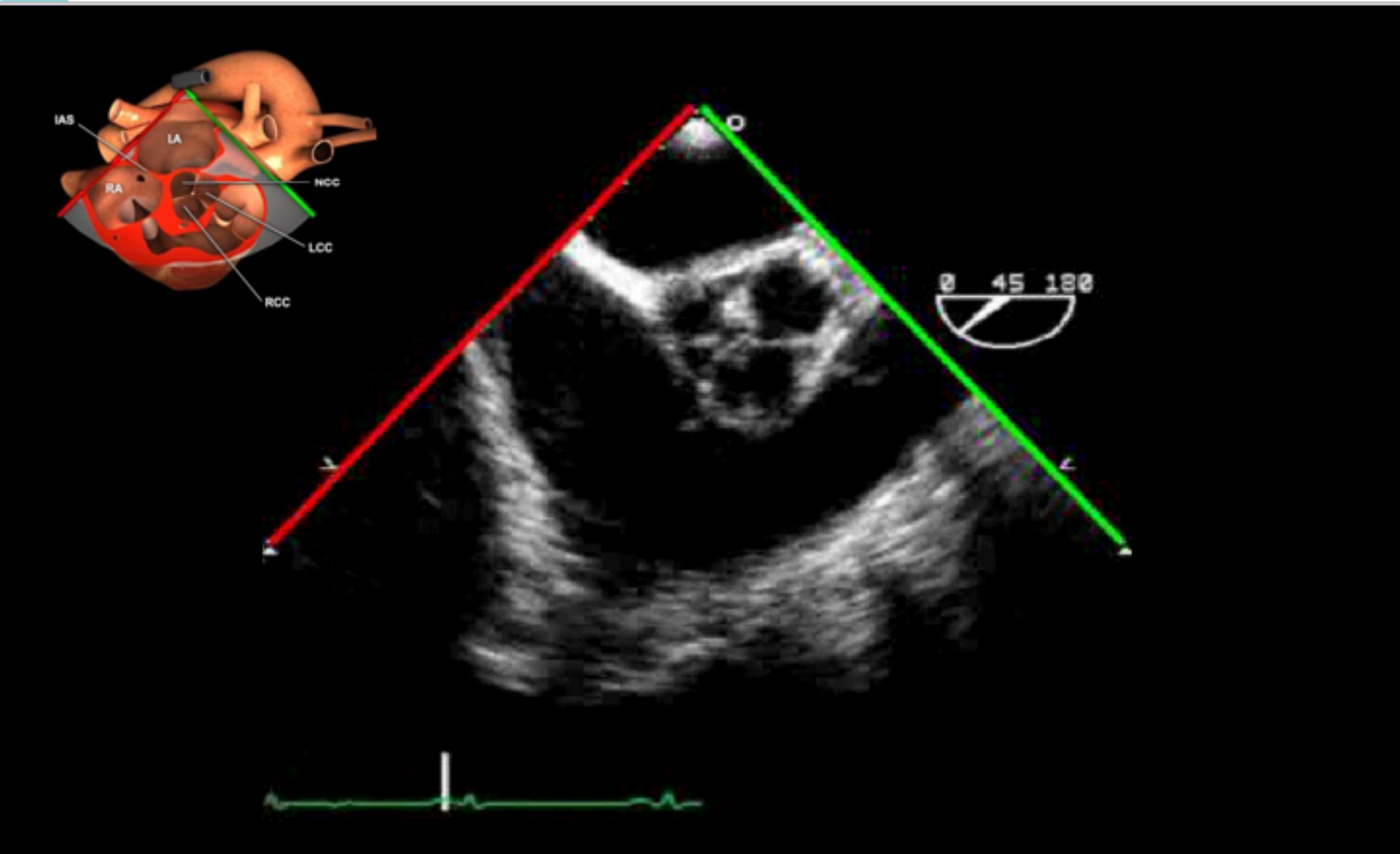
ME 2C view (90°)



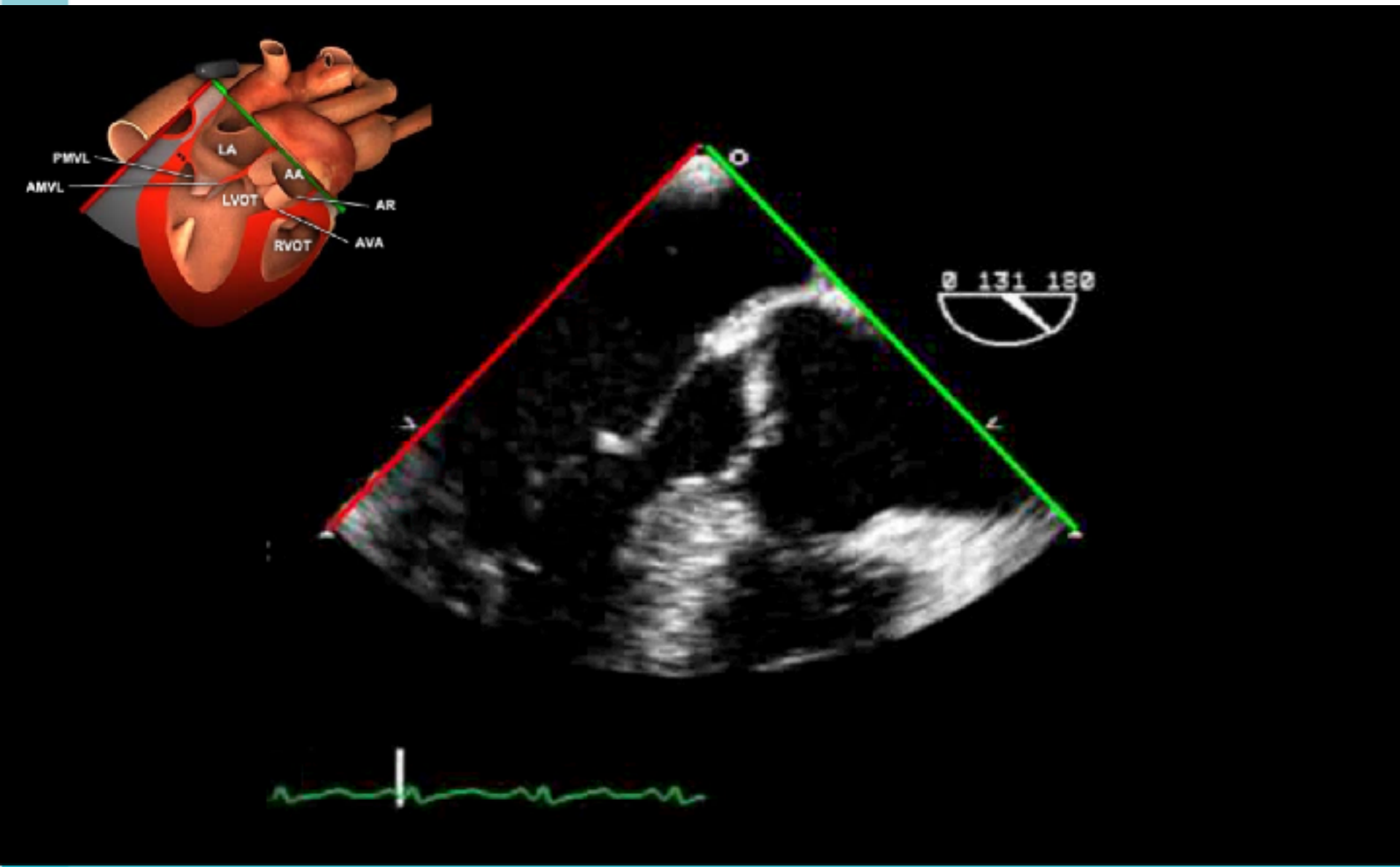
ME LAX view (120°) (CPR 品質)



ME Aortic valve SAX view

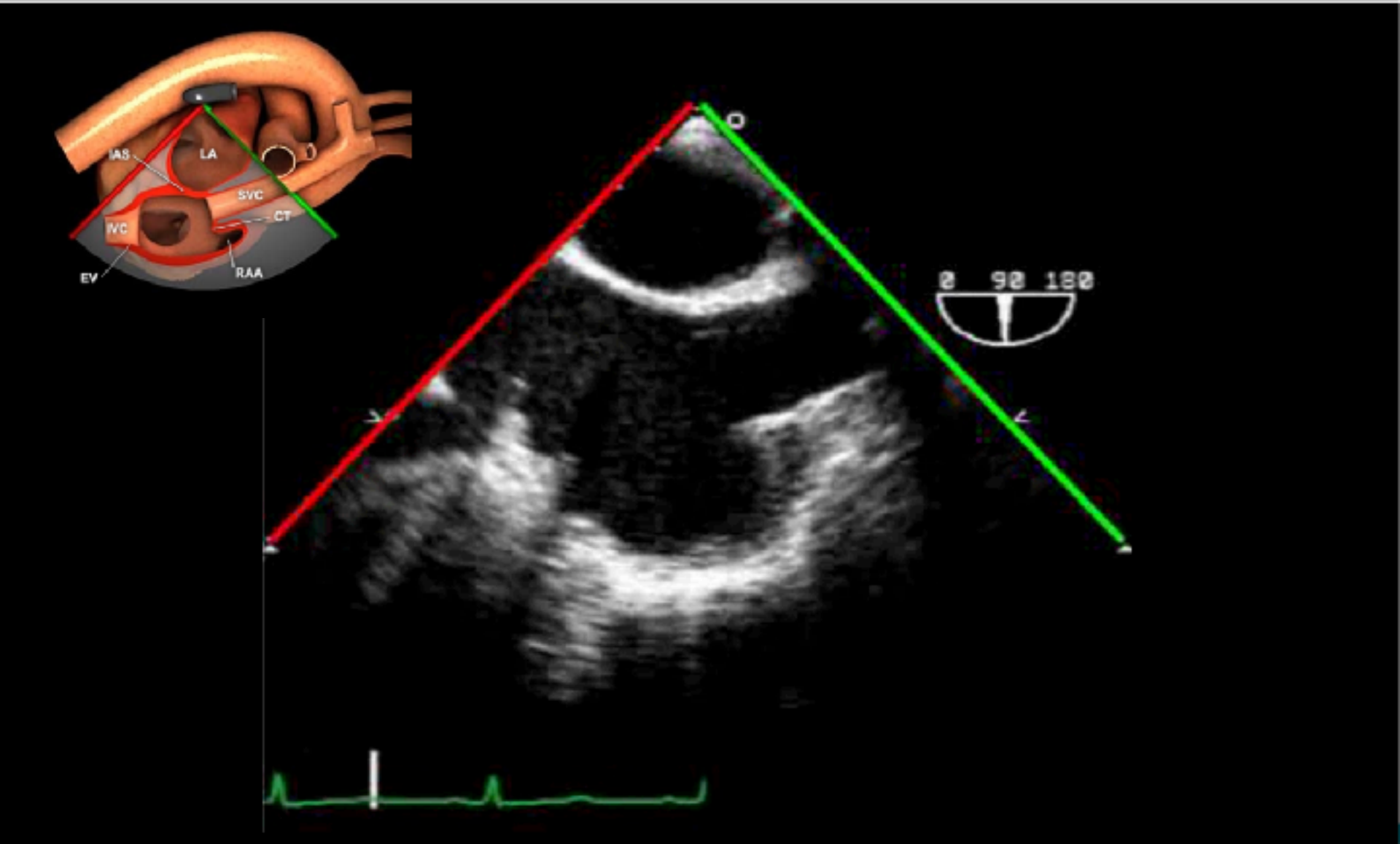


ME Aortic valve LAX view



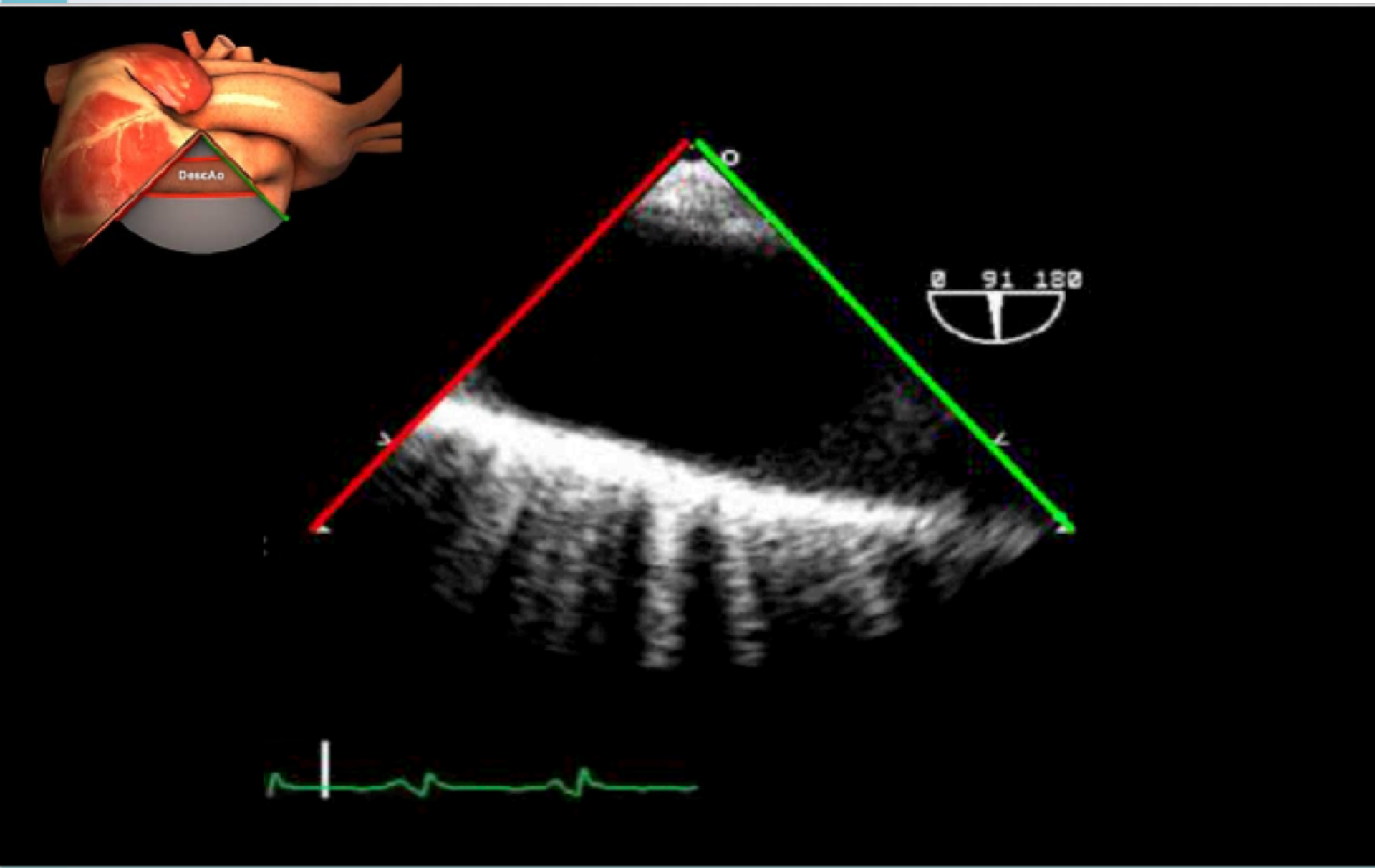
ME RV inflow outflow view

ME Bicaval view (90°)(管路/容積)

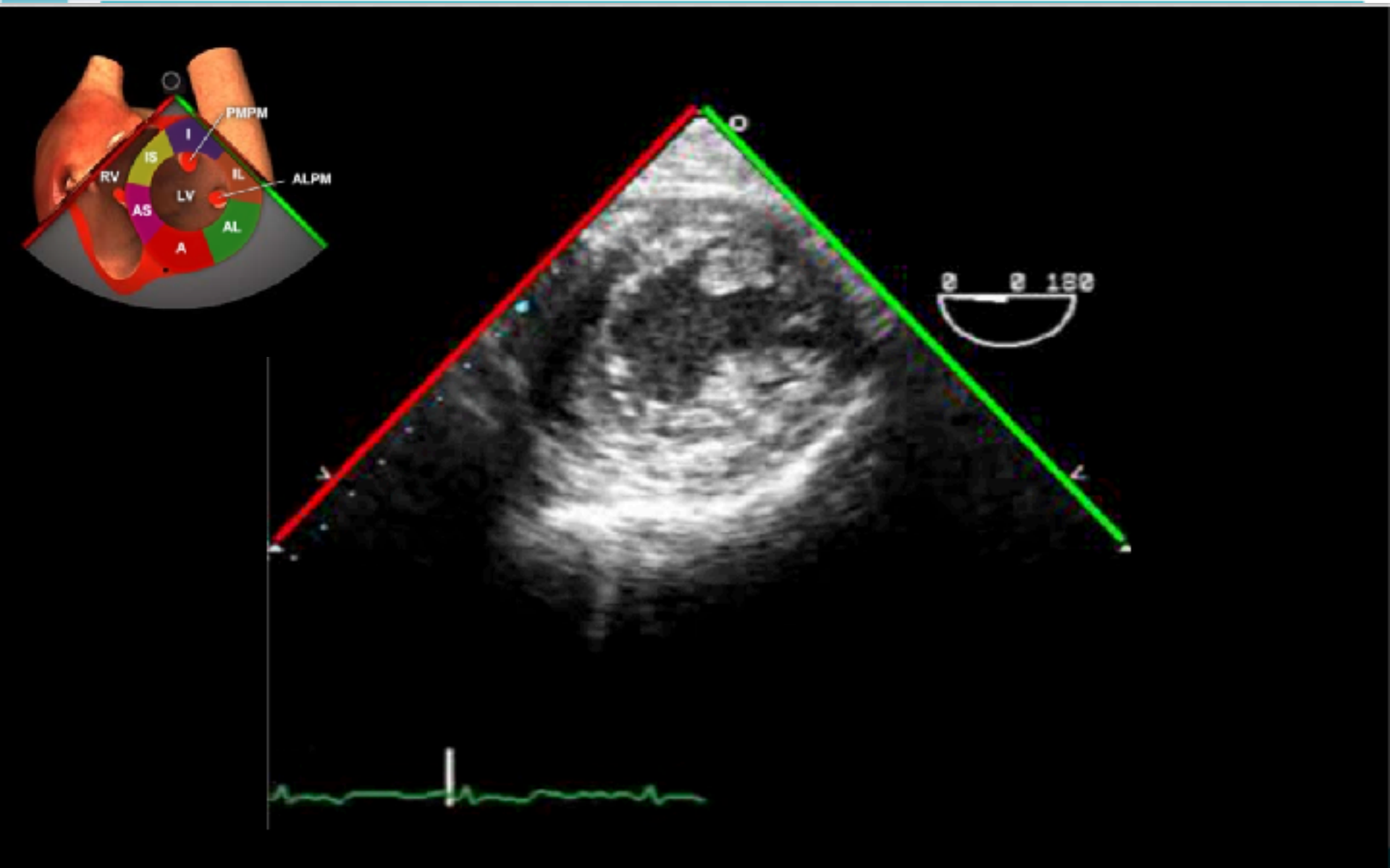


ME Descending aorta SAX view (逆轉向身後)

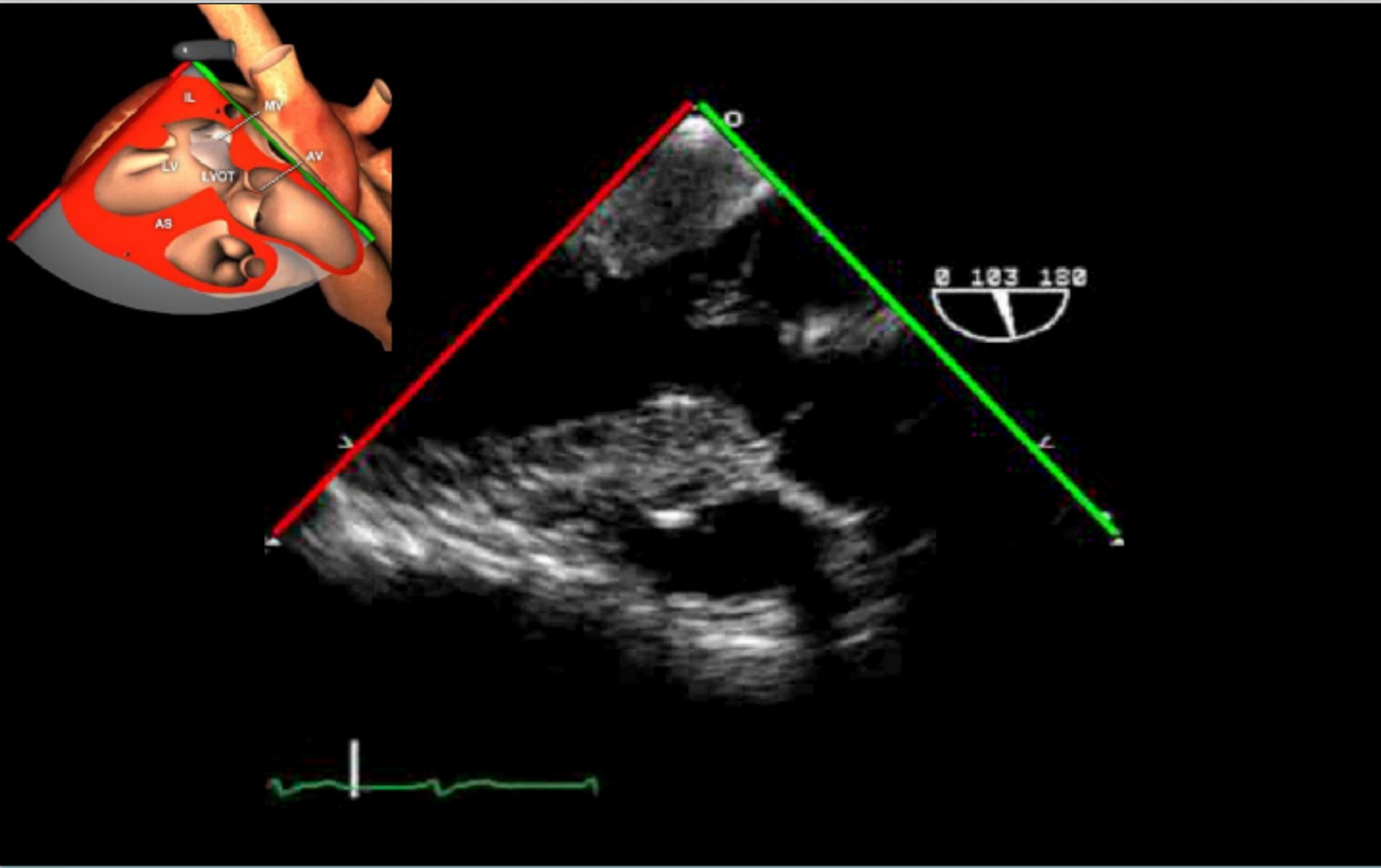
ME Descending aorta LAX view(逆轉向身後)



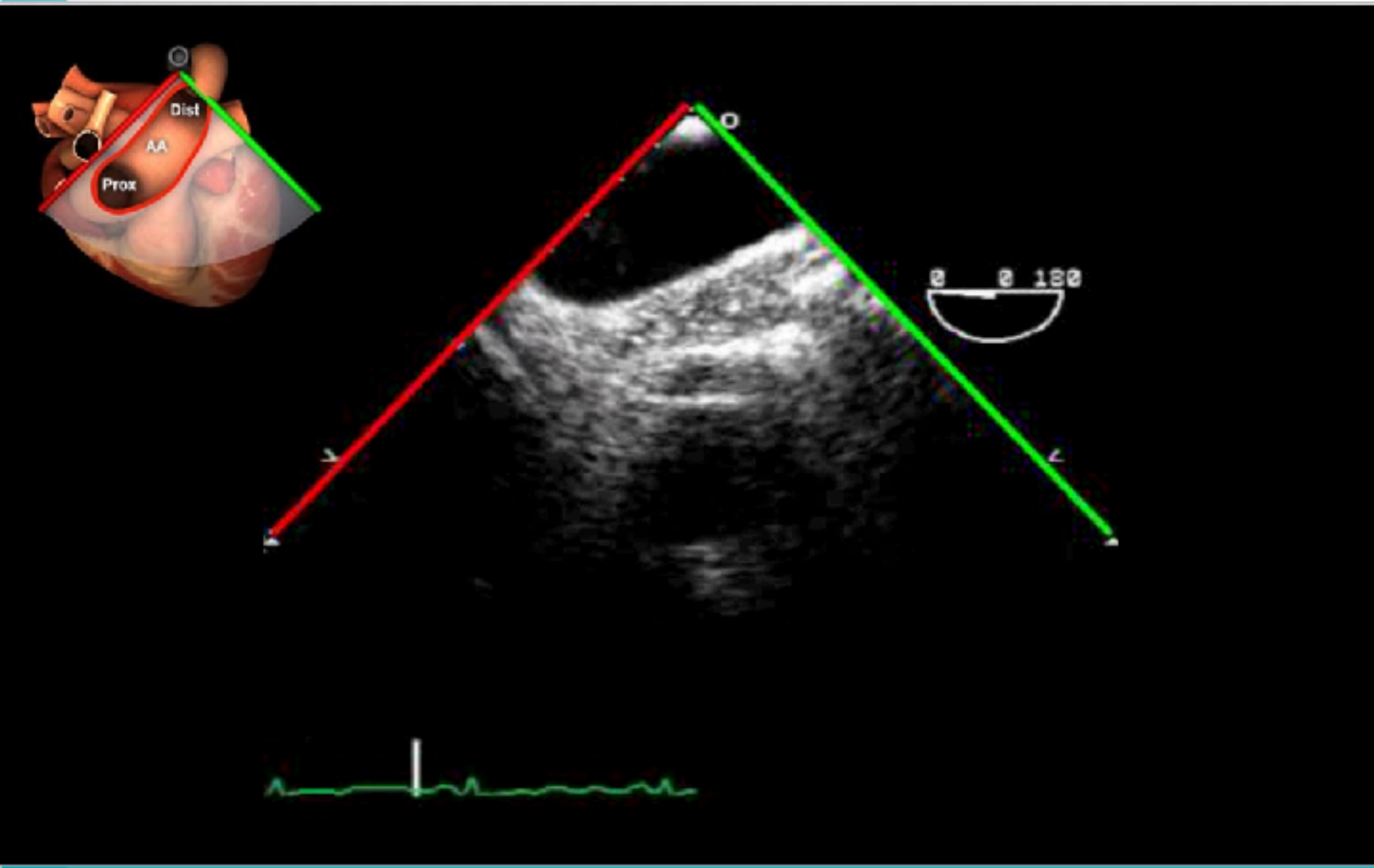
TG Mid SAX view (0°) (大輪順轉前彎向心)



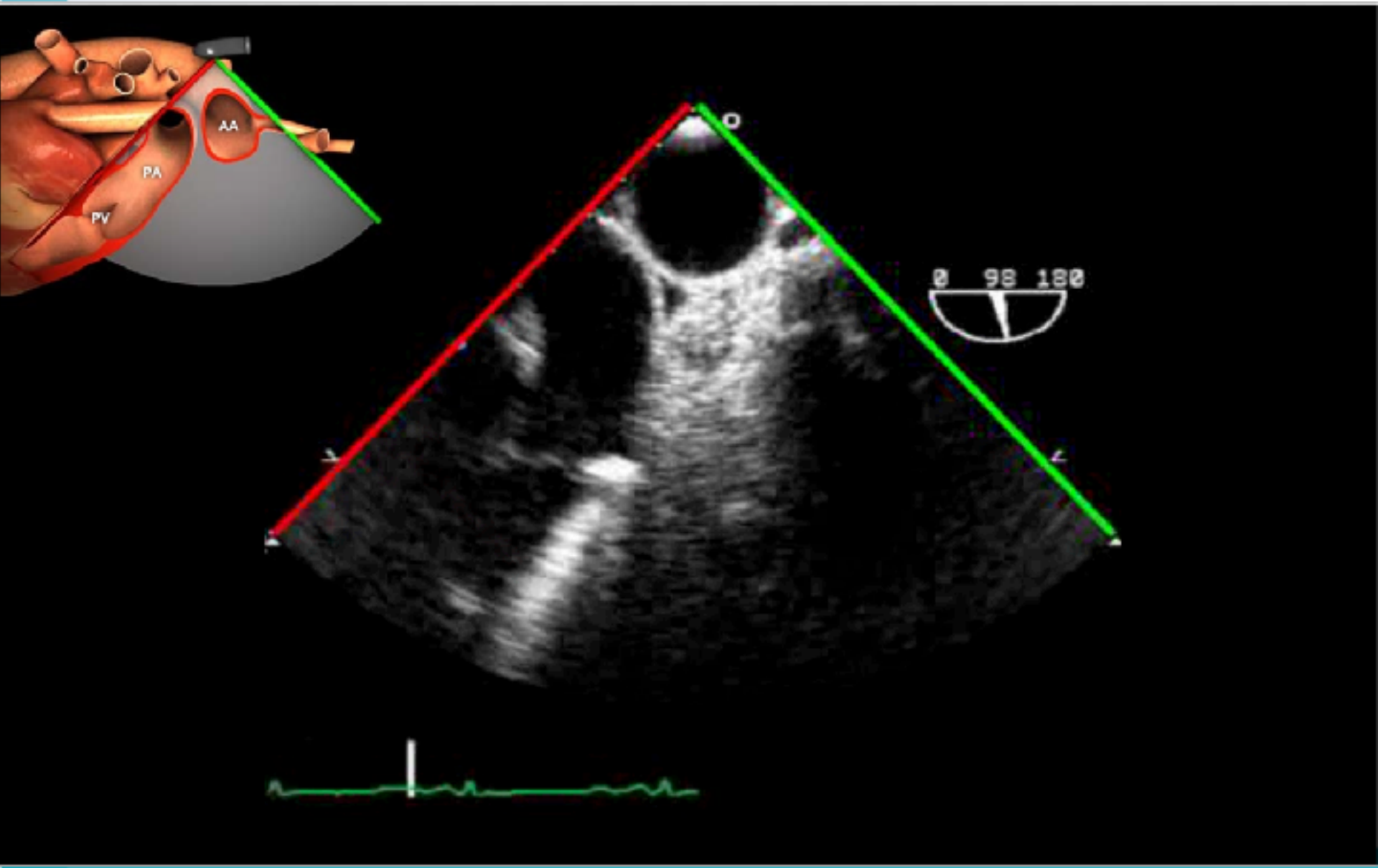
TG LAX view (CPR 品質另一選擇)



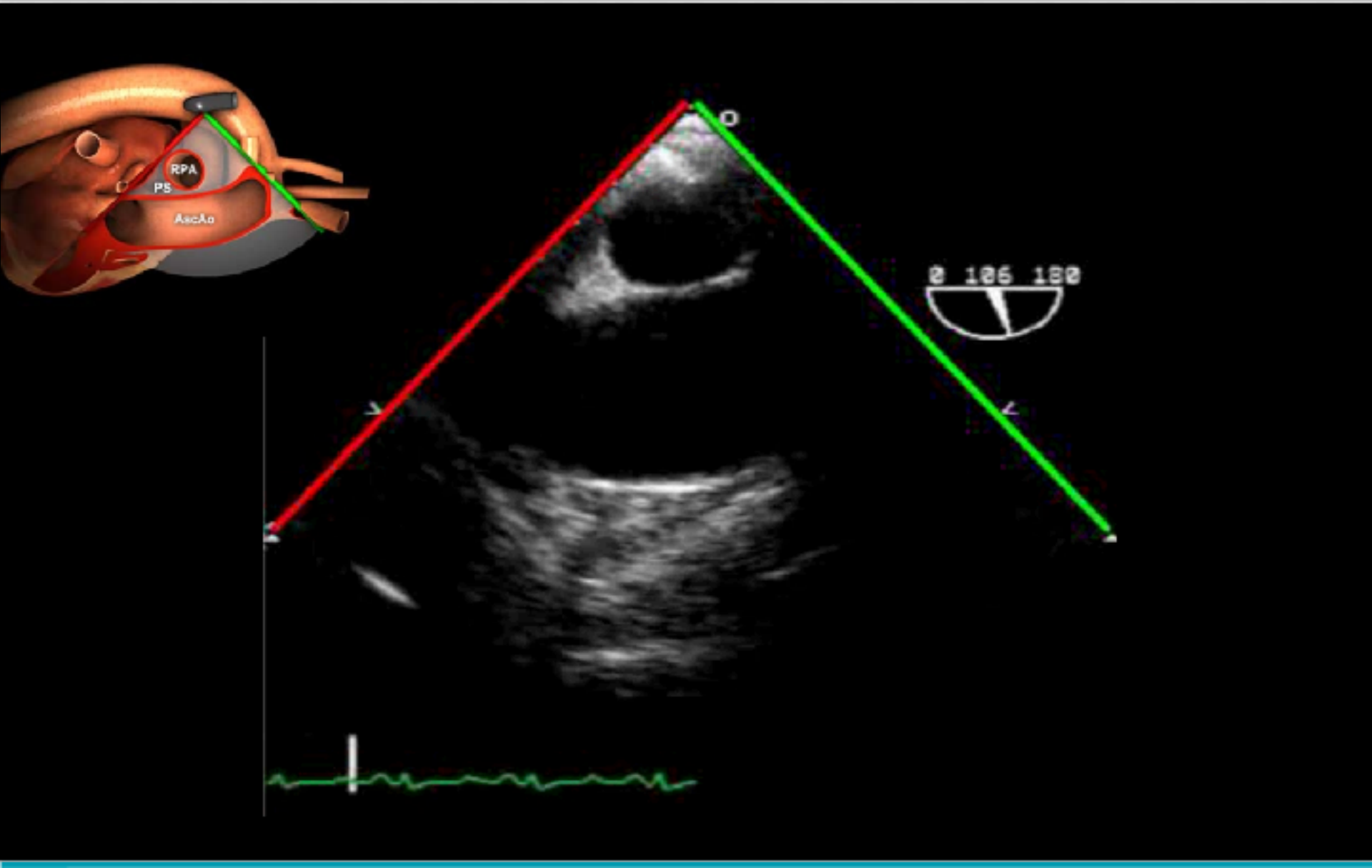
UE Aortic arch LAX view



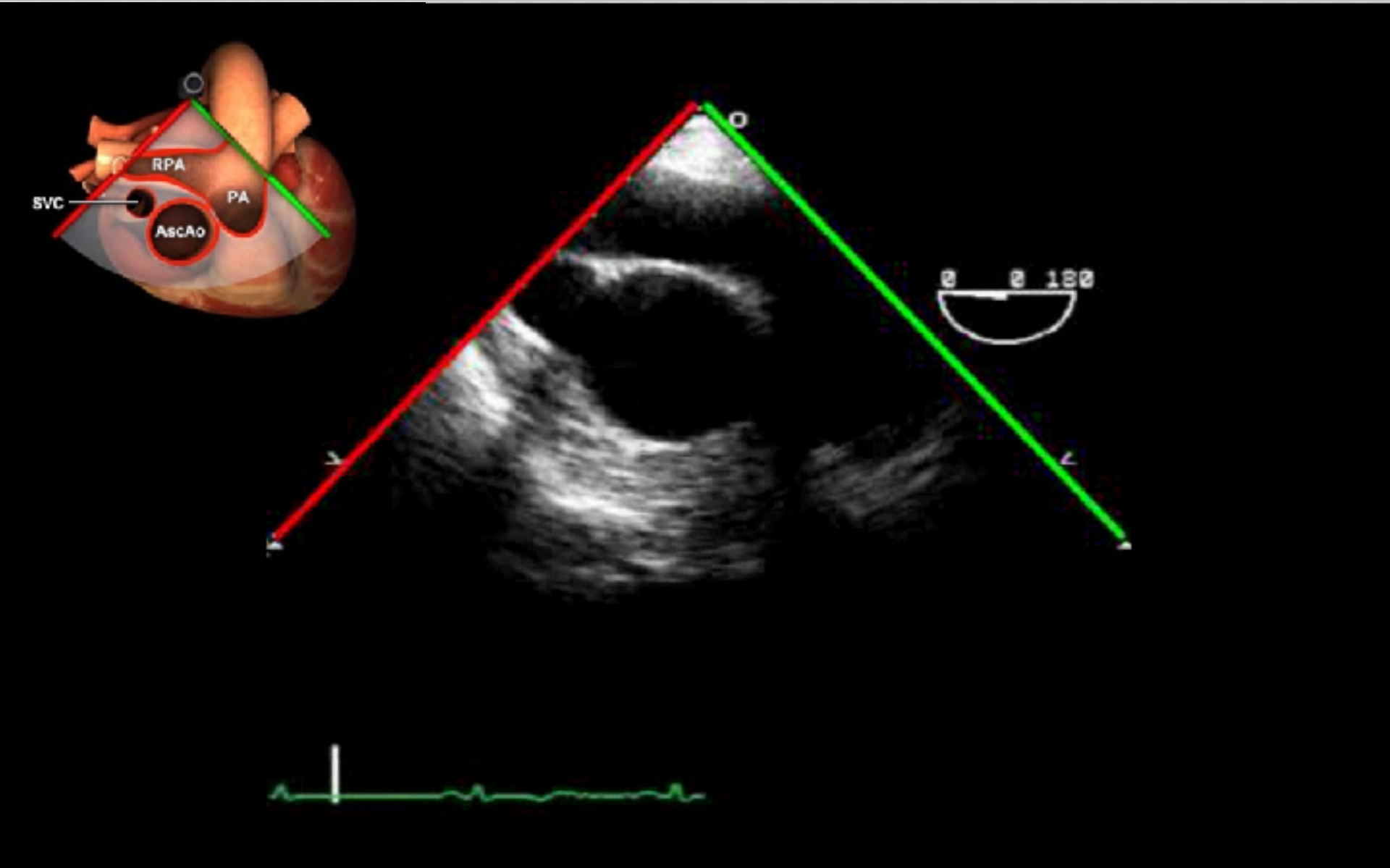
UE Aortic arch SAX view



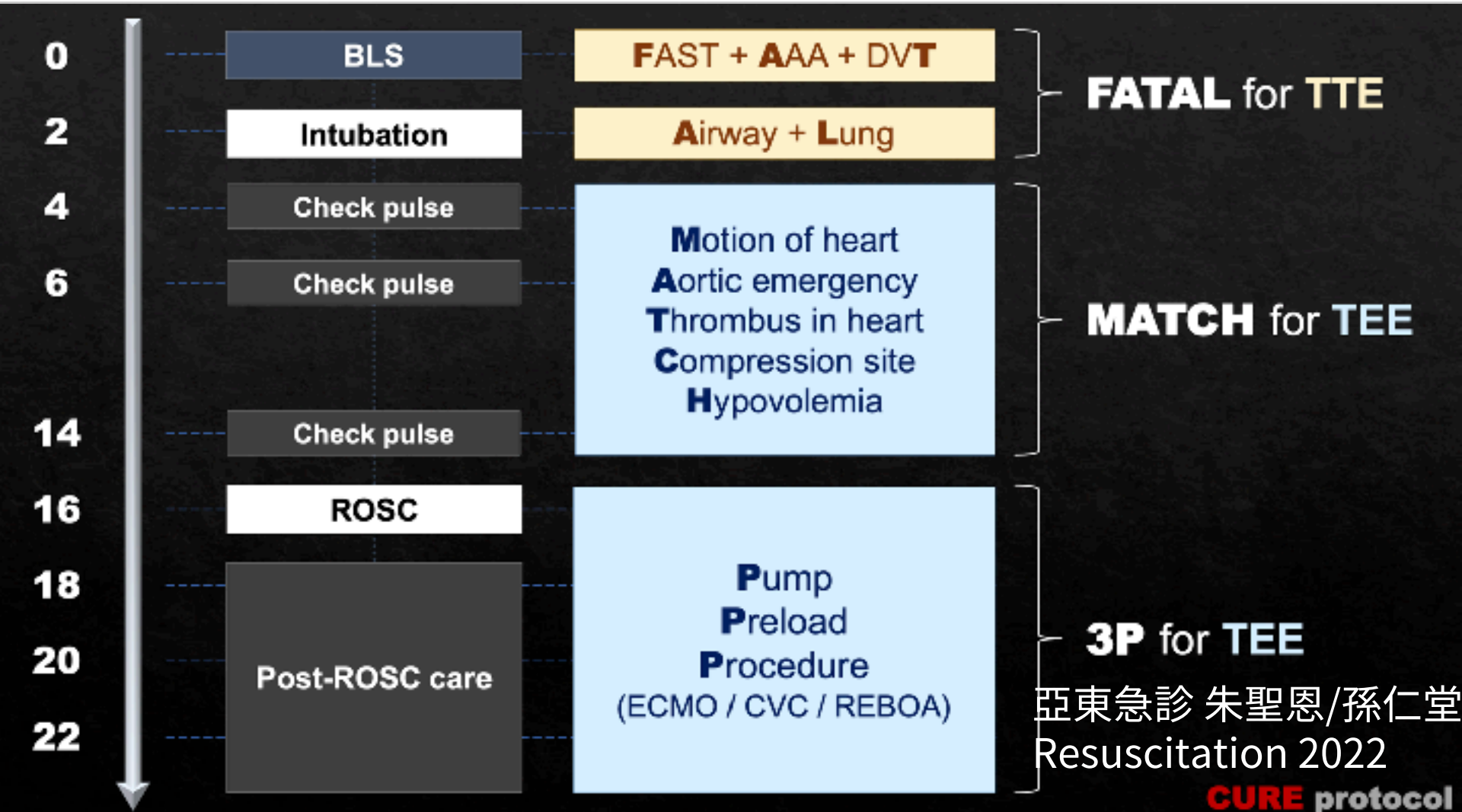
ME Ascending aorta LAX view



ME Ascending aorta SAX view



Core Ultrasound in REsuscitation (CURE): A novel protocol for ultrasound-assistant life support via application of both transesophageal and transthoracic ultrasound



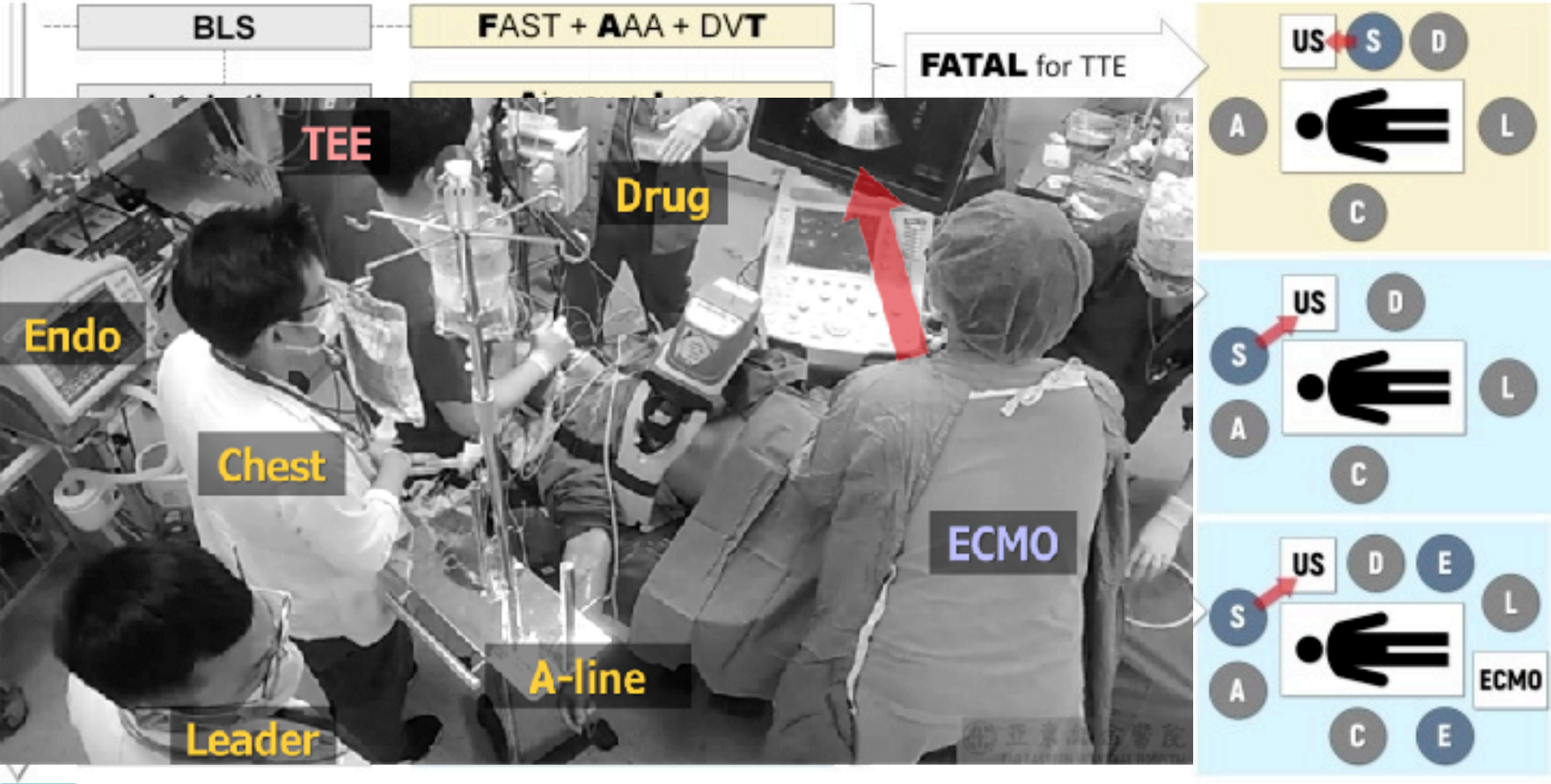
亞東急診 朱聖恩/孫仁堂

Resuscitation 2022

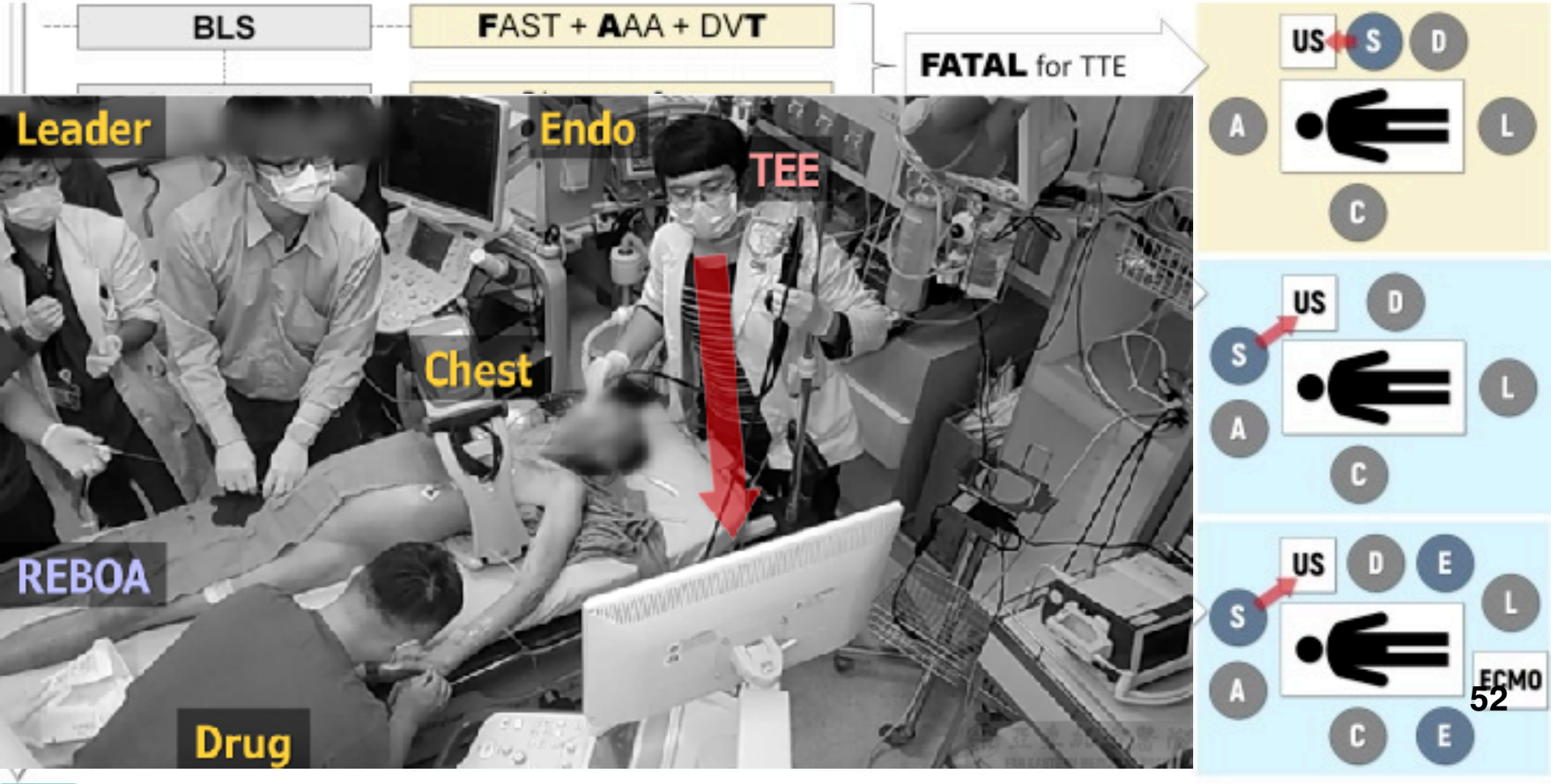
CURE protocol

Core Ultrasound in REsuscitation (CURE): A novel protocol for ultrasound-assistant life support via application of both transesophageal and transthoracic ultrasound

Core Ultrasound in REsuscitation (CURE): A novel protocol for ultrasound-assistant life support via application of both transesophageal and transthoracic ultrasound



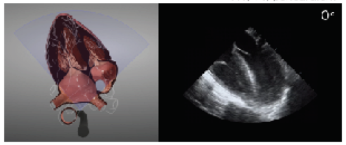
Core Ultrasound in REsuscitation (CURE): A novel protocol for ultrasound-assistant life support via application of both transesophageal and transthoracic ultrasound



亞東急診 朱聖恩/孫仁堂 Resuscitation 2022

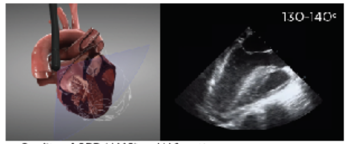
RESUSCITATIVE TEE VIEW GUIDE

ME 4C
RA, LA, RV, LV
MV, TV, pericardium



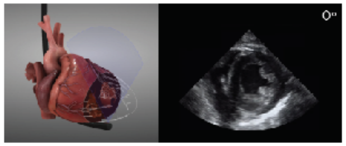
- Pathology pericardium
- RWMA
- LV/RV size & function
- Valvular pathology

ME LAX
LV, LA, MV, AV



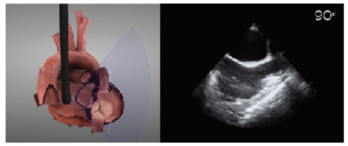
- Quality of CPR (AMC)
- LV function
- Pathology MV
- Pathology AV

TG SAX PAP
LV, RV



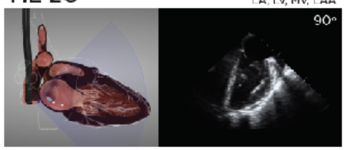
- LV function
- RWMA
- Pathology pericardium

ME Bicaval
IVC, RA, SVC



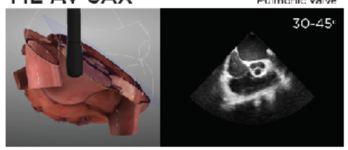
- Procedure guidance
- Venous guidewire
- ECMO
- Volume responsiveness

ME 2C
LA, LV, MV, LAA



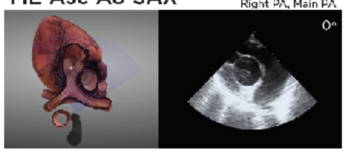
- Pathology LV
- LV apex
- Pathology MV
- Thrombus LAA

ME AV SAX
Cusps of AV, LA, RA,
Pulmonic valve



- Aortic stenosis
- ASD
- Pathology RVOT
- RCA and LMCA

ME Asc Ao SAX
Right PA, Main PA

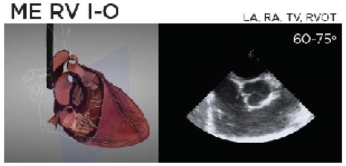


- Asc Aorta
- Pathology of PA
- Pulmonary embolism

ME Asc Ao LAX
Right PA Asc. Aorta

- Pulmonary embolism
- Pathology PA
- Outflow cannula
- LVAD

ME RV I-O
LA, RA, TV, RVOT



- Pathology RVOT
- Doppler TV

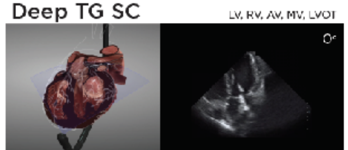
ME DTA SAX
DTA

- IABP
- Impella
- VA ECMO

ME DTA LAX
DTA

- Flow reversal (AI)
- IABP
- Impella
- VA ECMO

Deep TG SC
LV, RV, AV, MV, LVOT



- Doppler (VTI) LVOT

THE RESUSCITATIVE TEE WORKSHOP

www.resuscitativetee.com

Simulator Graphics © Heartworks by Intelligent Ultrasound
TEE images © Felipe Teran M.D.

INTELLIGENT ULTRASOUND

TEE-GUIDED CARDIAC ARREST RESUSCITATION

NON-SHOCKABLE RHYTHM
1. Epinephrine
2. Perform Cardiac Arrest Ultrasound

SHOCKABLE RHYTHM
1. Defibrillate / Cardiovert
2. Continue ACLS

TEE — CPR IN PROGRESS - PRIMARY SURVEY

- TEE Mid Esophageal 4c / Trans-Gastric Short Axis → Pericardial Effusion / Tamponade → Pericardiocentesis
- TEE Mid-Esophageal Long Axis → Inadequate LV compression / Obstruction LVOT → Reposition AMC

TEE — RHYTHM CHECK 1

- TEE Mid-Esophageal 4c → Ventricular Fibrillation → Defibrillate
- → Pseudo-PEA → Hs and Ts / Consider treating as profound shock

US — CPR IN PROGRESS - SECONDARY SURVEY

- ABDOMINAL FREE FLUID → Free Fluid in Chest or Abdomen → Consider surgical etiology
- AORTA → AAA > 4 cm → Consider ruptured AAA
- FEMORAL VEINS → DVT → Consider thrombolysis for PE

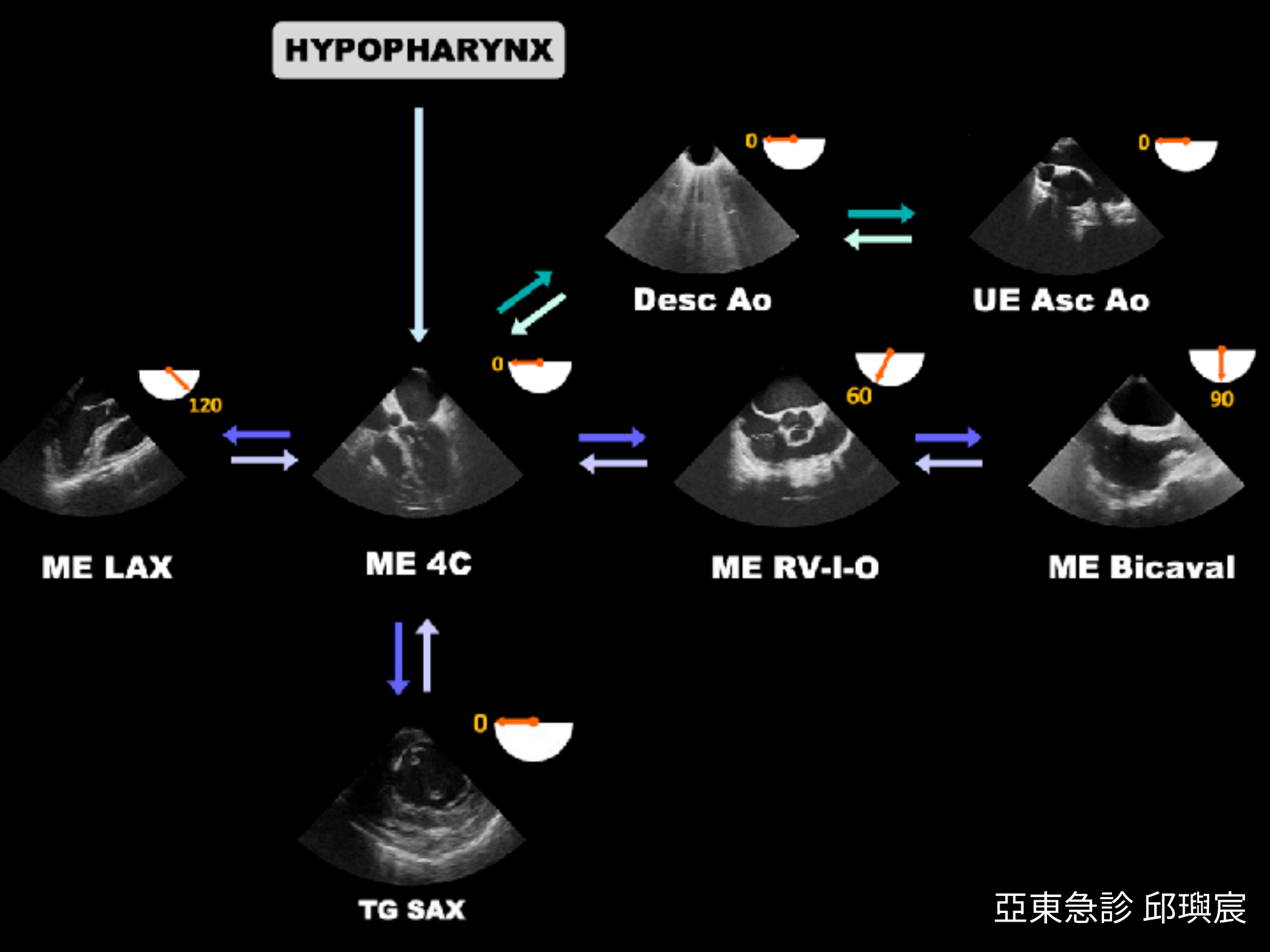
US / TEE — RHYTHM CHECK 2

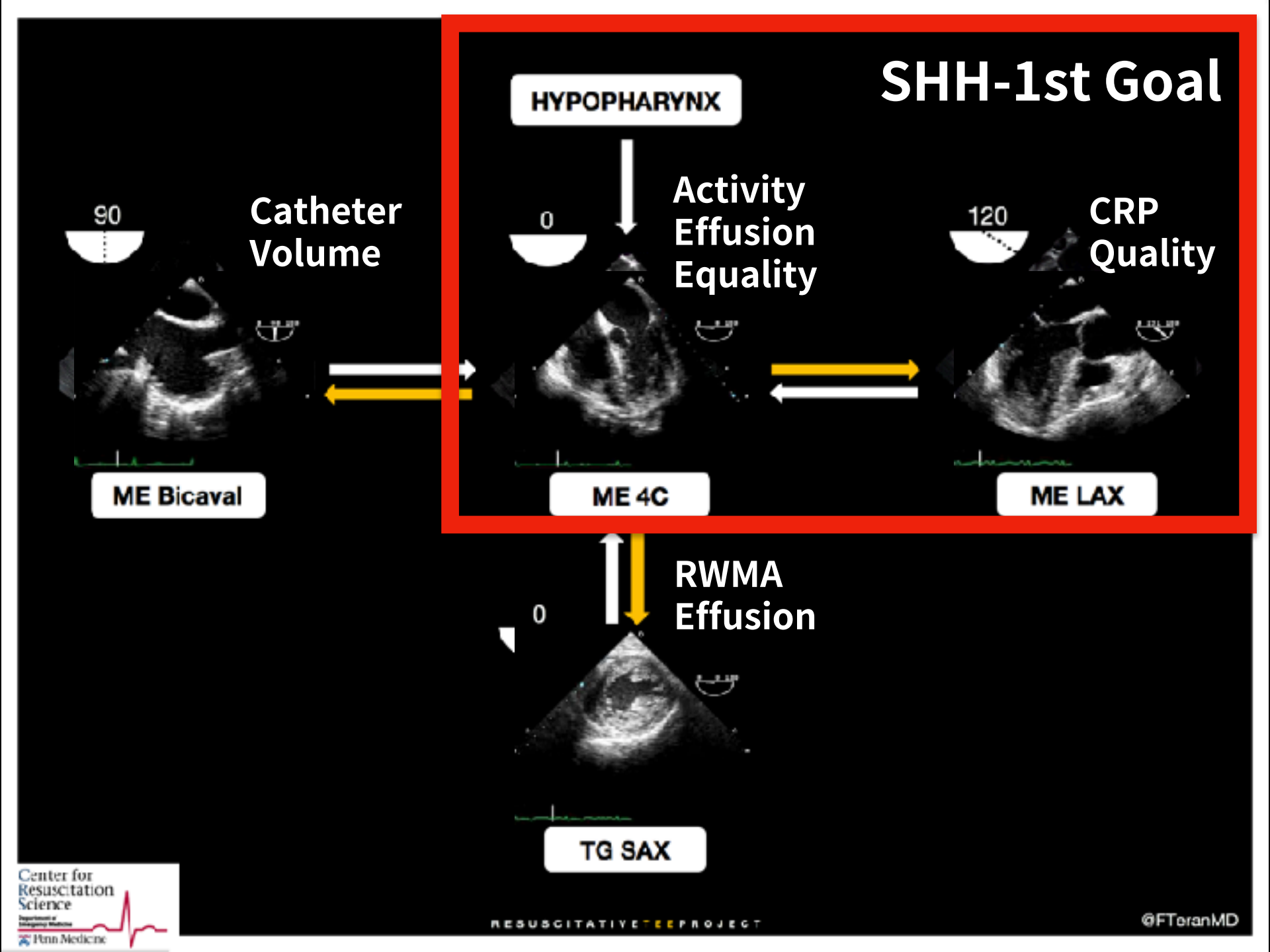
- PLEURA → Pneumothorax → Thoracostomy
- Mid Esophageal 4c → ROSC → Post Cardiac Arrest Care
- → Cardiac Standstill & $EtCO_2$ <20 mmHg after 20 minutes → Terminate Resuscitation

TEE — ADDITIONAL VIEW

- Mid Esophageal Bicaval → Procedural Guidance

TEE: Transesophageal Echocardiography
AMC: Automated Mechanical Compression
US: Transthoracic / Transabdominal Ultrasound (i.e. Phased Array Probe)


HYPOPHARYNX
0
Desc Ao
0
UE Asc Ao
0
120
ME LAX
ME 4C
60
ME RV-I-O
90
ME Bicaval
0
TG SAX


SHH-1st Goal
HYPOPHARYNX
Activity
Effusion
Equality
90
Catheter
Volume
0
120
CRP
Quality
ME Bicaval
ME 4C
ME LAX
RWMA
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