



# BASIC TEE IN ER

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

# 陳國智 醫師



急診超音波臨床評核醫師  
醫用超音波學會指導醫師  
雙和急診超音波教學負責人  
WINFOCUS director / instructor

**急診 / 重症 / 介入 / 急性疼痛**

經歷

新光急診超音波訓練中心主任  
西園醫院急診醫學科主任  
急診醫學會超音波委員會主委  
台灣疼痛醫學會大體模擬手術講師  
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# Transesophageal Echocardiographic Assessment of Mitral Valve Position and Pulmonary Venous Flow During Cardiopulmonary Resuscitation in Humans

Matthew Huei-Ming Ma, Juey-Jen Hwang, Ling-Ping Lai, Shih-Ming Wang, Guan-Tarn Huang, Kou-Gi Shyu, Yu-Lin Ko, Jiunn-Lee Lin, Wen-Jone Chen, Kwan-Lih Hsu, Jin-Jer Chen, Peiliang Kuan, Yung-Zu Tseng and Wen-Pin Lien

Originally published 15 Aug 1995 | <https://doi.org/10.1161/01.CIR.92.4.854> | Circulation. 1995;92:854-861

## TEE in Resuscitation

- Time for echo checks/pulse checks greatly reduced
- Remember, the AHA and European council guidelines urge little break time from quality compressions



# WINFOCUS

## 2010

## Rome

### TEE in Resuscitation

- Currently price is a disadvantage, typically \$40,000 +/- \$5,000
- Requires additional training
- But for focused application can do focused training







宇陞科技



# 20221015 急加年會工作坊





# 20221123 TE7 & TEE



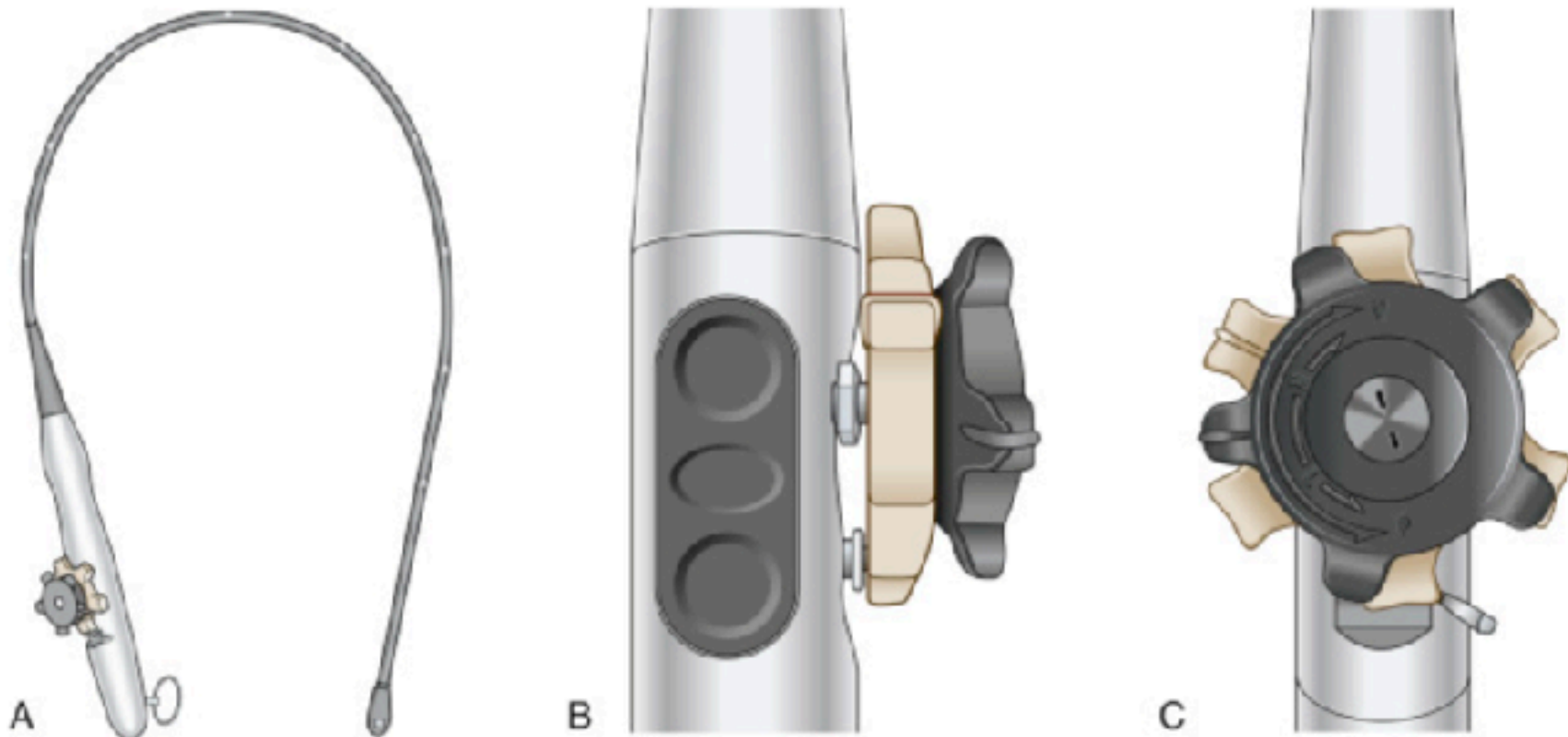
# TransEsophageal Echocardiography





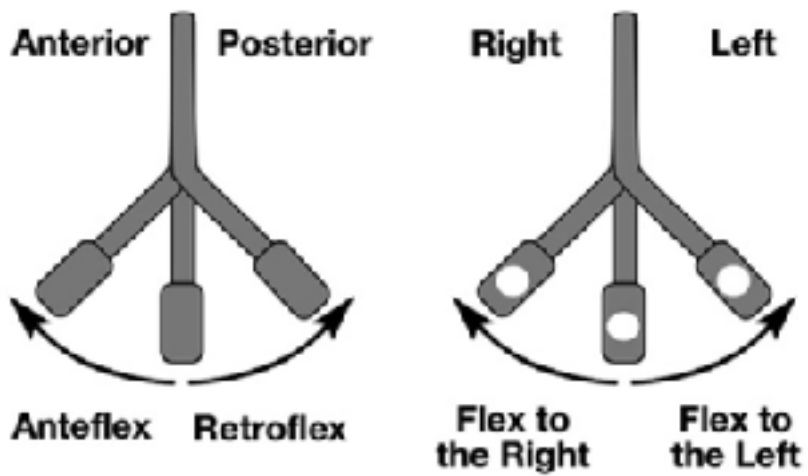
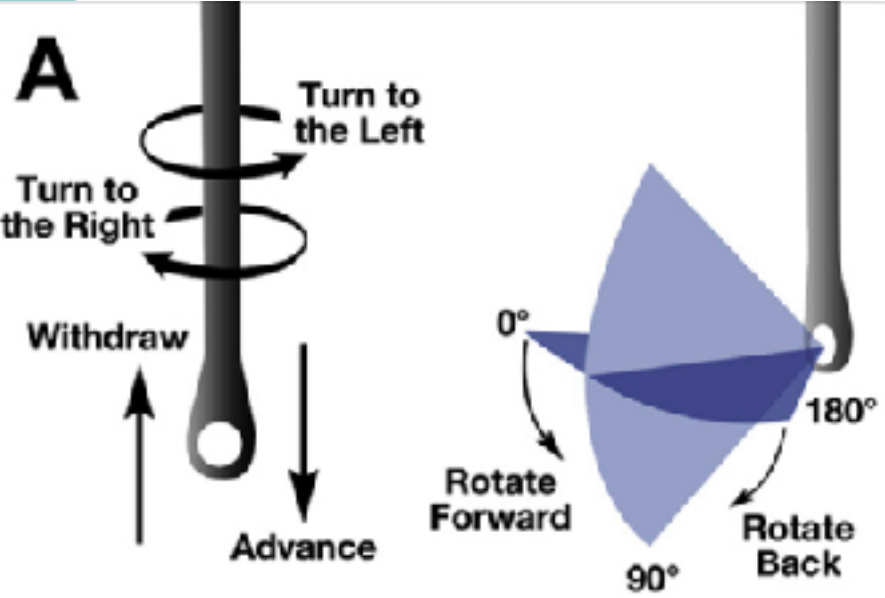
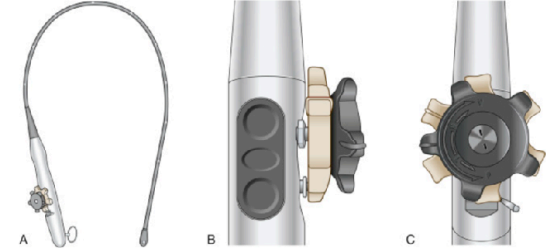


# TransEsophageal Echocardiography



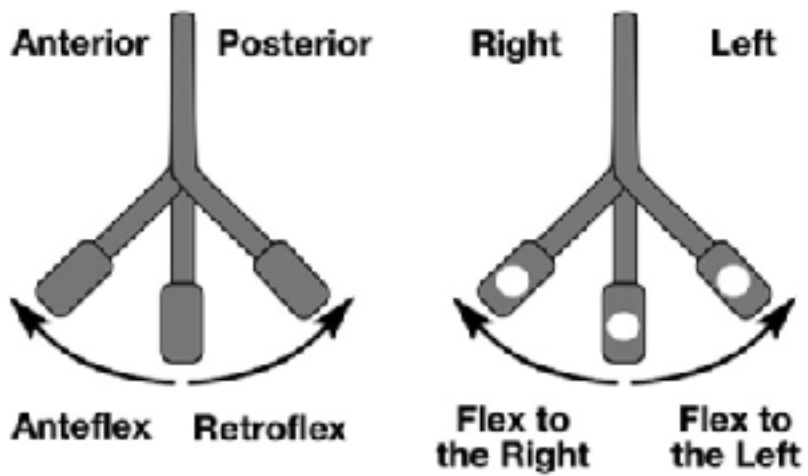
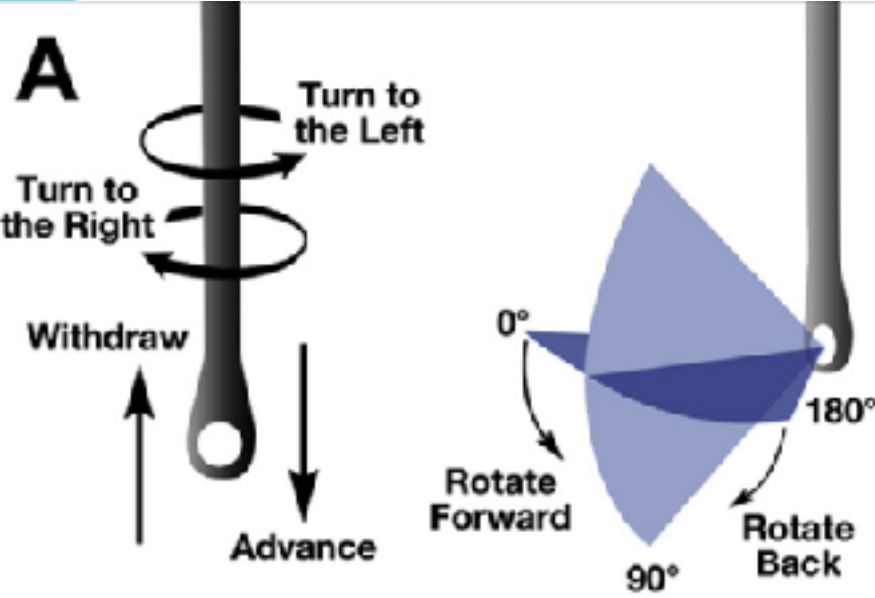
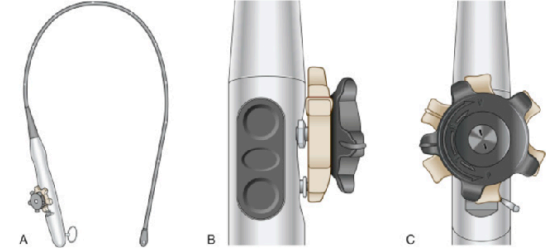
- 1主線: 前進後退加順逆轉動
- 2轉輪: 控制前後左右彎曲
- 2按鈕: 調節晶體角度 (0~180)

# How to perform TEE ?



**進和退**  
**順逆轉**  
**面朝前**  
**晶體旋**  
**前後彎**  
**左右彎**

# How to perform TEE ?



主幹線順時鐘：看腔靜脈

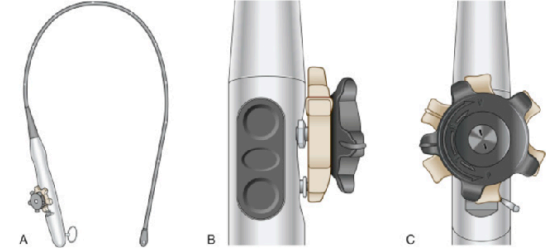
大轉輪順時鐘：向前彎曲

小轉輪順時鐘：向右彎曲

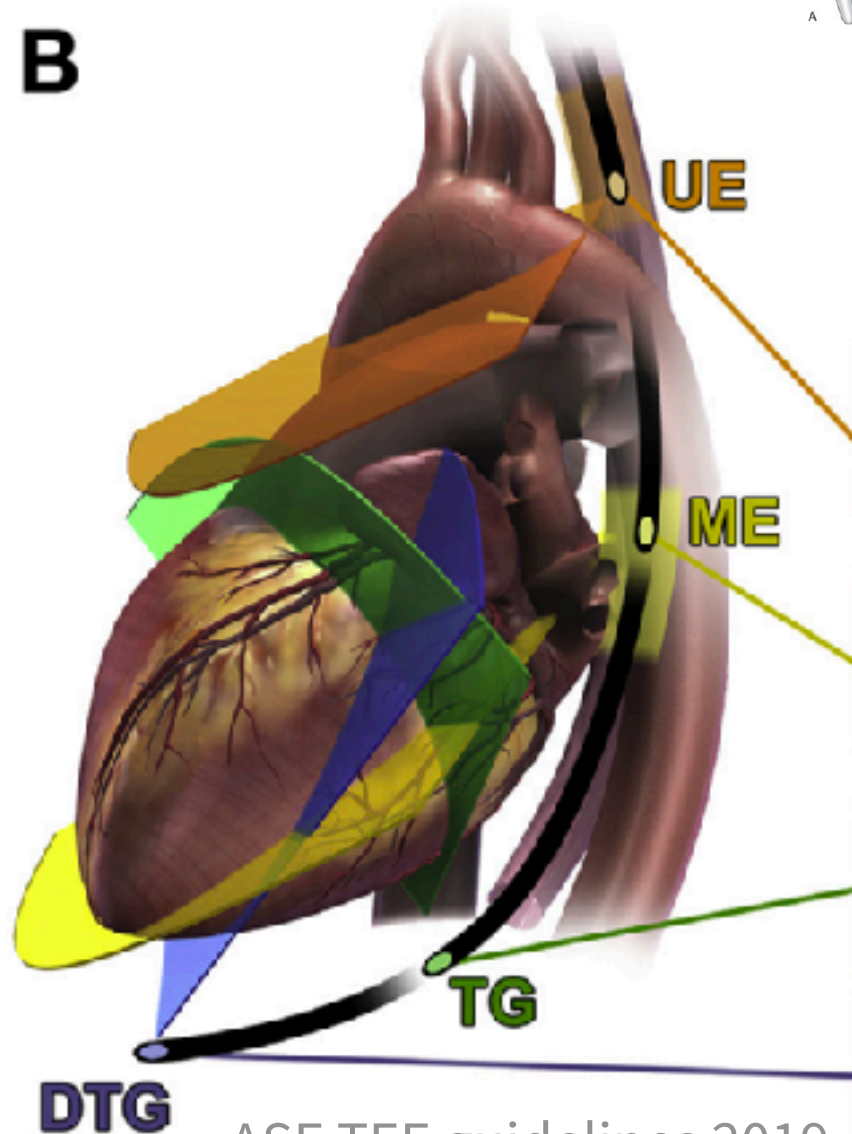


# How deep should we go ?

4



**B**



Upper Esophageal (UE)

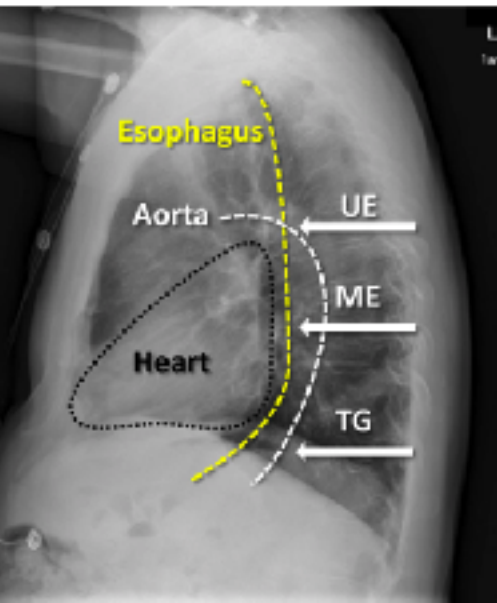
Mid Esophageal (ME)

Transgastric (TG)

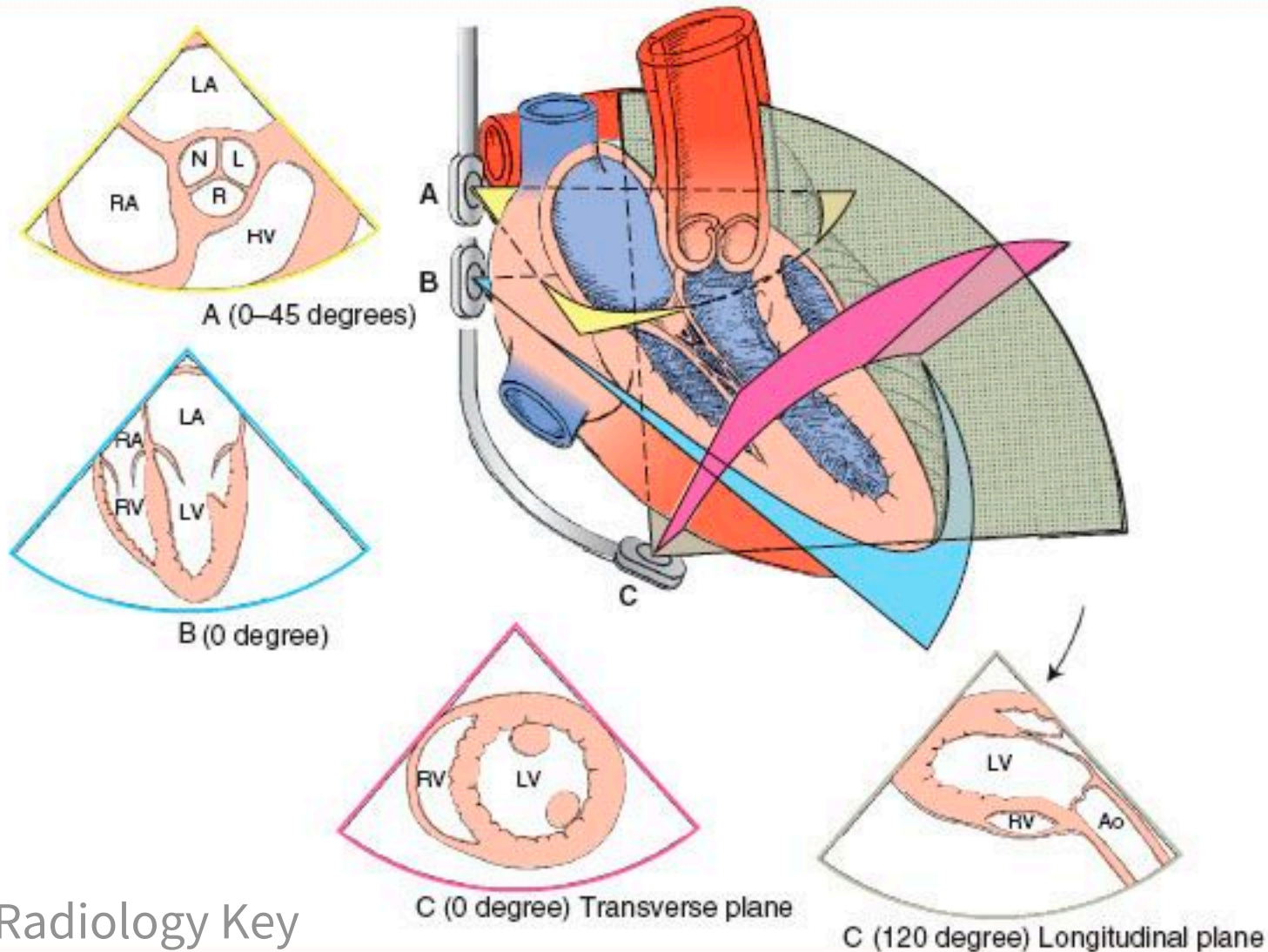
Deep Transgastric (DTG)

**DTG**

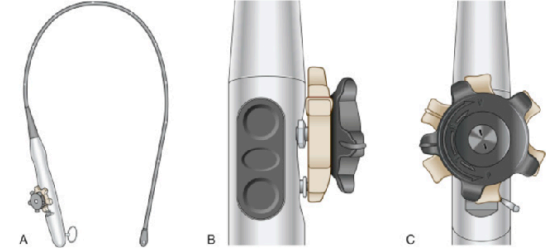
ASE TEE guidelines 2019



# TEE Basic Views at different levels



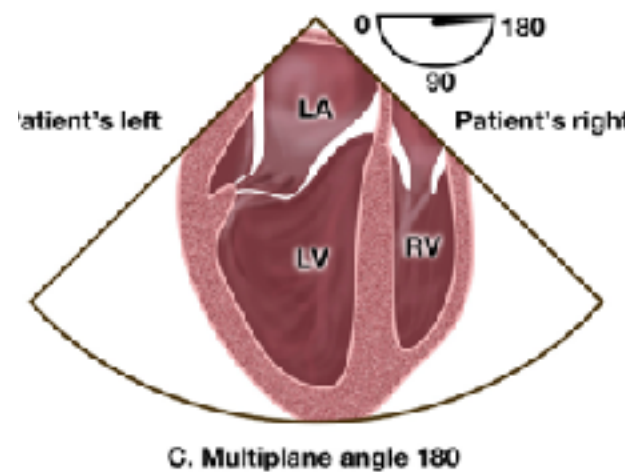
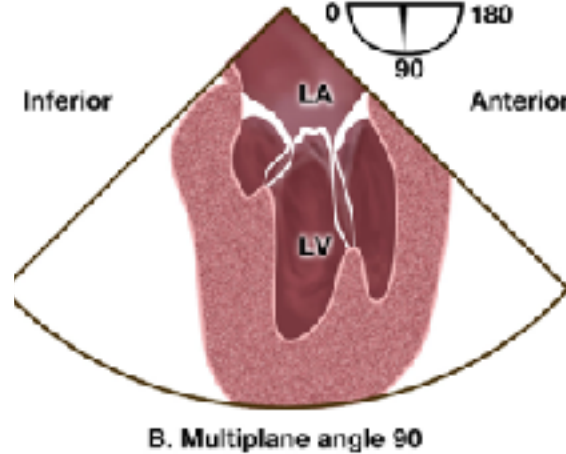
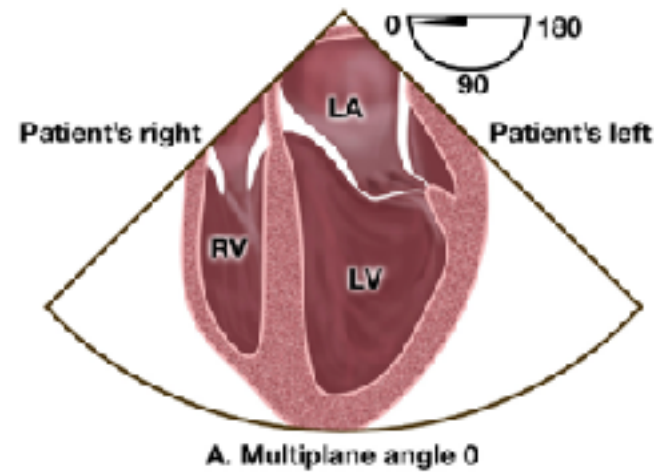
# How to define degree ?



0°

90°

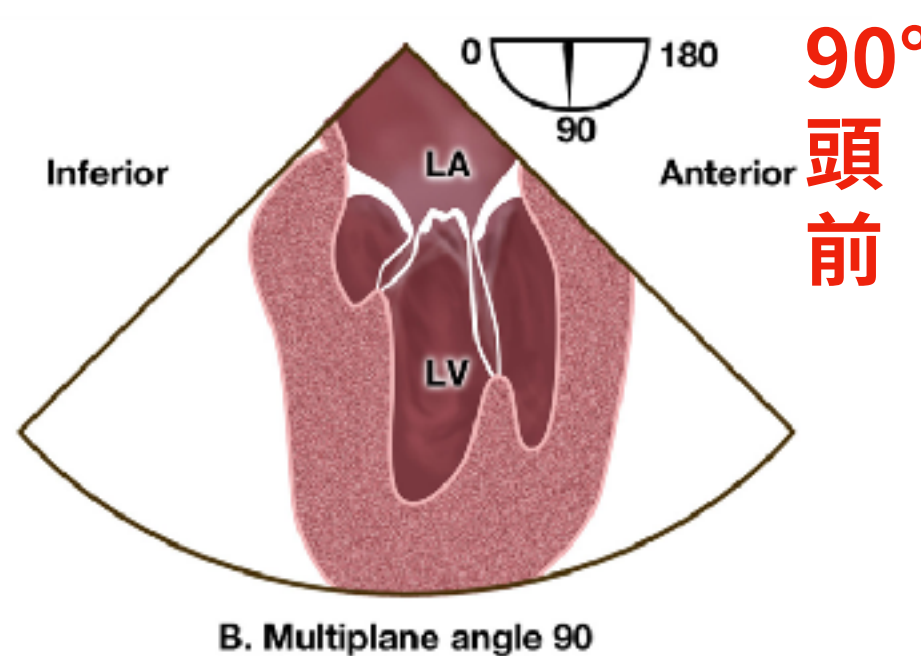
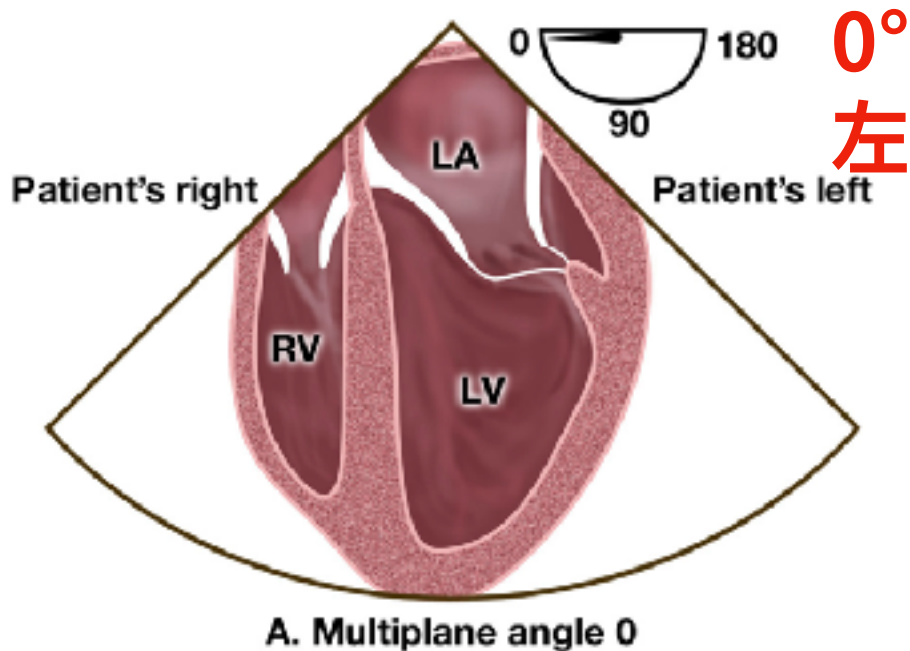
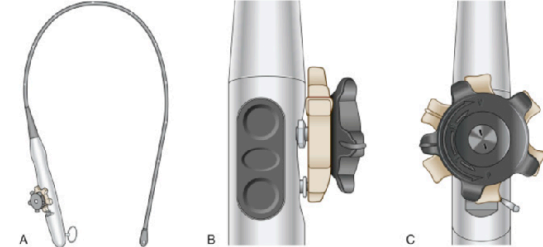
180°



最接近TEE的腔室為 **LA**



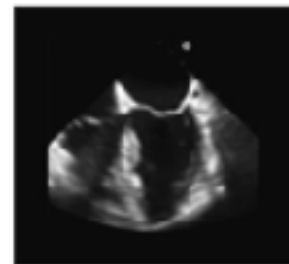
# 確認0°和90°的定位



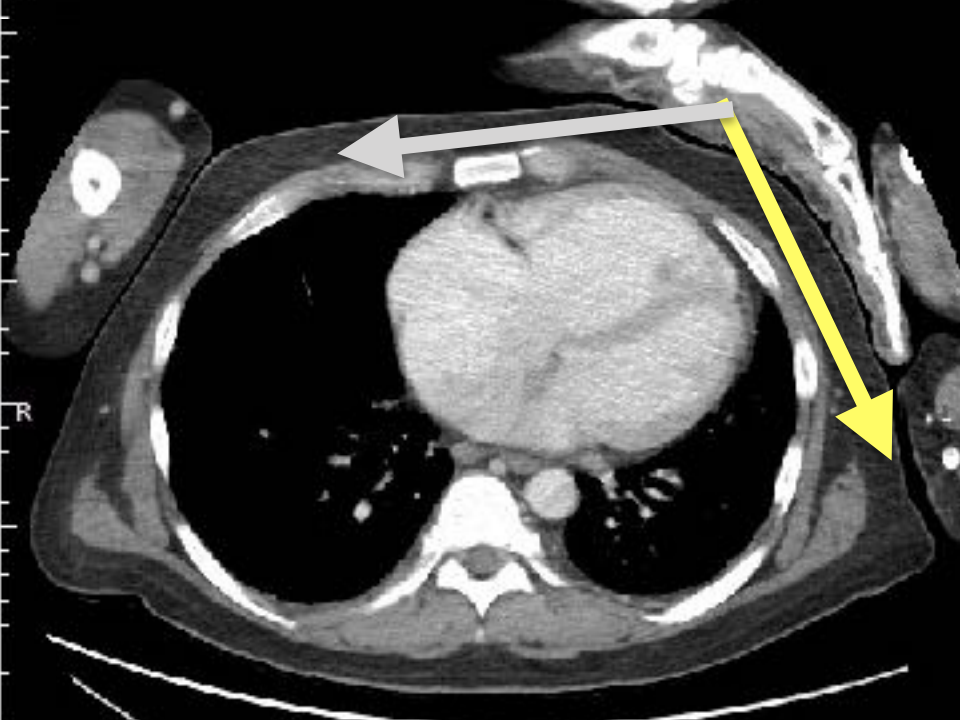
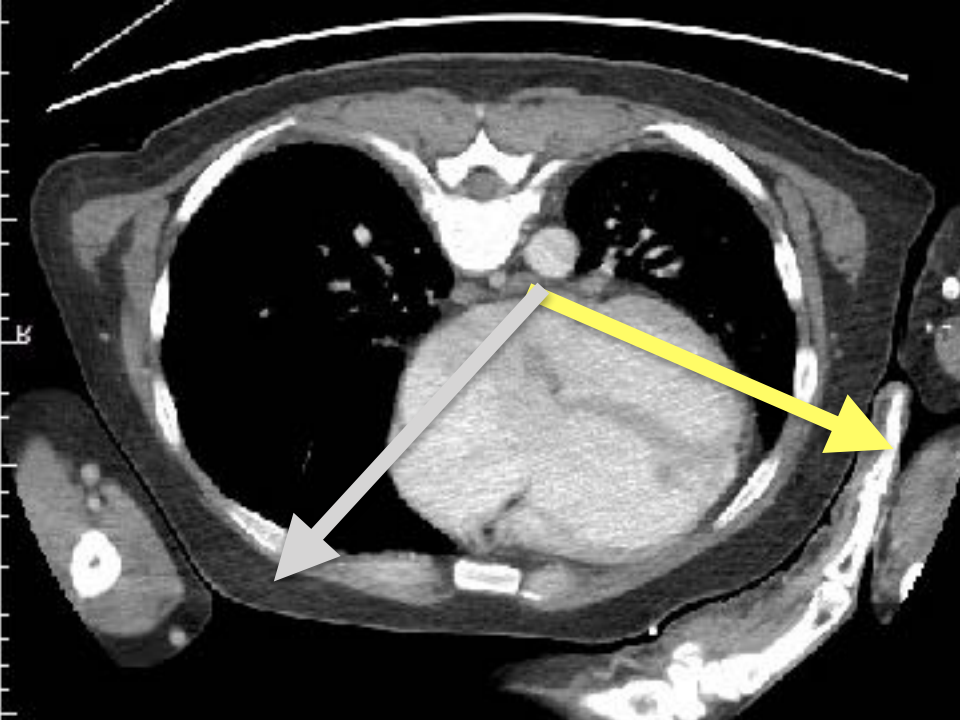


# TEE: ME-4C (0°)

ME 4-Ch



# TTE: A4C

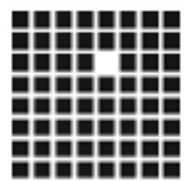




# WHY TEE IN ER ?

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# POLICY STATEMENT

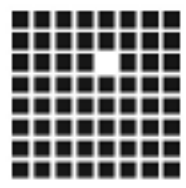
Approved April 2017

## *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





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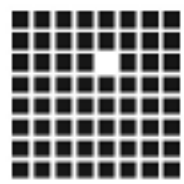
# POLICY STATEMENT

Approved April 2017

## *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**



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# POLICY STATEMENT

Approved April 2017

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

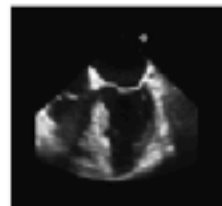
**需具備資格**

**初學: 25例 / Echo經驗: 10例**

# 完整TEE 28 Views

## Midesophageal views

### 1. ME 4-Ch



Transducer angle:  $\sim 0^\circ - 10^\circ$   
Level: ME

LA/RA  
IAS  
LW/RWIVS  
MV ( $A_2 - P_2$ )  
TV  
CS

### 2. ME 5-Ch



Transducer angle:  $\sim 0^\circ - 10^\circ$   
Level: ME

AoV  
LVOT  
LA/RA  
LW/RWIVS  
MV ( $A_1 - P_1$ )  
TV

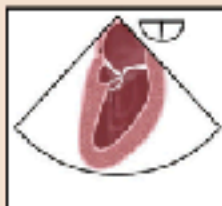
### 3. ME Mitral



Transducer angle:  $\sim 50^\circ - 70^\circ$   
Level: ME

LA  
CS  
LV  
MV ( $P_2 - A_2$ )  
Papillary muscles  
Chordae tendinae

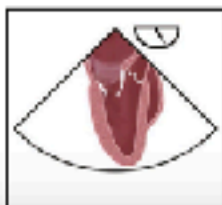
### 4. ME 2-Ch



Transducer angle:  $\sim 80^\circ - 100^\circ$   
Level: ME

LA  
CS  
LAA  
LV  
MV ( $P_3 - A_3$ )  
Circumflex CA

### 5. ME LAX



Transducer angle:  $\sim 120^\circ - 140^\circ$   
Level: ME

LA  
LV  
LVOT  
RVOT  
MV ( $P_2 - A_2$ )  
AoV  
Proximal Asc Ao

# 完整TEE 28 Views

6. ME Adv LAX



Transducer angle:  $\sim 120^\circ$ –  
 $140^\circ$   
Level: ME

LA  
LVOT  
MV ( $P_2$ - $P_3$ )  
AoV  
Proximal Asc Ao  
LCA

7. ME Asc Ao LAX



Transducer angle:  $\sim 80^\circ$ –  
 $110^\circ$   
Level: ME

Mid Asc Ao  
RPA

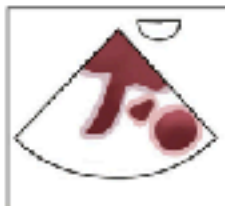
8. ME Asc Ao SAX



Transducer angle:  $\sim 0^\circ$ – $30^\circ$   
Level: ME

Mid Asc Ao  
MFA/Br PAs  
SVC

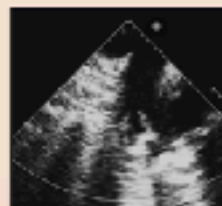
9. ME Rt Pulm veins



Transducer angle:  $\sim 0^\circ$   
Level: ME

Mid Asc Ao  
SVC  
RUPV  
RLPV

10. ME Lt Pulm veins



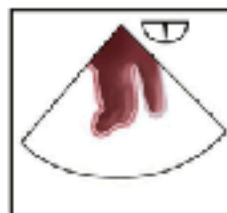
Transducer angle:  $\sim 80^\circ$ –  
 $110^\circ$   
Level: ME

LUPV  
LIPV  
LPA



# 完整TEE 28 Views

11. ME LAA



Transducer Angle: ~90°-  
110°  
Level: ME

LAA  
LUPV

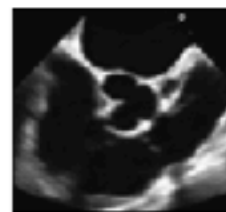
12. ME AoV SAX



Transducer angle: ~25°-  
45°  
Level: ME

AoV  
PV  
LA/RA  
Superior IAS  
RVOT  
LCA/RCA

13. ME RV In-Out



Transducer angle: ~50°-  
70°  
Level: ME

AoV  
PV  
LA/RA  
Superior IAS TV  
RVOT  
IVS: membranous, outlet

14. ME Mid Bicaaval TV



Transducer angle: ~50°-  
70°  
Level: ME

LA/RA  
Mid IAS  
TV  
SVC  
IVC  
CS

15. ME Bicaaval



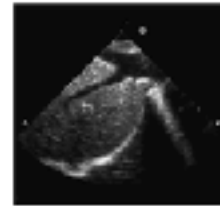
Transducer angle: ~90°-  
110°  
Level: ME

LA  
RA/RAA  
IAS  
SVC  
IVC

# 完整TEE 28 Views

## Transgastric views

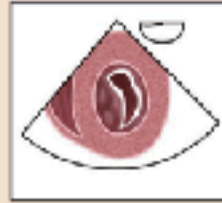
16. TG IVC/hep veins



Transducer angle:  $\sim 60^\circ - 100^\circ$   
Level: TG

IVC  
Hepatic veins

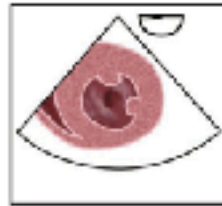
17. TG Basal SAX



Transducer angle:  $\sim 0^\circ - 20^\circ$   
Level: TG

LV (base)  
RV (base)  
MV  
TV  
IVS: muscular

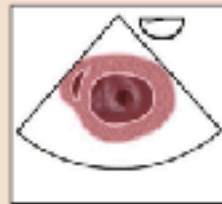
18. TG Mid Pap SAX



Transducer angle:  $\sim 0^\circ - 20^\circ$   
Level: TG

LV (mid)  
Papillary muscles  
RV (mid)  
IVS: muscular

19. TG Apical SAX



Transducer angle:  $\sim 0^\circ - 20^\circ$   
Level: TG

LV (apex)  
RV (apex)  
IVS: apical muscular

20. TG LAX



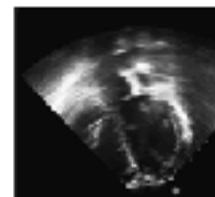
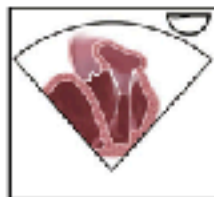
Transducer angle:  $\sim 120^\circ - 140^\circ$   
Level: TG

LV  
LVOT  
AoV  
Ao root  
MV

# 完整TEE 28 Views

## Deep transgastric views

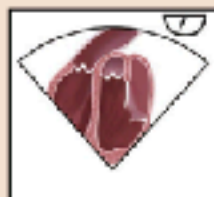
21. DTG 5-Ch



Transducer angle:  $\sim 0^\circ$ – $20^\circ$   
Level: DTG

LV/RV  
LVOT  
AoV  
Ao root  
MV  
IVS

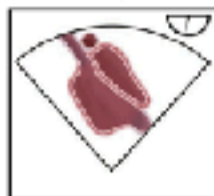
22. DTG RMOT



Transducer angle:  $\sim 50^\circ$ – $90^\circ$   
Level: DTG

LV/RV  
RMOT  
PV  
LVOT  
AoV  
MV  
IVS

23. DTG Atr Sept

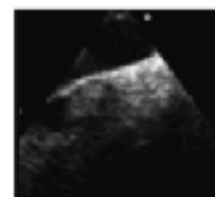
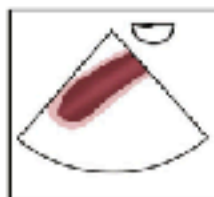


Transducer angle:  $\sim 80^\circ$ – $90^\circ$   
Level: DTG

RA/FAA  
IA  
RFA  
IAS  
SVC  
IVC

## Upper esophageal views

24. UE Ao Arch LAX



Transducer angle:  $\sim 0^\circ$ – $10^\circ$   
Level: UE

Ao arch  
Innominate vein

25. UE Ao Arch SAX



Transducer angle:  $\sim 70^\circ$ – $90^\circ$   
Level: UE

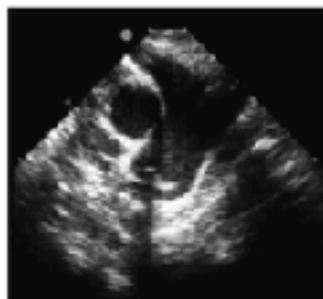
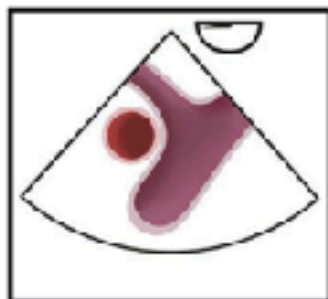
Ao arch  
Innominate vein  
MFA  
Br PAus  
PV



# 完整TEE 28 Views



26. UE PA

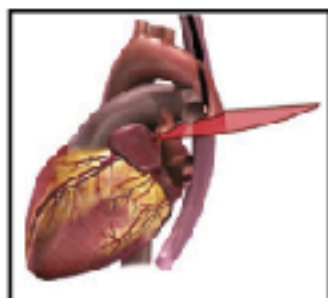
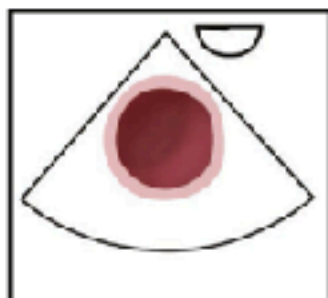


Transducer angle:  $\sim 0^{\circ}$ – $20^{\circ}$   
Level: UE

MPA  
LPA  
RPA  
Mid Asc Ao

## Aortic views

27. Desc Ao SAX



Transducer angle:  $\sim 0^{\circ}$ – $10^{\circ}$   
Level: UE to TG

Desc Ao

28. Desc Ao LAX

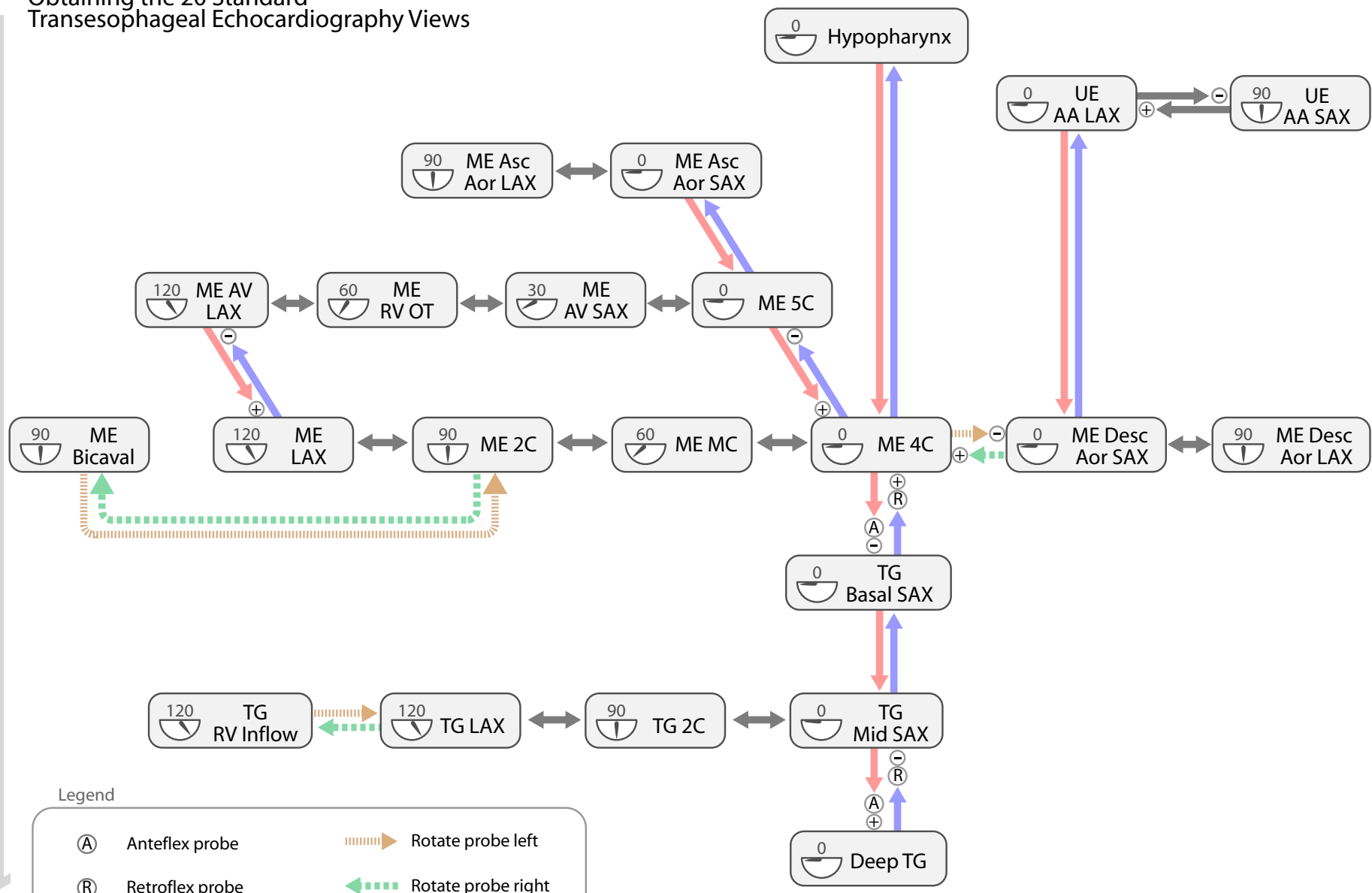


Transducer angle:  $\sim 90^{\circ}$ –  
 $100^{\circ}$   
Level: UE to TG

Desc Ao

# Obtaining the 20 Standard Transesophageal Echocardiography Views

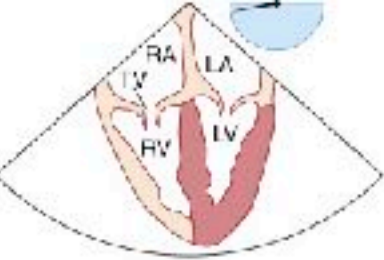
Probe Depth



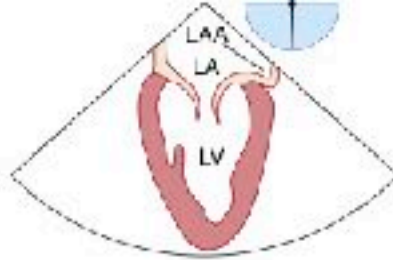
## Legend

(A)	Anteflex probe	→	Rotate probe left
(R)	Retroflex probe	←	Rotate probe right
⊖	Decrease omniplane depth (display depth)	↓	Increase probe depth
⊕	Increase omniplane depth (display depth)	↑	Decrease probe depth
↔	Change omniplane angle	90	Omniplane angle

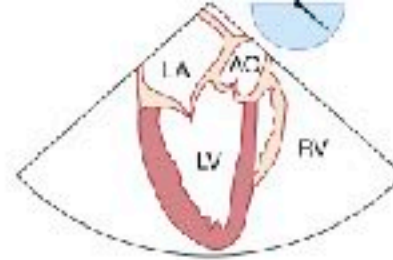
2C - Two Chamber	Asc Aor - Ascending Aortic	ME - Mid Esophageal
4C - Four Chamber	Desc Aor - Descending Aortic	RV - Right Ventricle
5C - Five Chamber	OT - Outflow Tract (Inflow-Outflow)	SAX - Short Axis
AA - Aortic Arch	LAX - Long Axis	TG - Transgastric
AV - Aortic Valve	MC - Mitral Commissural	UE -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



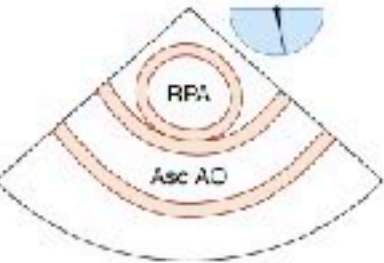
A. ME Four Chamber



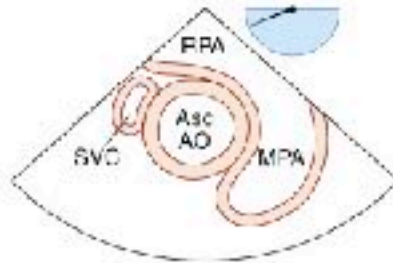
B. ME Two Chamber



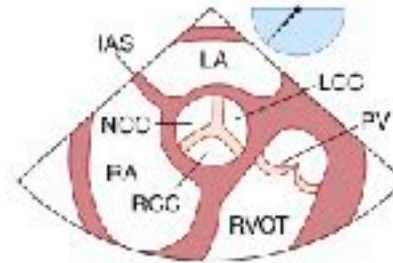
C. ME LAX



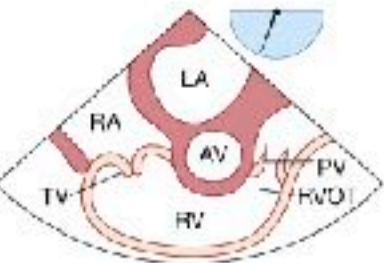
D. ME Asc Aortic LAX



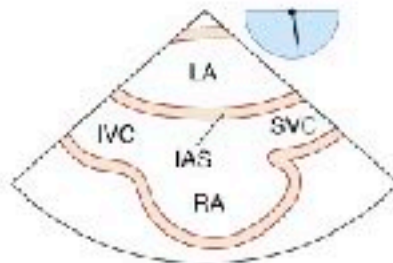
E. ME Asc Aortic SAX



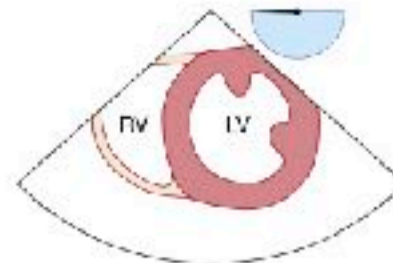
F. ME AV SAX



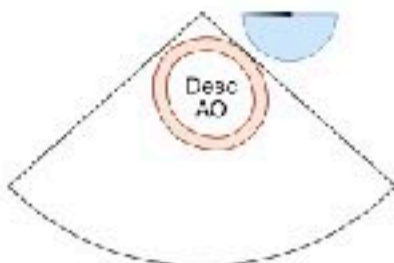
G. ME IV Inflow-Outflow



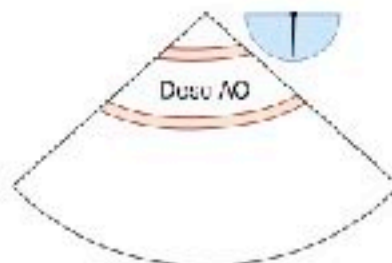
H. ME B-caval



I. TG Mid SAX



J. Desc Aortic SAX



K. Desc Aortic LAX

# ASE/SCA

# 11

# Basic


# Peri-OP

# Views



# RESUSCITATIVE TEE VIEW GUIDE

**ME 4C** RL, LA, RV LV  
180° TV position



• Pathology pericardium • BPPA  
• LADV size & function • Mitral pathology

**TG SAX PAP** LV/RV



• LV function • RVNA • Pathology pericardium

**ME 2C** L, R, LV, RV, LBB



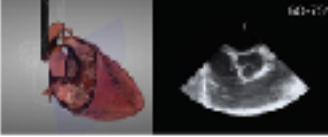
• Pathology LV • LV/ROD  
• Pathology MV • Thrombus LAA

**ME Asc Ao SAX** Distal PA, Heart PA



• Asc Aorta • Pathology of PA • Pathology pericardium

**ME RV I-O** LA, RV, TR, RVOT




• Pathology RVOT • Tricuspid TV

**ME DTA LAX** DTA



• Flow reversal LAD • BPPA  
• Engage • LA EDNO

**ME LAX** LRA, RV, LV



• Quality of CO (MPO) • LV function  
• Pathology MA • Pathology LV

**ME Bicaval** VC, RA, SVC



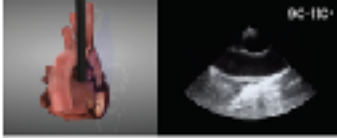
• Distention of RA • Venous pathology  
• EDNO • Volume measurement

**ME AV SAX** Cusp of A, LA, RA, Aortic valve



• Aortic stenosis • ASD  
• Pathology RVOT • RCA and LCA

**ME Asc Ao LAX** Distal PA, Asc Aorta




• Distention pericardium • Pathology PA  
• Collateral vessels • LVAD

**ME DTA SAX** DTA



• BPPA • Engage • LA EDNO

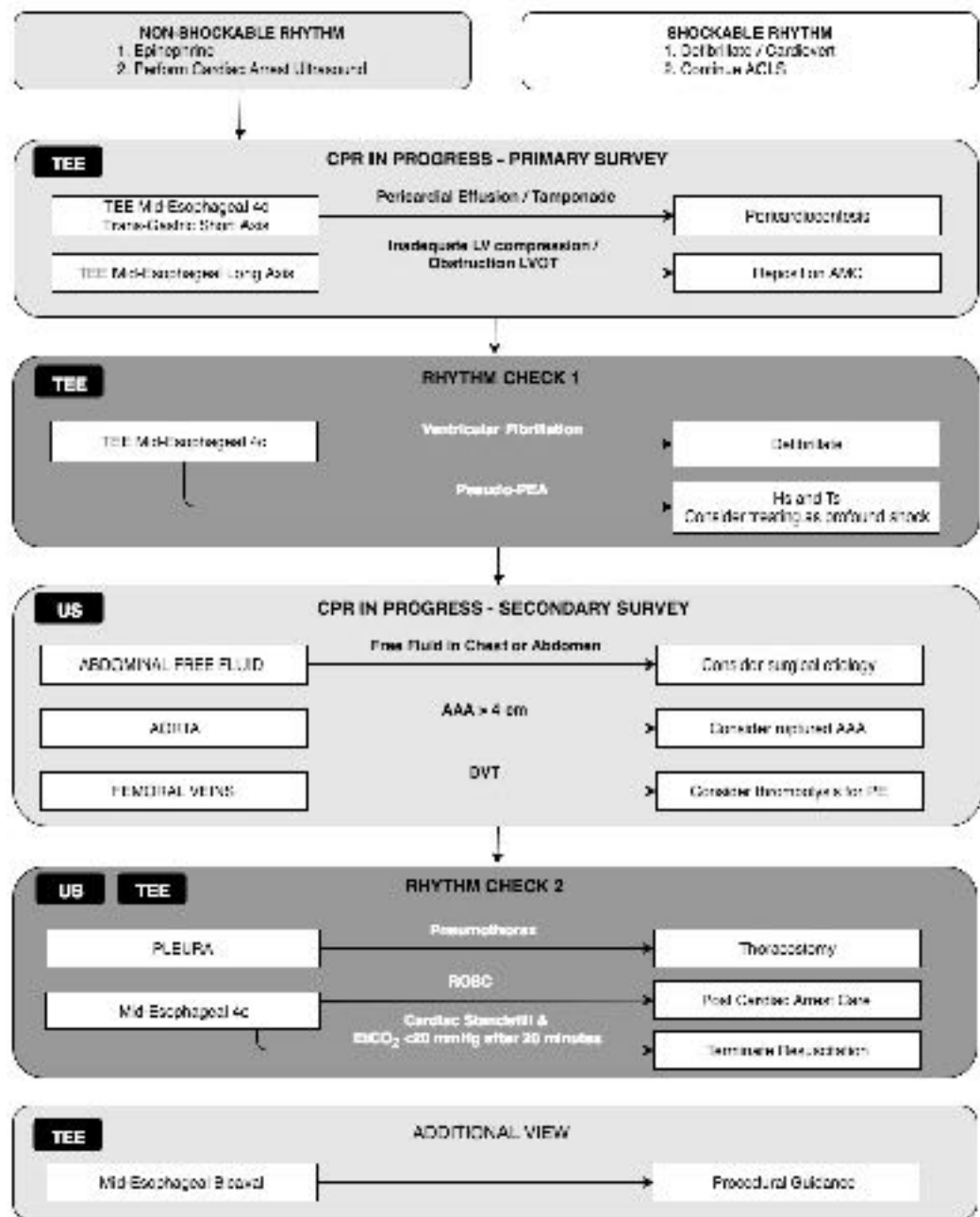
**Deep TG SC** LV/RV, AV/RV, LVOT



• Deep RV TV • LVOT

# TEE-GUIDED CARDIAC ARREST RESUSCITATION

R. Poonjara, R. F. Poonjara

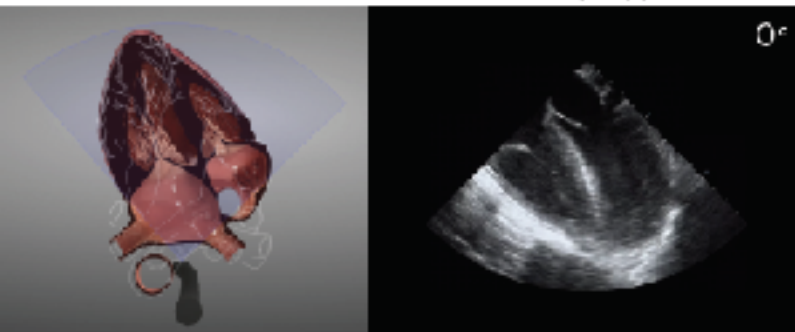




# RESUSCITATIVE TEE VIEW GUIDE

## ME 4C

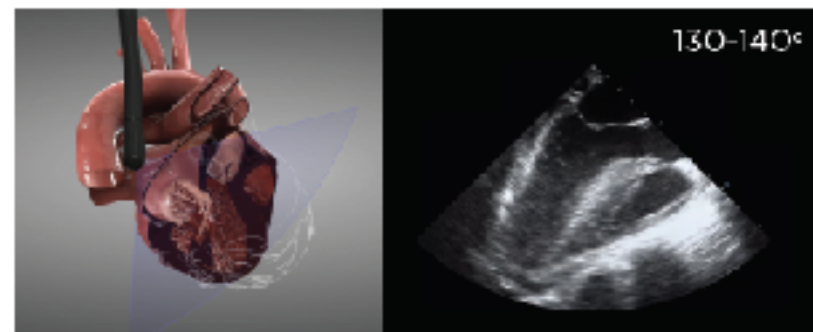
RA, LA, RV, LV  
MV, TV, pericardium



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

## ME LAX

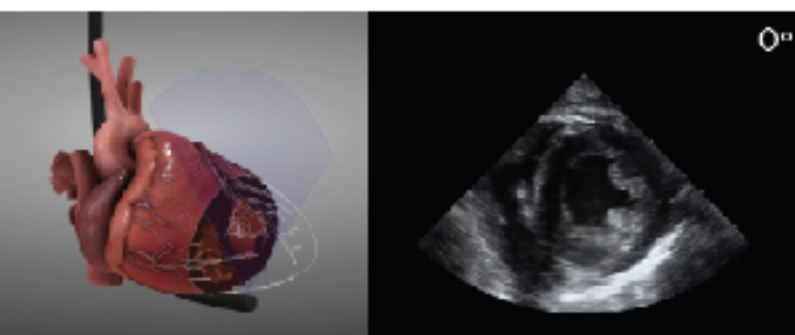
LV, LA, MV, AV



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

## TG SAX PAP

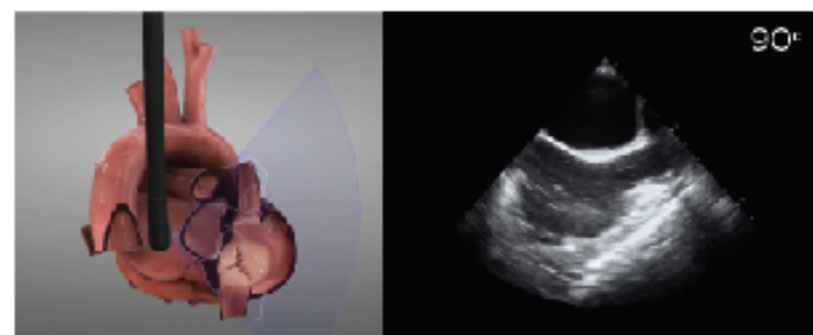
LV, RV



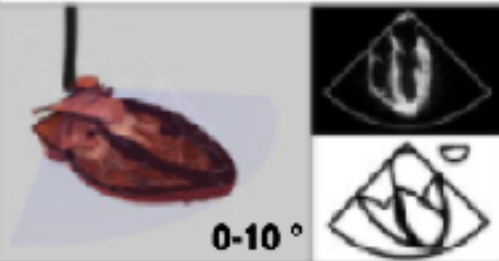



- LV function
- RWMA
- Pathology pericardium

## ME Bicaval

IVC, RA, SVC

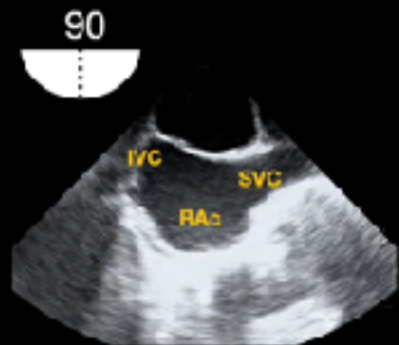


- Procedure guidance
- ECMO
- Venous guidewires
- Volume responsiveness

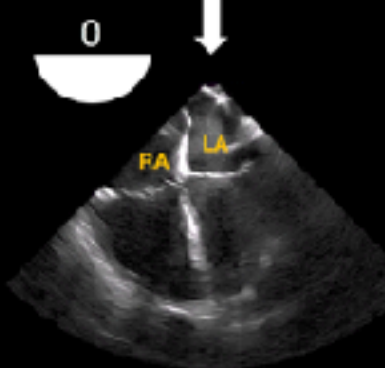
RESUSCITATIVE TEE views	Cardiac structures	TTE equivalent	Clinical Application
<b>Mid-esophageal 4 chamber (ME4C)</b>	 <p>0-10 °</p>	Four chambers, mitral and tricuspid valves and pericardium	Pericardial effusion Intra ventricular thrombus LV/RV function Valve lesions and dysfunction
<b>Mid-esophageal long axis (MELAX)</b>	 <p>120-140 °</p>	Left ventricle, left atrium, mitral and aortic valves	Quality of CPR LV function Pericardial effusion Mitral / aortic valve dysfunction
<b>Transgastric short (TG)</b>	 <p>0-20 °</p>	Left ventricle	Parasternal short axis Left ventricular function (RWMA) Pericardial effusion
<b>Mid-esophageal Bicaval (ME Bicaval)</b>	 <p>90-110 °</p>	Simultaneous view of IVC, RA and SVC	N/A Procedural guidance Volume responsiveness



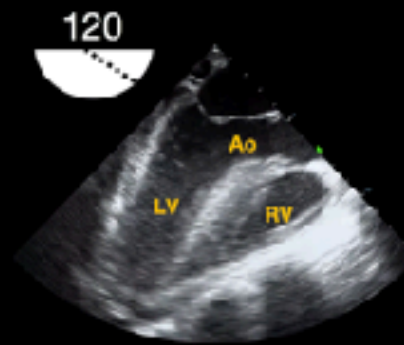
**HYPOPHARYNX**



**ME Bicaval**



**ME 4C**

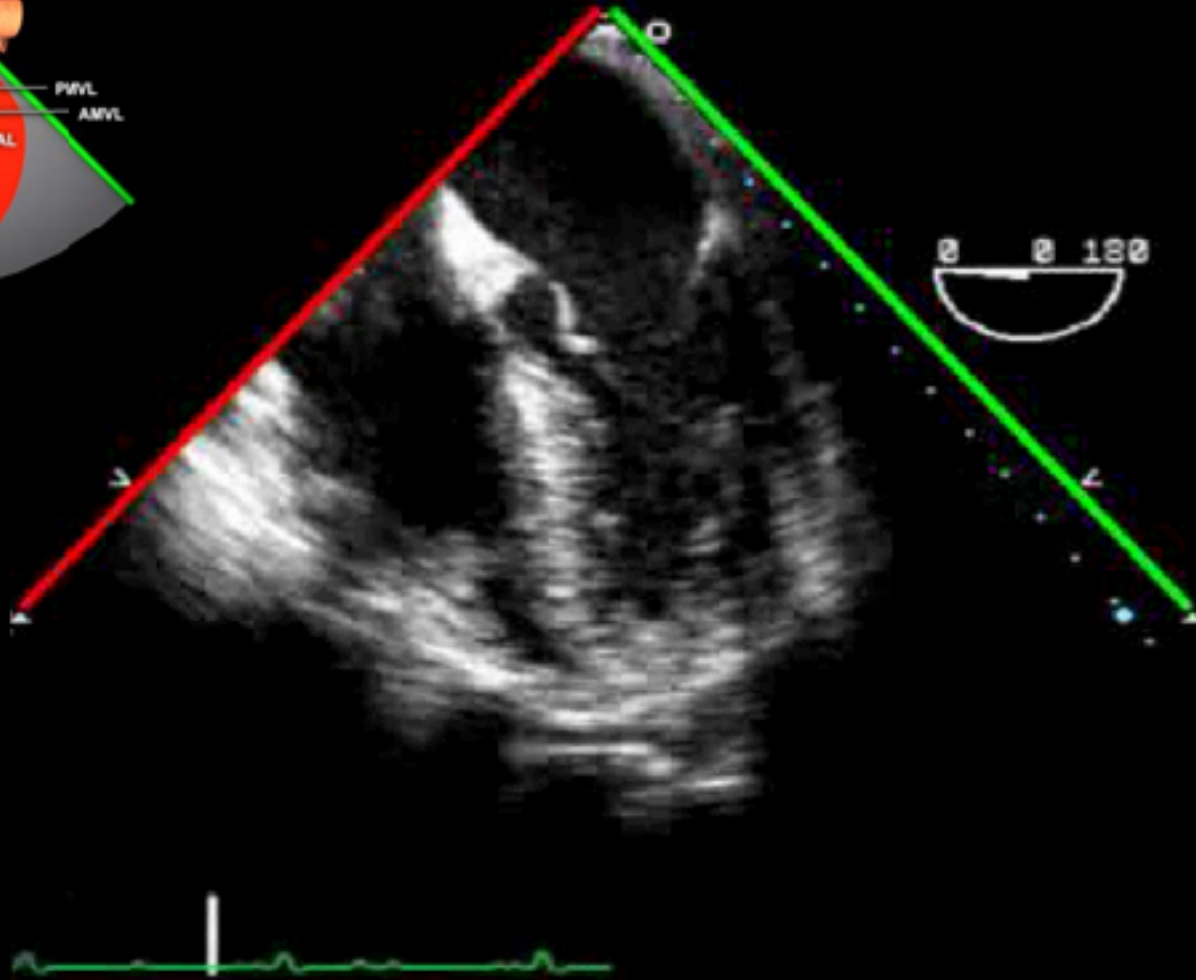
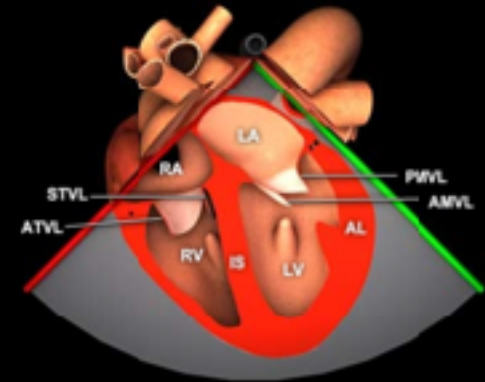


**ME LAX**

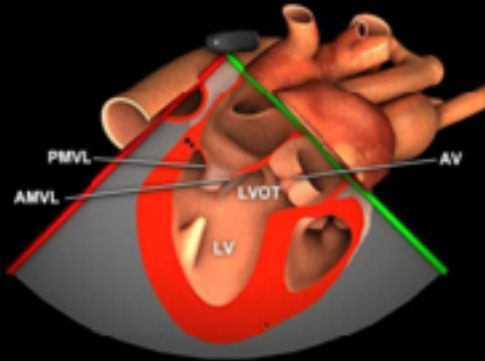


**TG SAX**

# ME 4C view (0°)



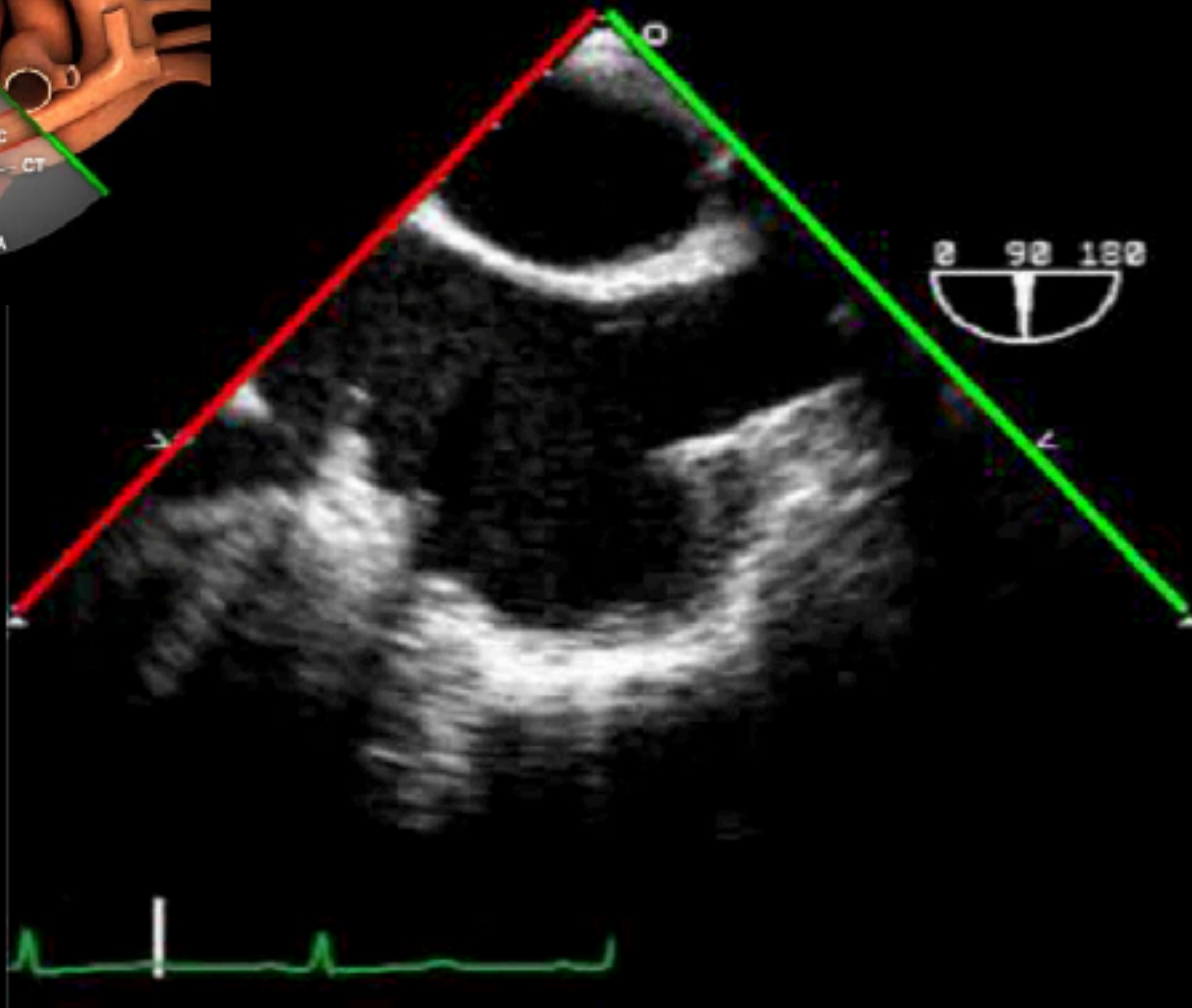
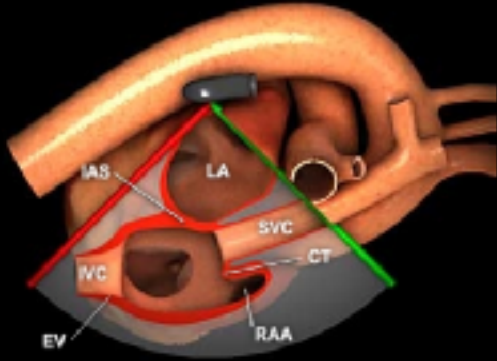
# ME LAX view (120°)





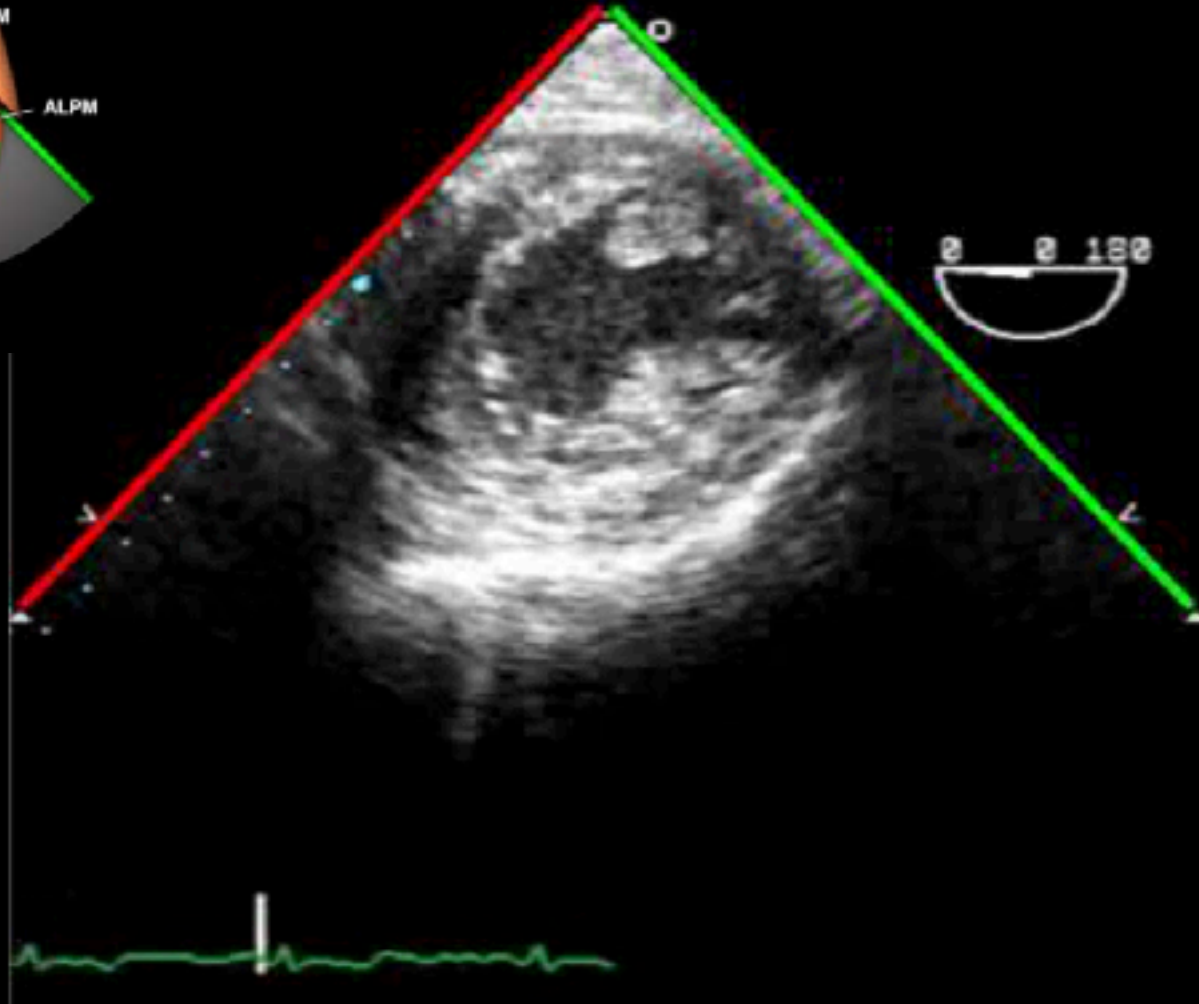
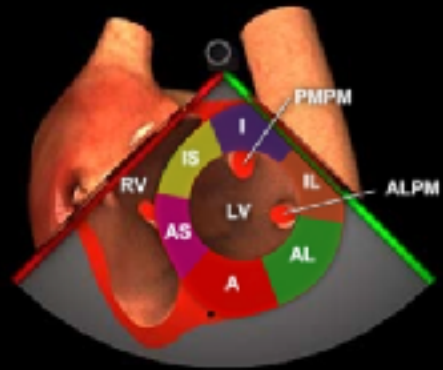


# ME Bicaaval view (90°)



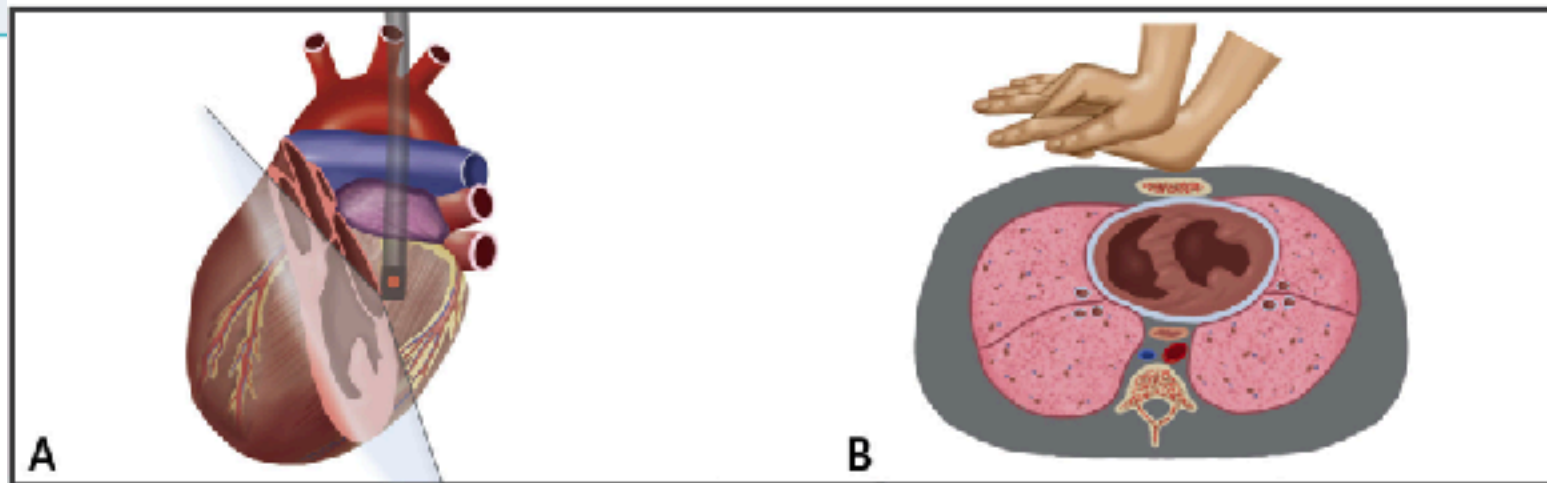


# TG Mid SAX view (0°)



## Enhancing Quality of CPR

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





## Diagnostic Role/Procedural Guidance

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



## Prognostic Role

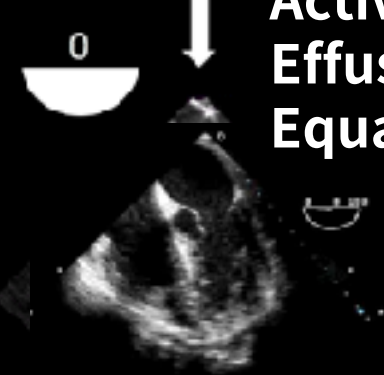
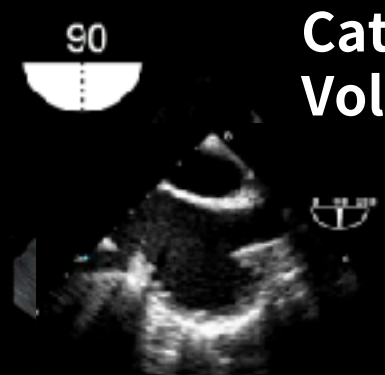
- Characterization of myocardial activity (i.e., cardiac standstill, organized vs. disorganized contractions)
- Continuous imaging of cardiac function

**HYPOPHARYNX**

**Catheter  
Volume**

**Activity  
Effusion  
Equality**

**CRP  
Quality**

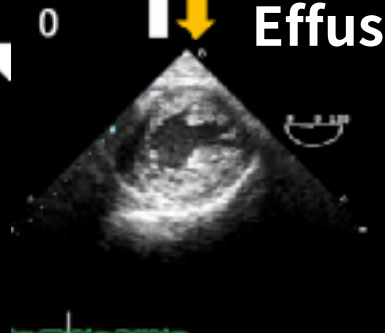


**ME Bicaval**

**ME 4C**

**ME LAX**

**RWMA  
Effusion**

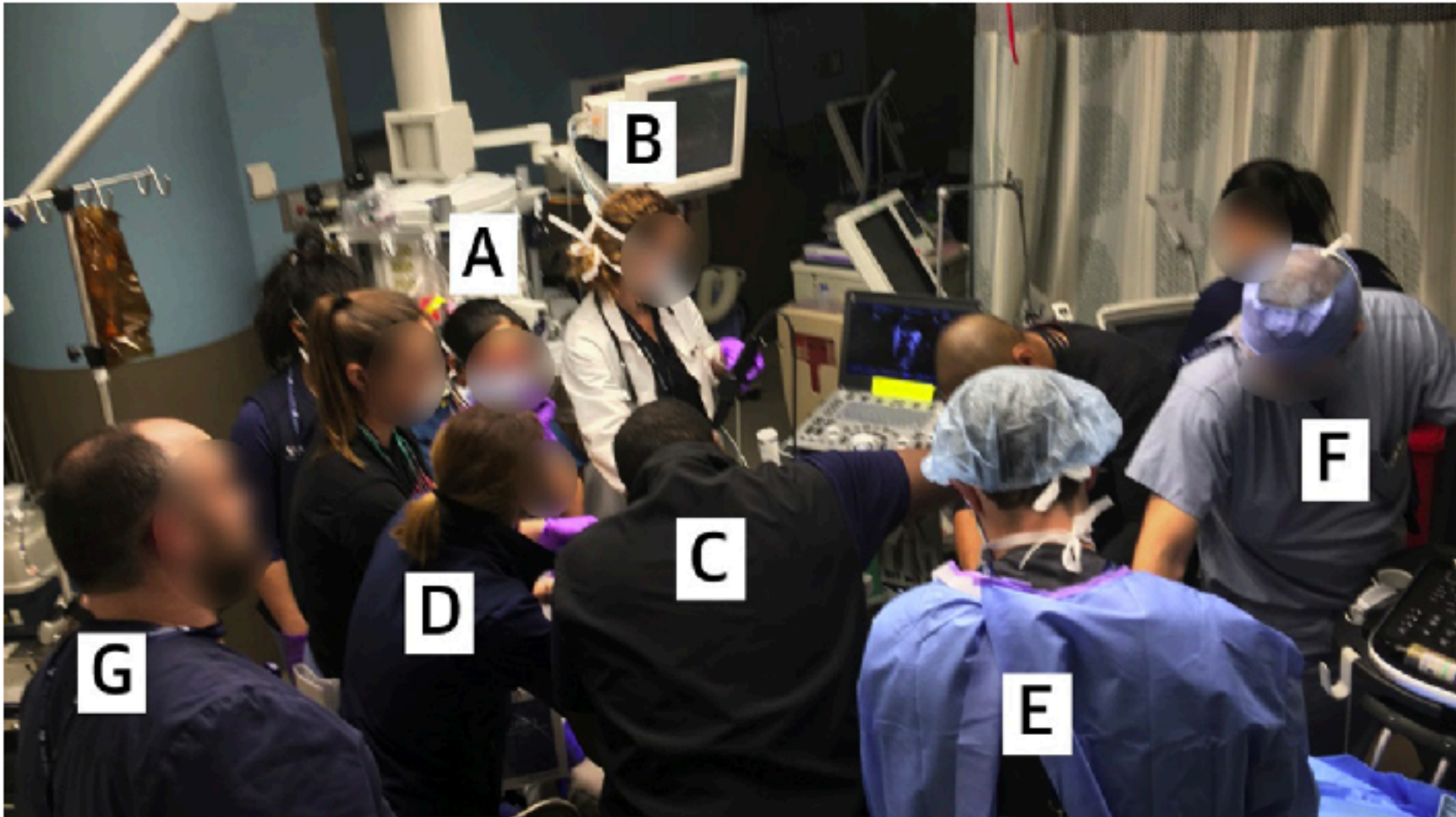


**TG SAX**

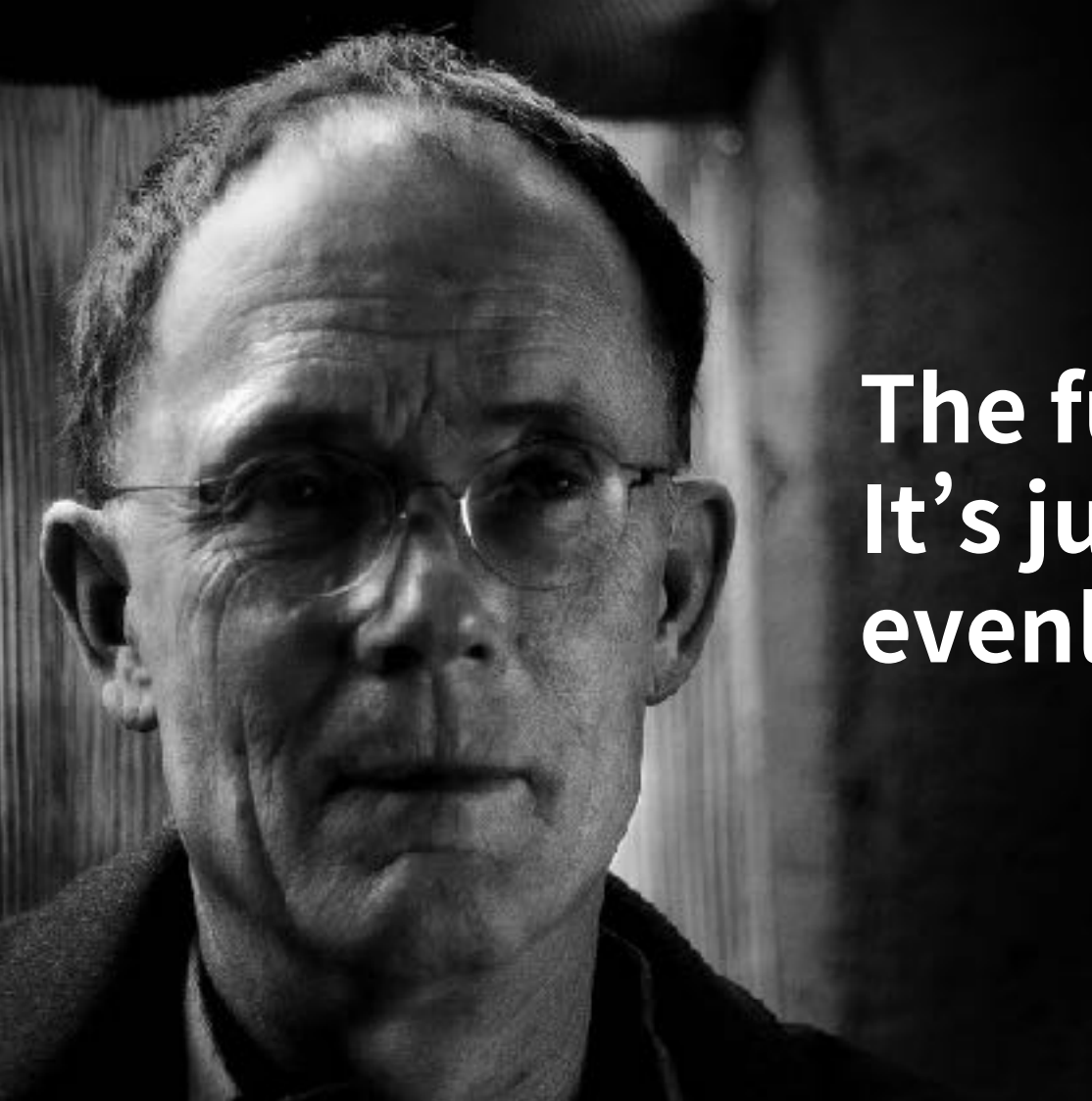
# TEAM



**FIGURE 2** Incorporation of Focused TEE During Cardiac Arrest Resuscitation Care







**The future is here.  
It's just not  
evenly distributed yet.**

**~Willian Gibson**

## 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



SEARCH

# TEE RESOURCES



**Virtual** Transesophageal Echocardiography

Toronto General Hospital Department of Anesthesia  
Perioperative Interactive Education