



TEE

Johan Nordström BÖL Ultraljudsgruppen, Karolinska Solna



Mål

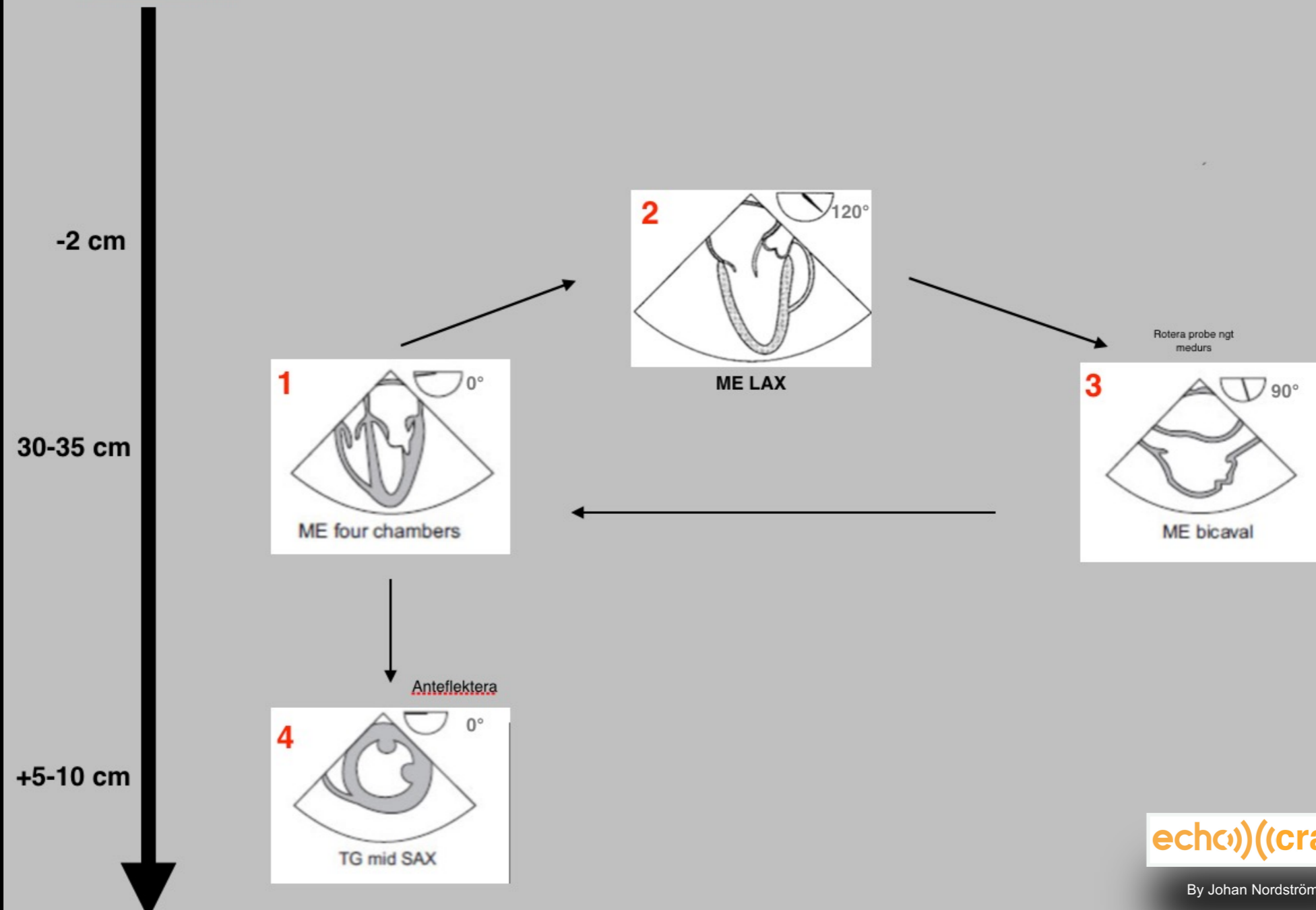
- Förenkla TEE så att ni ska våga använda det
- Tänka TEE
- Enkel TEE algoritm
 - Minimera komplexiteten på u-sökn
 - Maximera utbyttet



POC TEE

Probedjup
i esofagus

TEE vid hjärtstopp / ROSC / shock / trauma





Fall

Traumalarm -

25 årig man klämd mellan båt och båtvagga.

Transport:

Vaken. Cirk instabil med sjunkande Bt vid varje mätning

Vid ankomst: 1.5 h delay sedan olyckan

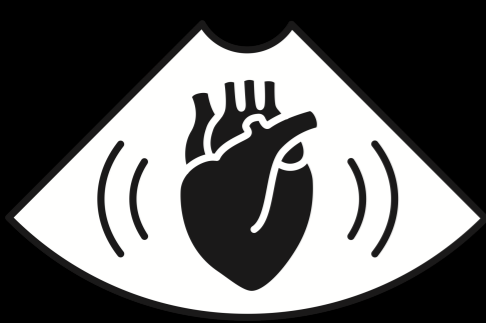
Vaken. Pratbar.

Kallsvettig, askgrå, kippar efter andan



Status:

- Trådtunna pulsar. Omätbart tryck. HF140.
Halsvenstas
 - Peritonitstatus
 - **FAST:** Positiv - Vätska runt lever
- Ingen pericardvätska ^{sic}
 - **Rtg pulm:** - Pneumothorax hö
- => Op sal för sövning och laparotomi



Op sal:

- Artärnål (U-ljud): sBt80. HF 140
- Transfusion påbörjas (blodvärmare/högflöde)
- RSI med Ketalar + Celo => Trismus
- Maskvent. Fortsatt trismus.
- Propofol. Intub.

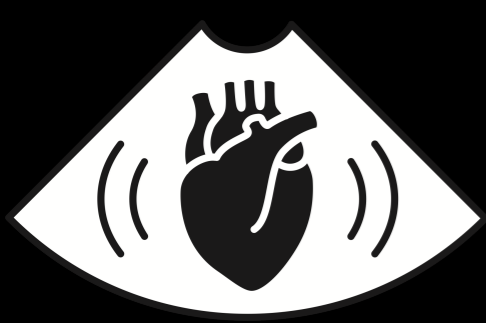


Efter sövning:

- Hypotensiv m sBt80. Trots volym + NorAdr
- Marmorerad på ben + halsvenstas

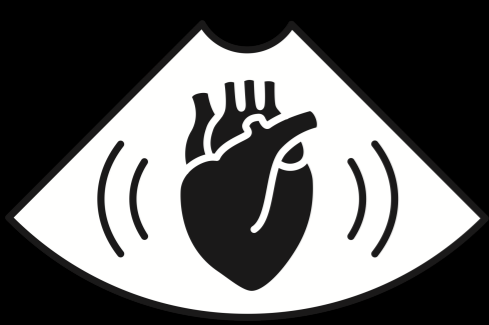
Obstruktiv shock

Bedömning:



Obstruktiv shock =>

- Bulow hö - Ingen förbättring
- Laparotomi =>
 - Grav shock -> PEA
 - Mkt blod i buken +Intern aortakompression(ingen puls i aorta) + Adrenalin + Massiv transfusion
- => Ingen effekt



TEE

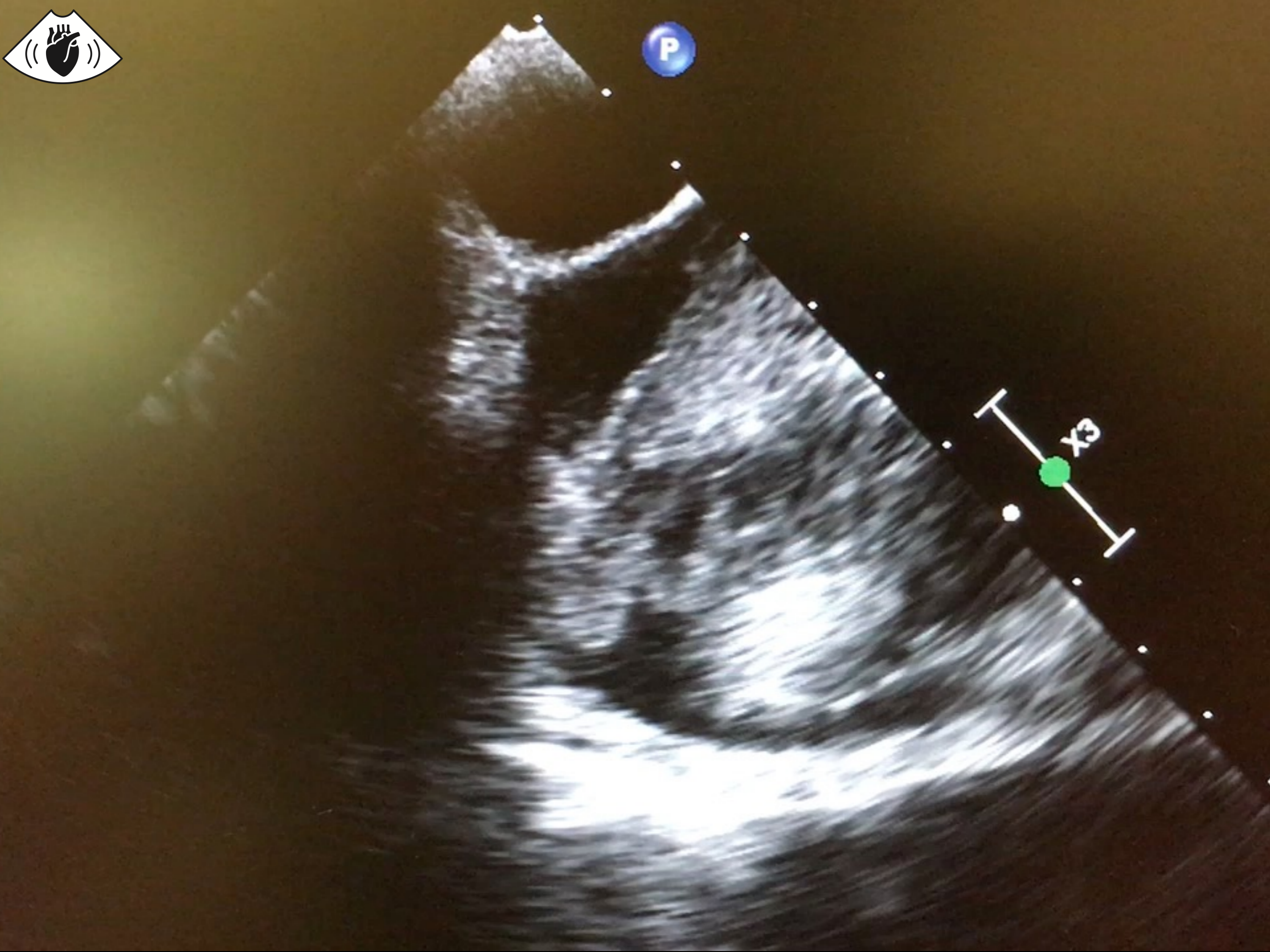


En bild säger mer än



P

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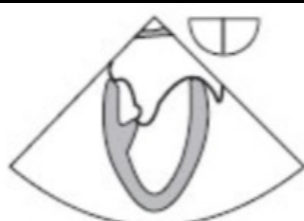
"Fyslab TEE"

Guidelines for Performing a Comprehensive Transesophageal Echocardiographic Examination: Recommendations from the American Society of Echocardiography and the Society of Cardiovascular Anesthesiologists.

Rebecca T. Hahn. anesthesia-analgesia 2014



ME four chambers



ME two chambers



ME LAX



TG mid SAX



TG two chambers



TG basal SAX



ME mitral commissural



ME AV SAX



ME AV LAX



TG LAX



deep TG LAX



ME bicaval



ME RV inflow-outflow



TG RV inflow



ME asc aortic SAX



ME asc aortic LAX



desc aortic SAX



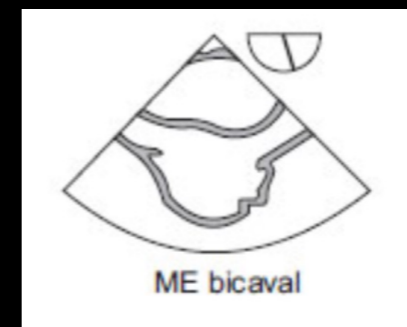
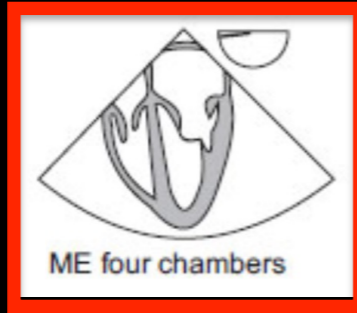
desc aortic LAX

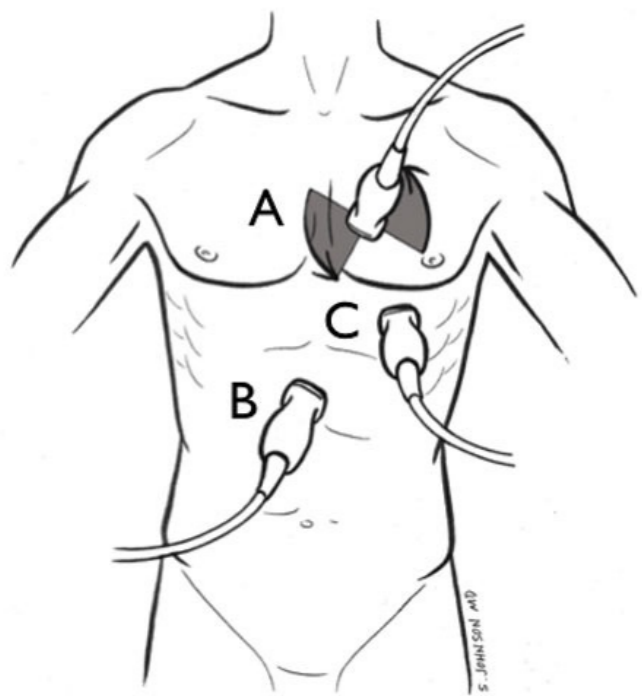


UE aortic arch LAX



UE aortic arch SAX.





AP 4Ch



PS LAX



ME four chambers



ME LAX



TG mid SAX

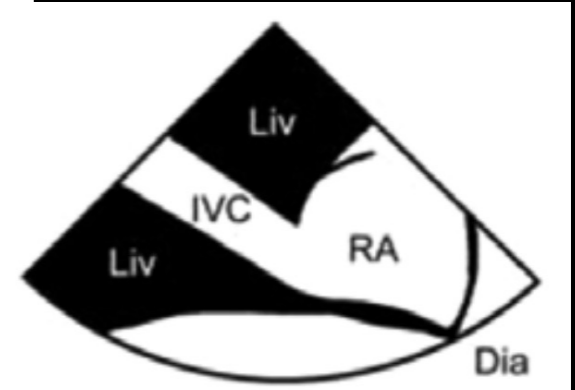


ME bicaval

PLAX
SAX
A4CH
SC - IVC



PS SAX

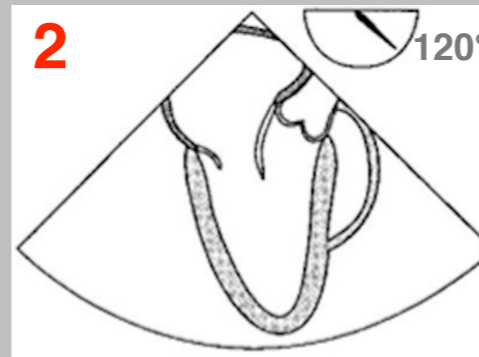


SC IVC

Probedjup
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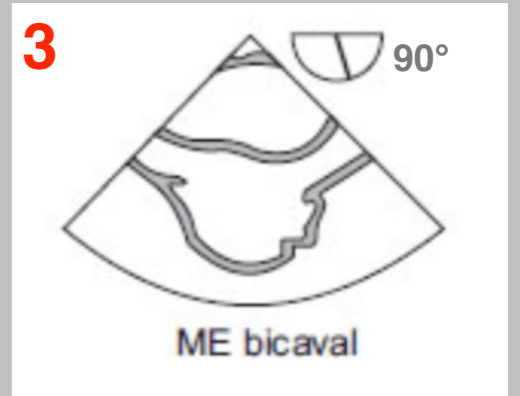
TEE vid hjärtstopp / ROSC / shock / trauma

-2 cm



ME LAX

Rotera probe ngt
medurs



ME bicaval

30-35 cm



ME four chambers

Anteflektera

+5-10 cm

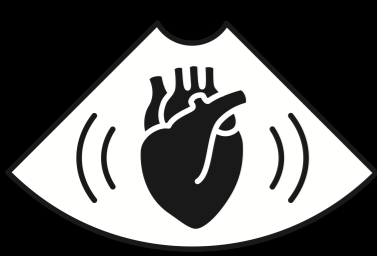


TG mid SAX



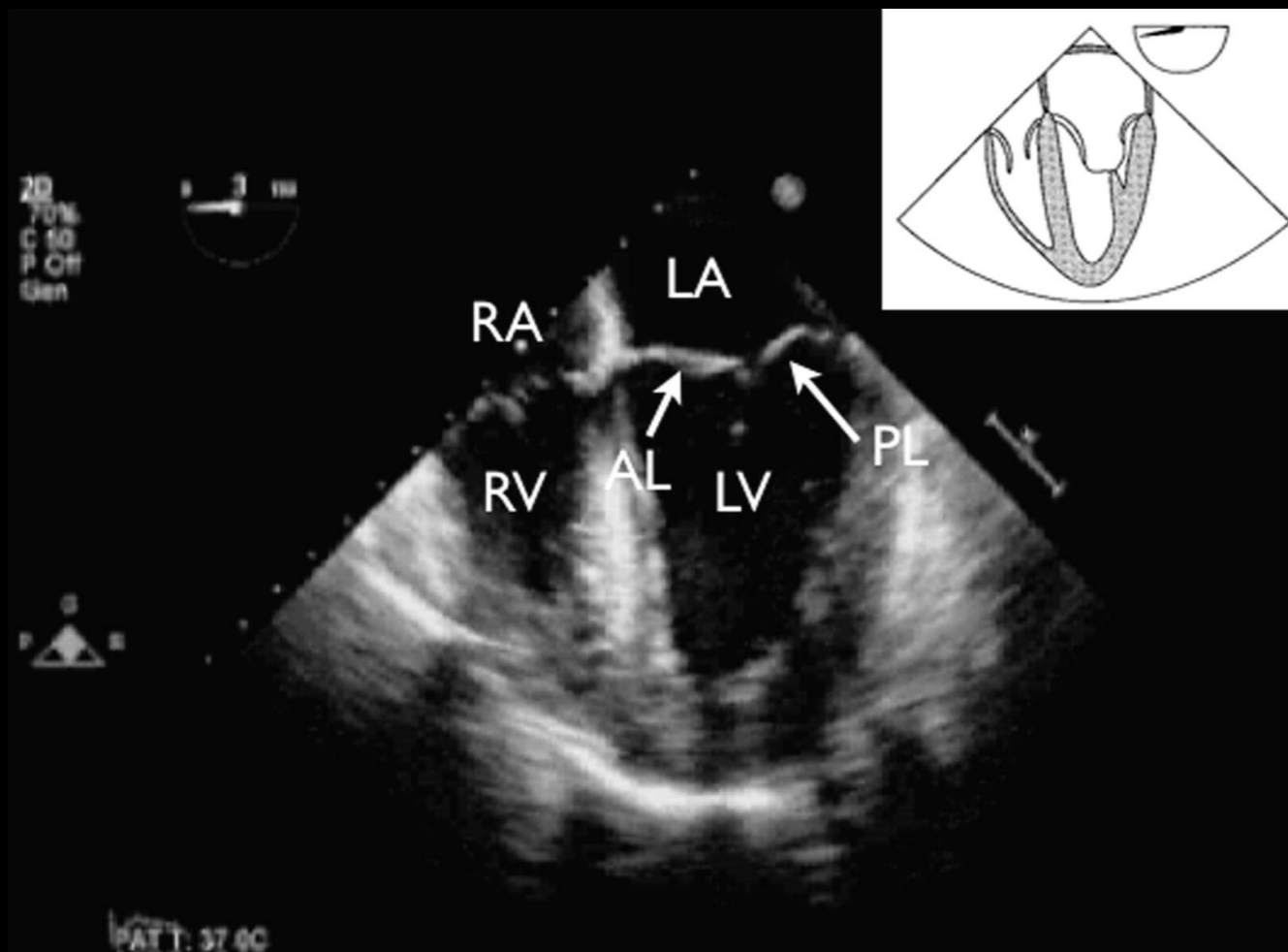
echo((craft

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TEE

1. Säkrad luftväg
2. Uteslut KI
3. Gela probe + bitblock
4. För varsamt ner ekoprobe till ca 30 cm. Kristall 0°

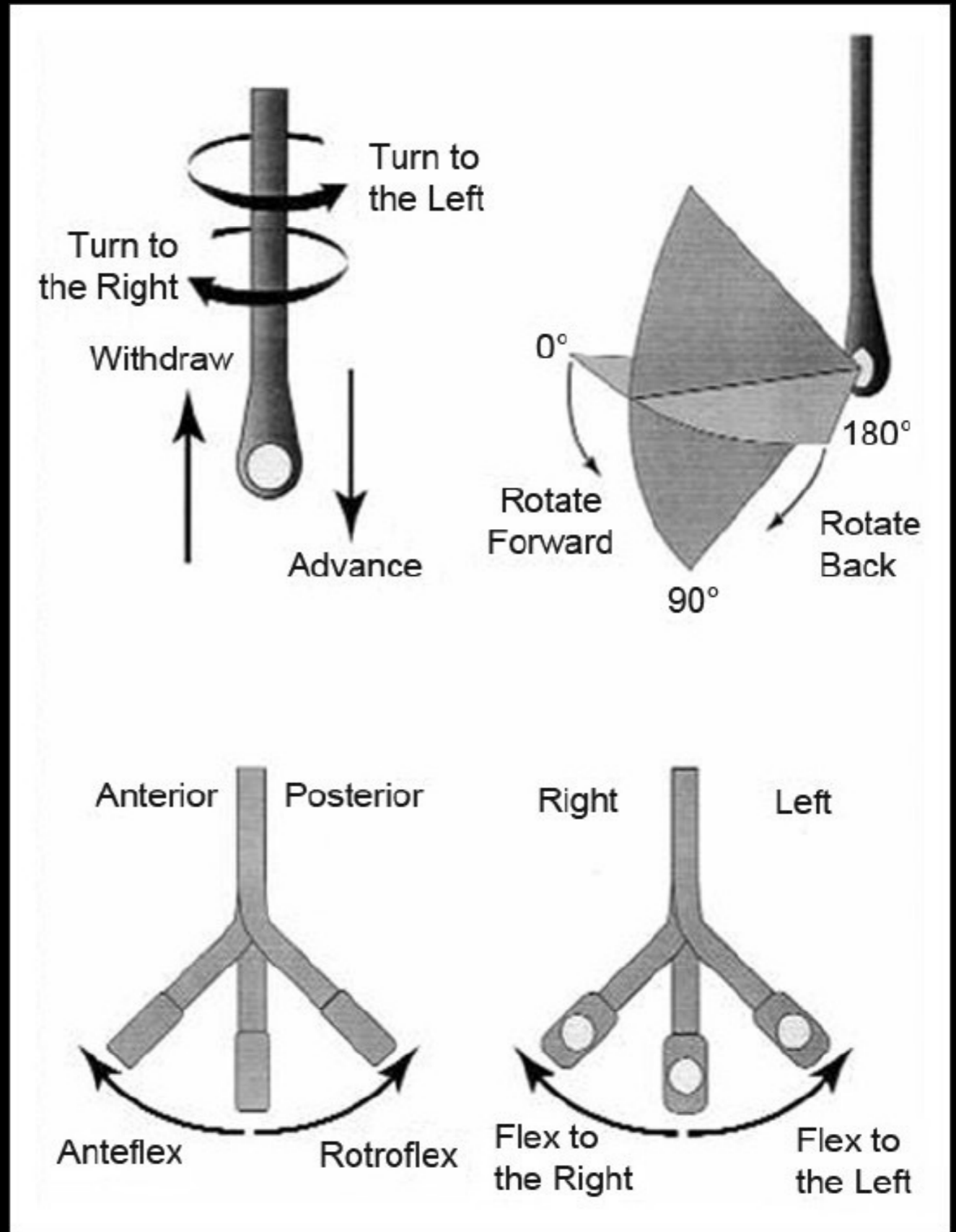
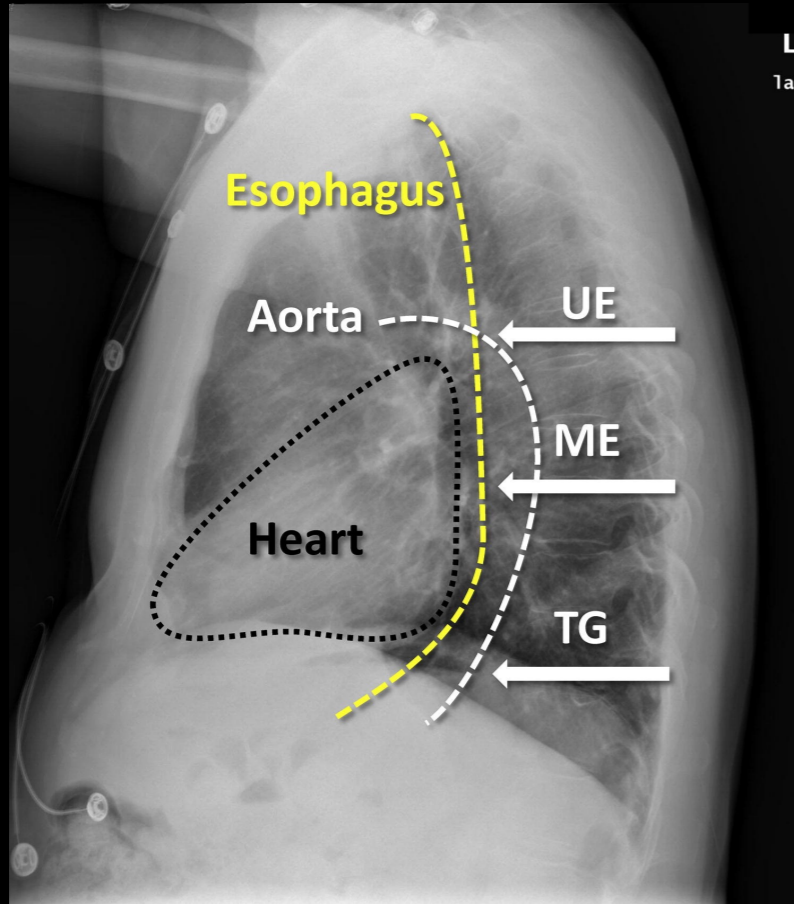


Tips

- Lyft käken
- Proben i medellinjen
- Laryngoskop vb
(Videolaryngoskop!!)
- Ante - retroflexion

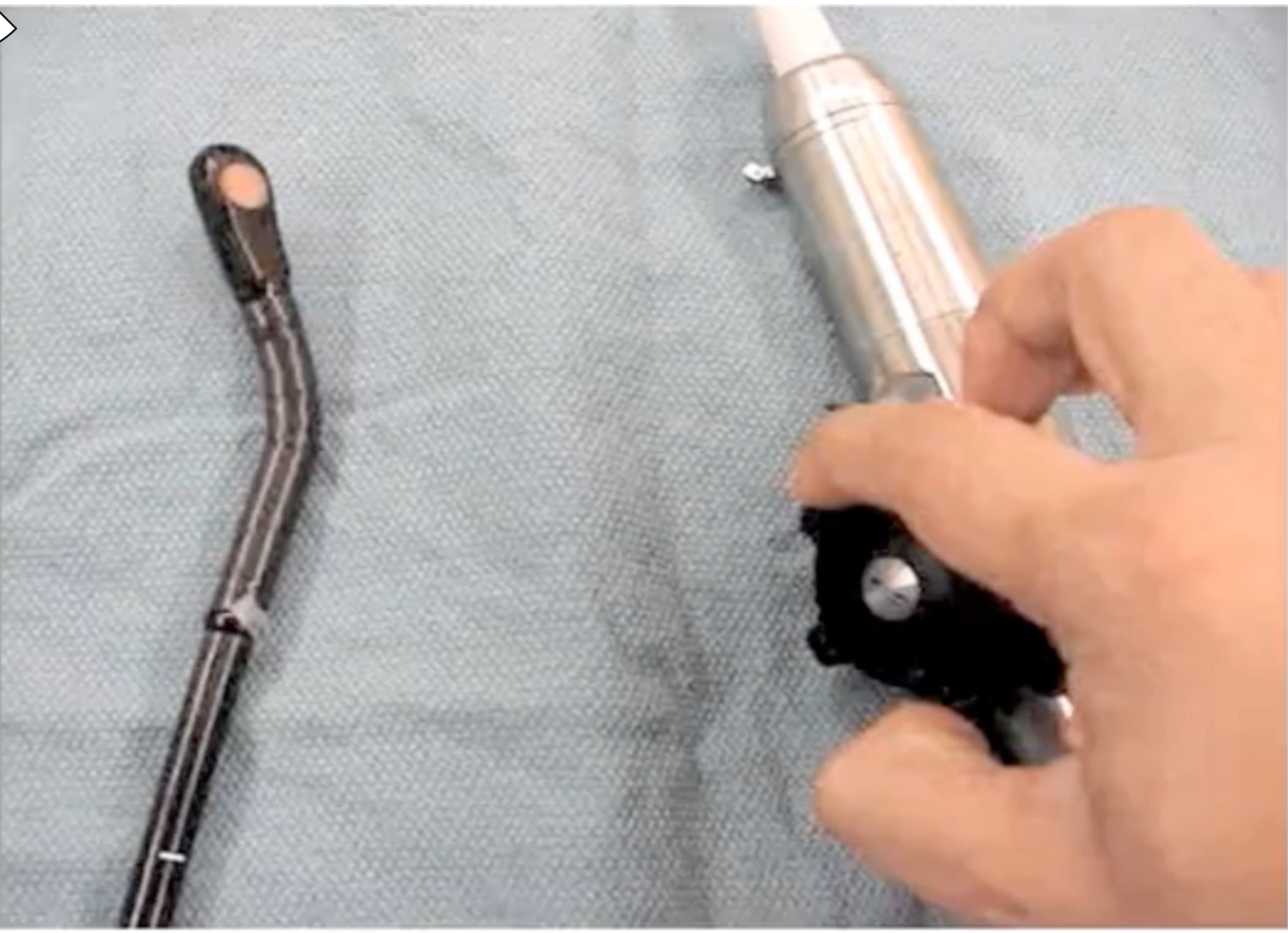


TEE





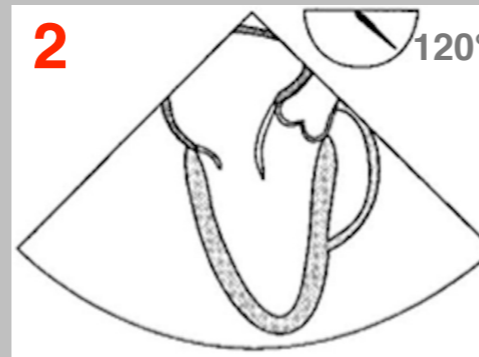
TEE Probe Manipulation



Probedjup
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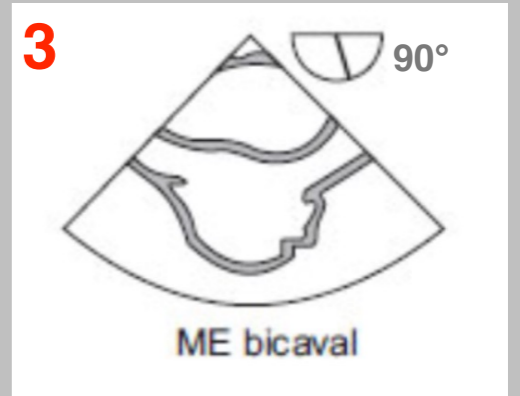
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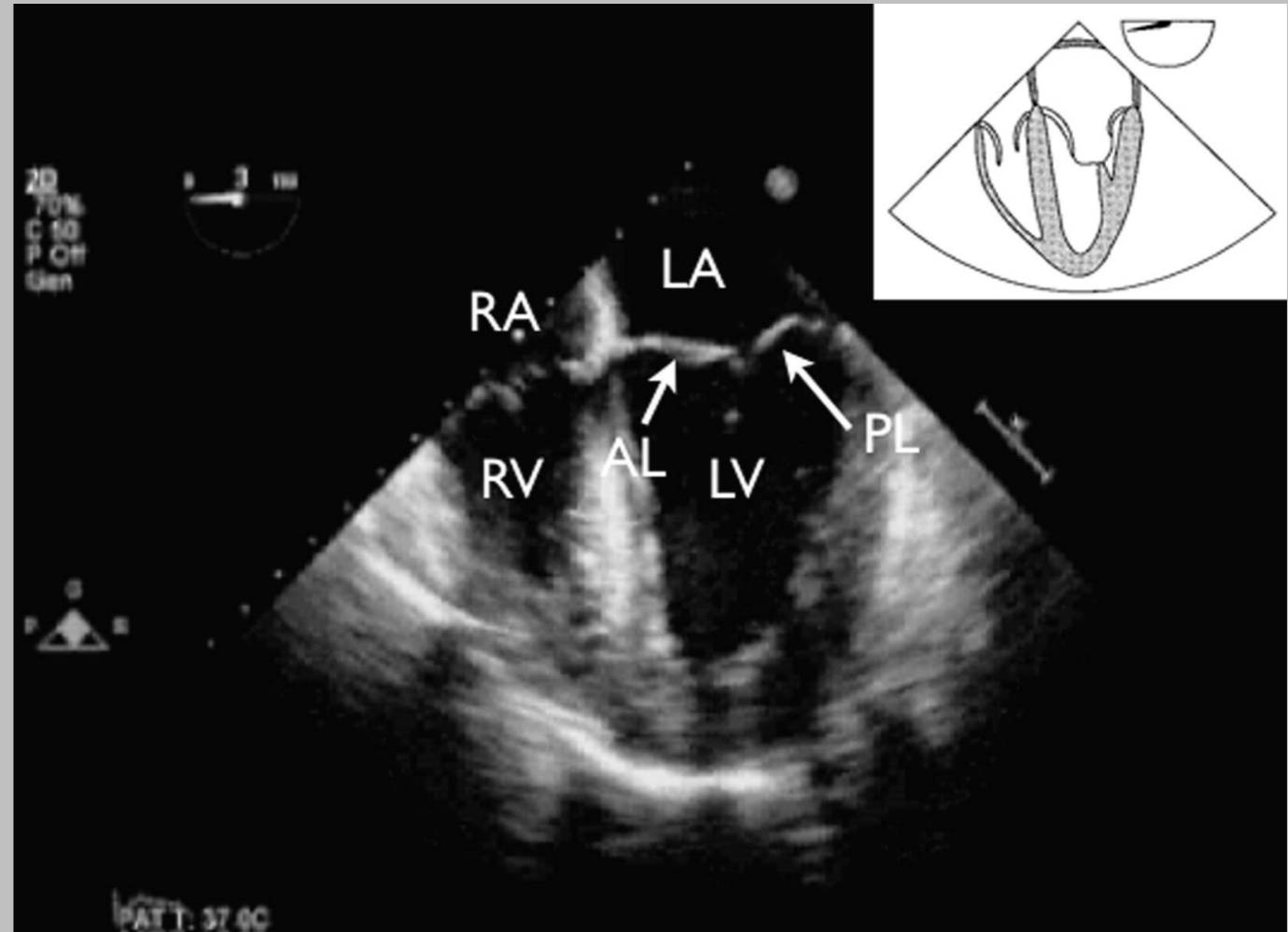
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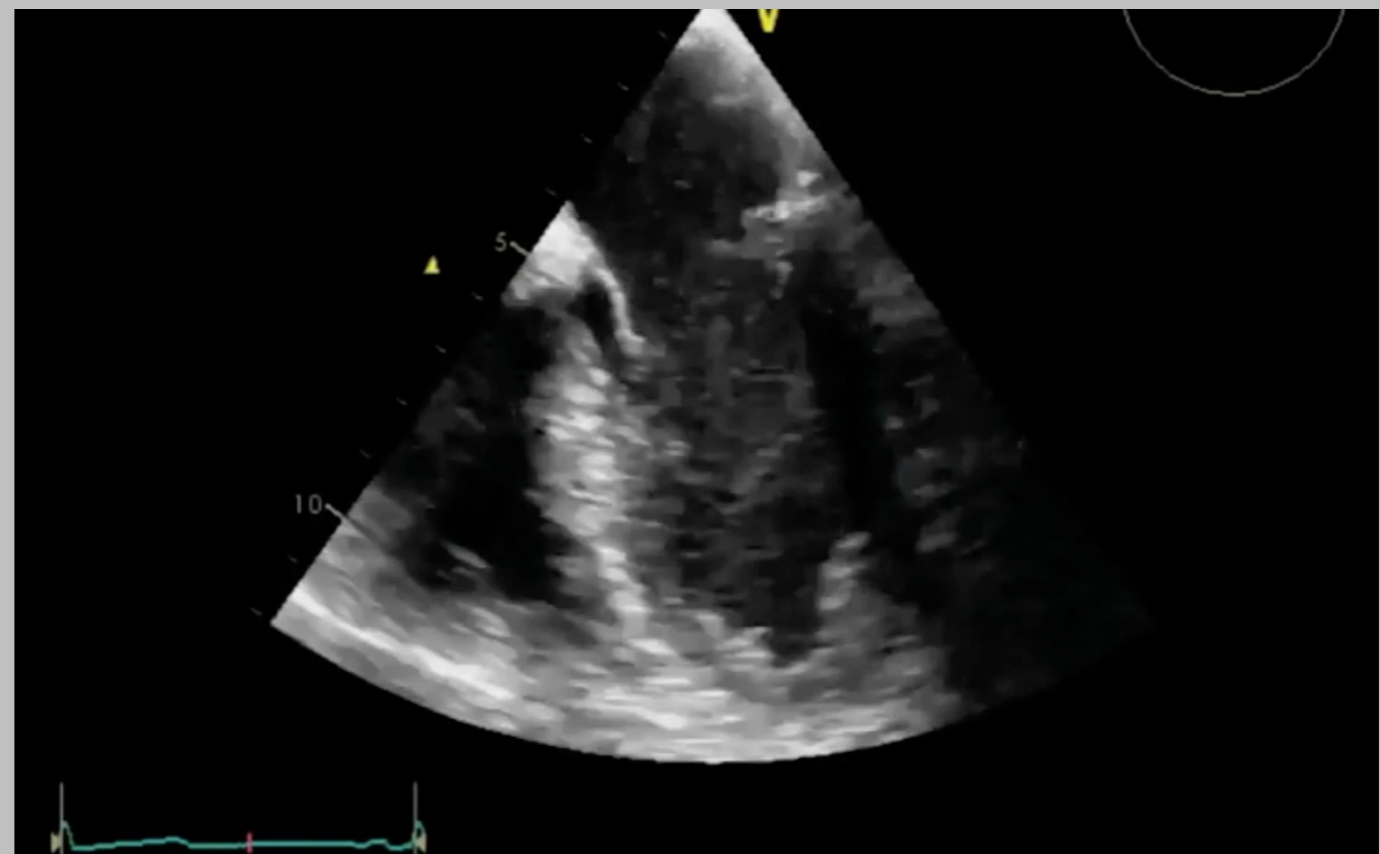
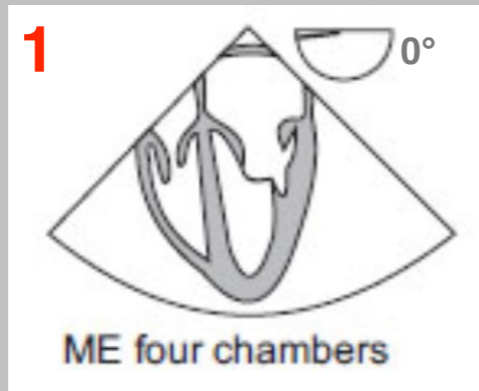
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30-35 cm



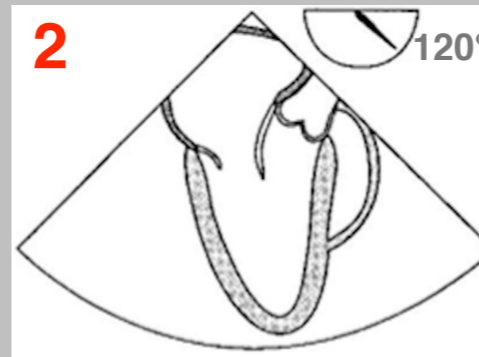
+5-10 cm

- Pericardvätska
- Storlek vä/hö.
- Samtliga hjärtrum. Inkl septum
- Global VK o HK funktion
- Fyllnad
- Väggtjocklek särskilt septum
- Klafffunktion: aorta, mitralis och tricuspidalis klaff +/- färgdoppler: Stenoser och insuff?

Probedjup
i esofagus

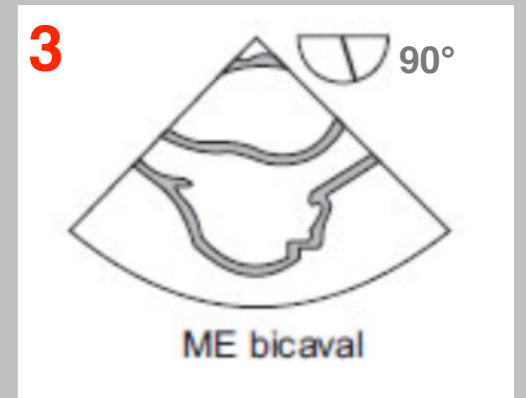
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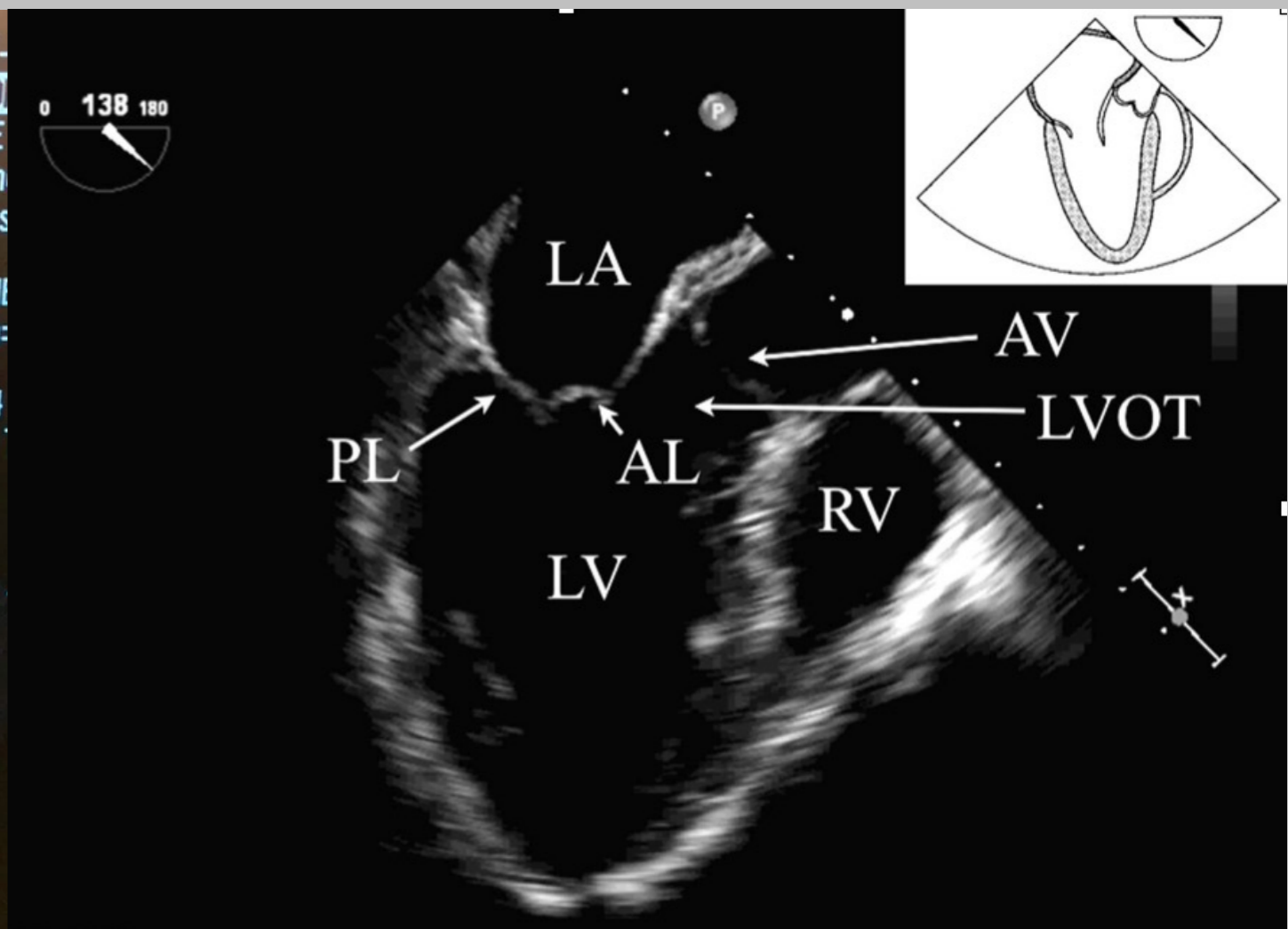
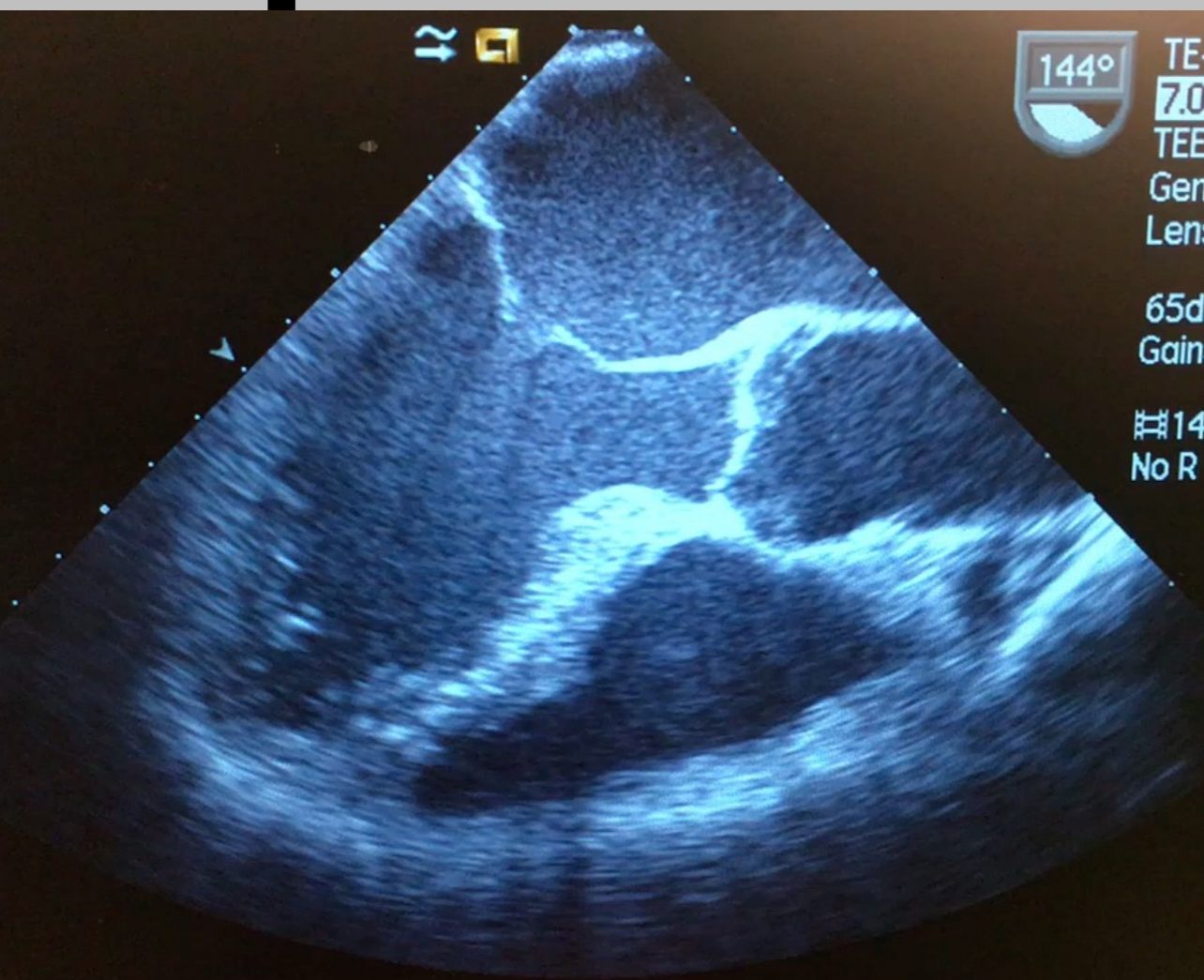
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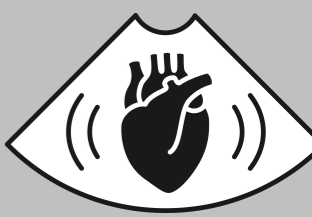


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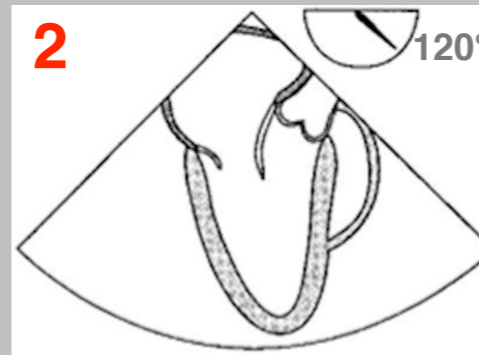


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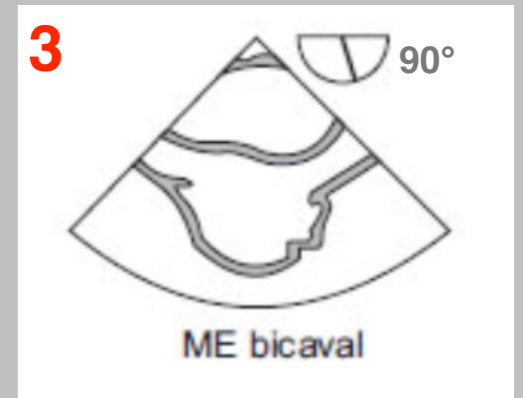


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Anteflektera

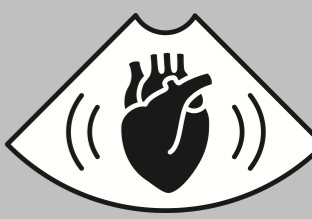
+5-10 cm



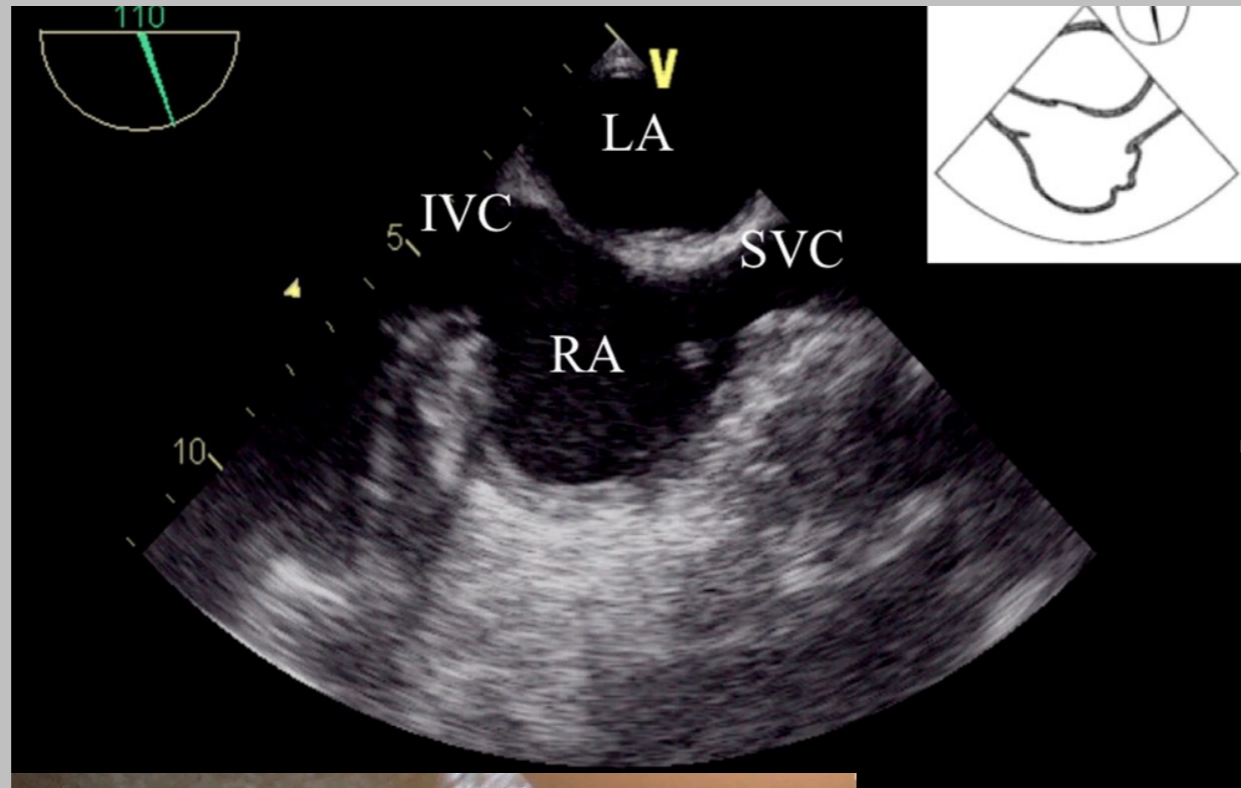
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30-35 cm



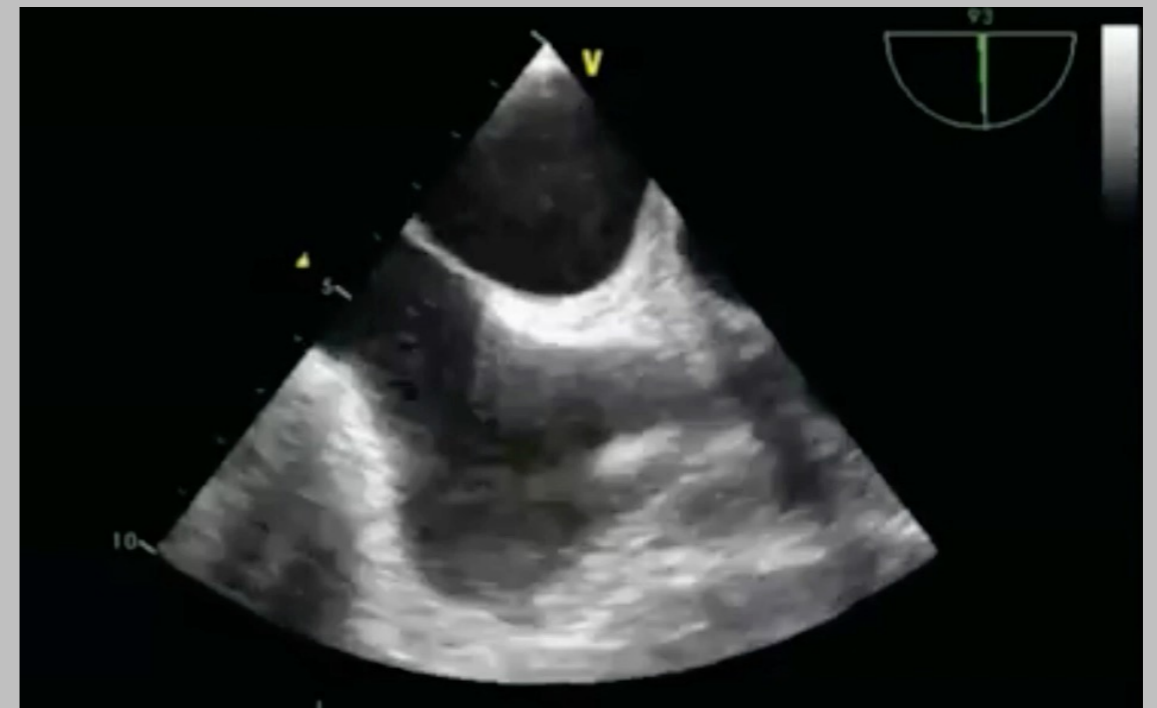
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medurs

3



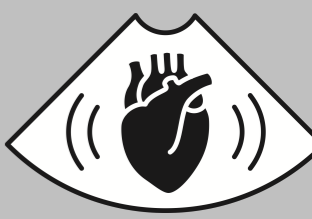
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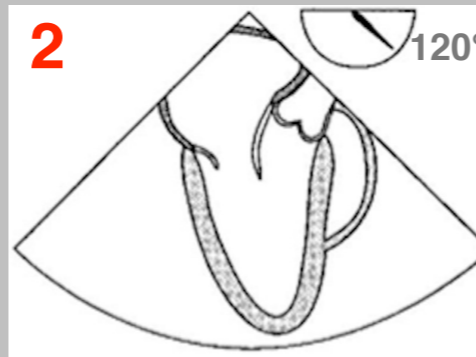


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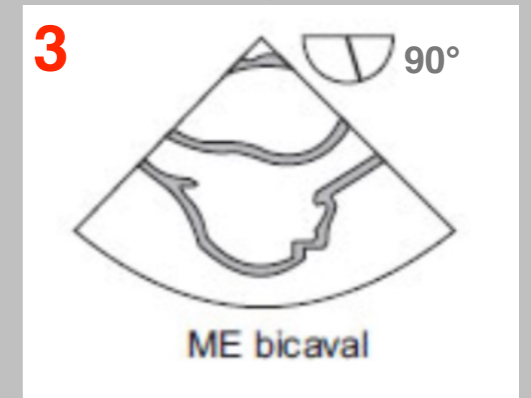
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-2 cm



30-35 cm

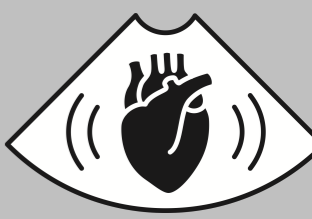


+5-10 cm



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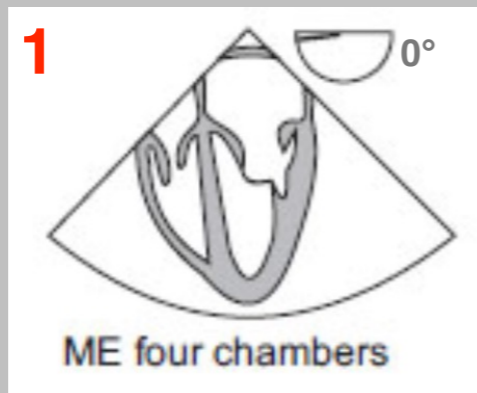
-2 cm



Mid

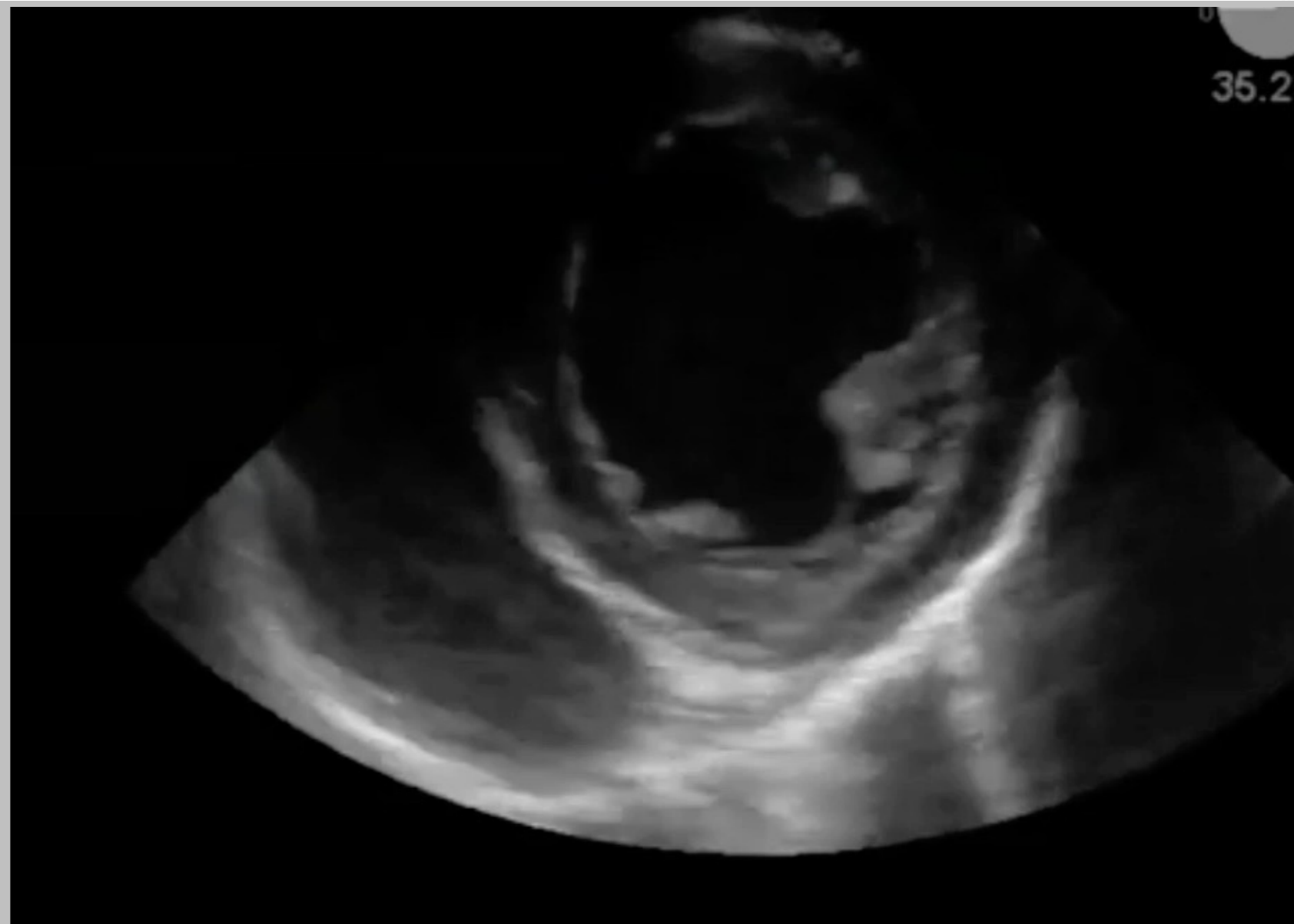
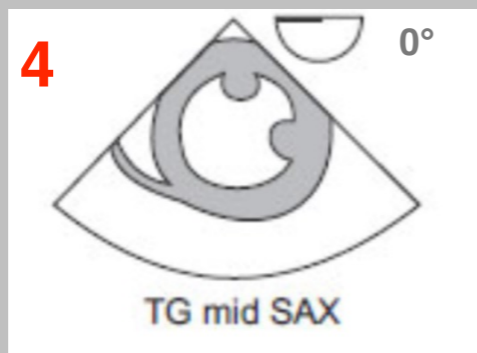


30-35 cm



Anteflektera

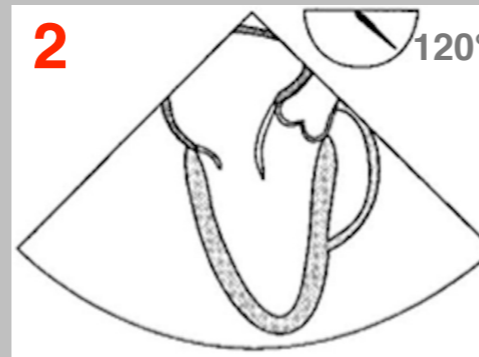
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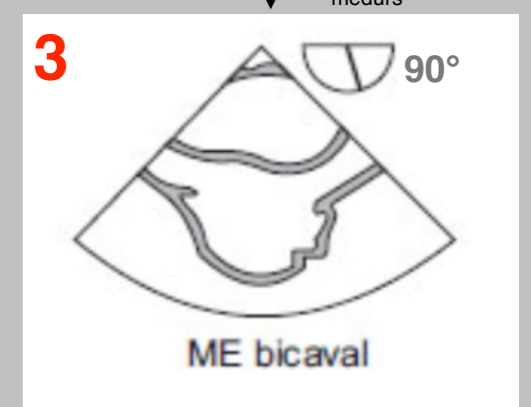
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-2 cm



30-35 cm



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THE **BOSTON**
RESUSCITATIVE
TEE WORKSHOP

OCTOBER 22 & 23 2021 PRECEDING
ACEP 2021



THE **TORONTO**
RESUSCITATIVE
TEE WORKSHOP

DECEMBER 10 & 11 - 2021



THE **PHOENIX**
RESUSCITATIVE
TEE WORKSHOP

NOVEMBER 19 & 20 - 2021



THE **NEW YORK CITY**
RESUSCITATIVE
TEE WORKSHOP



A Multicenter Survey of 10,419 Examinations

Select an area to

Werner G. Daniel, MD; Raimund Erbel, MD; Wolfgang Kasper, MD; ...
 Rolf Engberding, MD; George R. Sutherland, MD; Eberhard Grube, MD;
 Peter Hanrath, MD; Bernhard Maisch, MD; Karl Dennig, MD; Michael Schartl, MD;
 Peter Kremer, MD; Christiane Angermann, MD; Sabino Iliceto, MD;
 Julius M. Curtius, MD; and Andreas Mügge, MD

Cardiology/brief research report

Transesophageal Echocardiography During Cardiopulmonary Resuscitation Is Associated With Shorter Compression Pauses Compared With Transthoracic Echocardiography

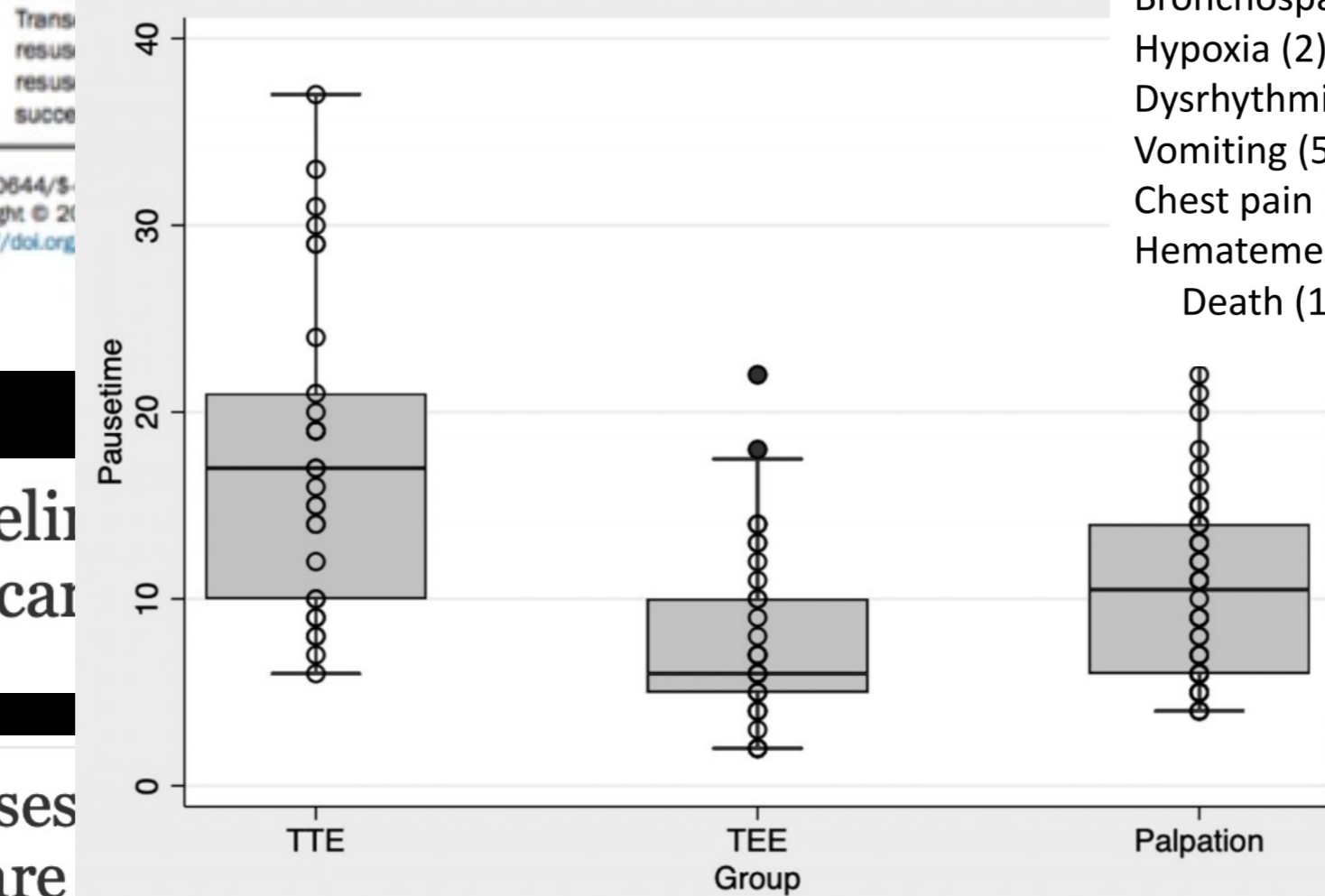
James Fair III MD^a, Michael P. Mallin MD^b, Aaron Adler^a, Patrick Ockerse MD^a, Jacob Steenblock MD^{a, c}, Scott T. Youngquist MD, MS^{a, d}

Background. During the past few years, transesophageal echocardiography (TEE) has been increasingly used in clinical cardiology; data concerning the practicability and safety of the technique, however, are rare.

Methods and Results. This report analyzes the experience of 15 European centers performing TEE studies for at least 1 year. At the time of this survey, 10,419 TEE examinations had been attempted or performed in these institutions. These TEE examinations were carried out by 54 physicians, 53.7% of whom had been trained in endoscopic techniques. Within the same time period, 160,431 precordial echocardiographic examinations were performed in the 15 institutions; the ratio between TEE and transthoracic studies averaged 9.03±6.4% (range of the 15 centers, 1.4–23.6%). Of the 10,419 patients, 9,240 (88.7%) were conscious inpatients or outpatients at the time of the TEE examination; the vast majority of the conscious patients did not receive intravenous sedation before TEE. In 201 cases (1.9%), insertion of the TEE probe was unsuccessfully attempted because of a lack of patient cooperation and/or operator experience (98.5%) or because of anatomical reasons (1.5%). In 90 of 10,218 TEE studies (0.88%) with successful probe insertion, the examination had to be interrupted because of the patient's intolerance of the echoscope (65 cases); because of pulmonary (eight cases), cardiac (eight cases), or bleeding complications (two cases); or for other reasons (seven cases). One of the bleeding complications resulted from a malignant lung tumor with esophageal infiltration and was fatal (mortality rate, 0.0098%).

Conclusions. This multicenter survey documents that TEE studies are associated with an acceptable low risk when used by experienced operators under proper safety conditions. (Circulation 1991;83:817–821)

Cardiac arrest is one of the most challenging patient presentations managed by emergency care providers and echocardiography can be instrumental in the diagnosis, prognosis, and treatment guidance in these



- Bronchospasm (6)
- Hypoxia (2)
- Dysrhythmia (7)
- Vomiting (5)
- Chest pain (1)
- Hematemesis from malignant tumor
- Death (1 case)

Guidelines
Echocardiography

Transesophageal
of-Care

0196-0644/\$-
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<https://doi.org>



Starta och anslut defibrillatorn

Analysera EKG-rytm



VF/VT

Defibrillera x 1
HLR i 2 minuter

Asystoli/PEA

HLR i 2 minuter

Återkomst av
spontan cirkulation
Vård efter hjärtstopp

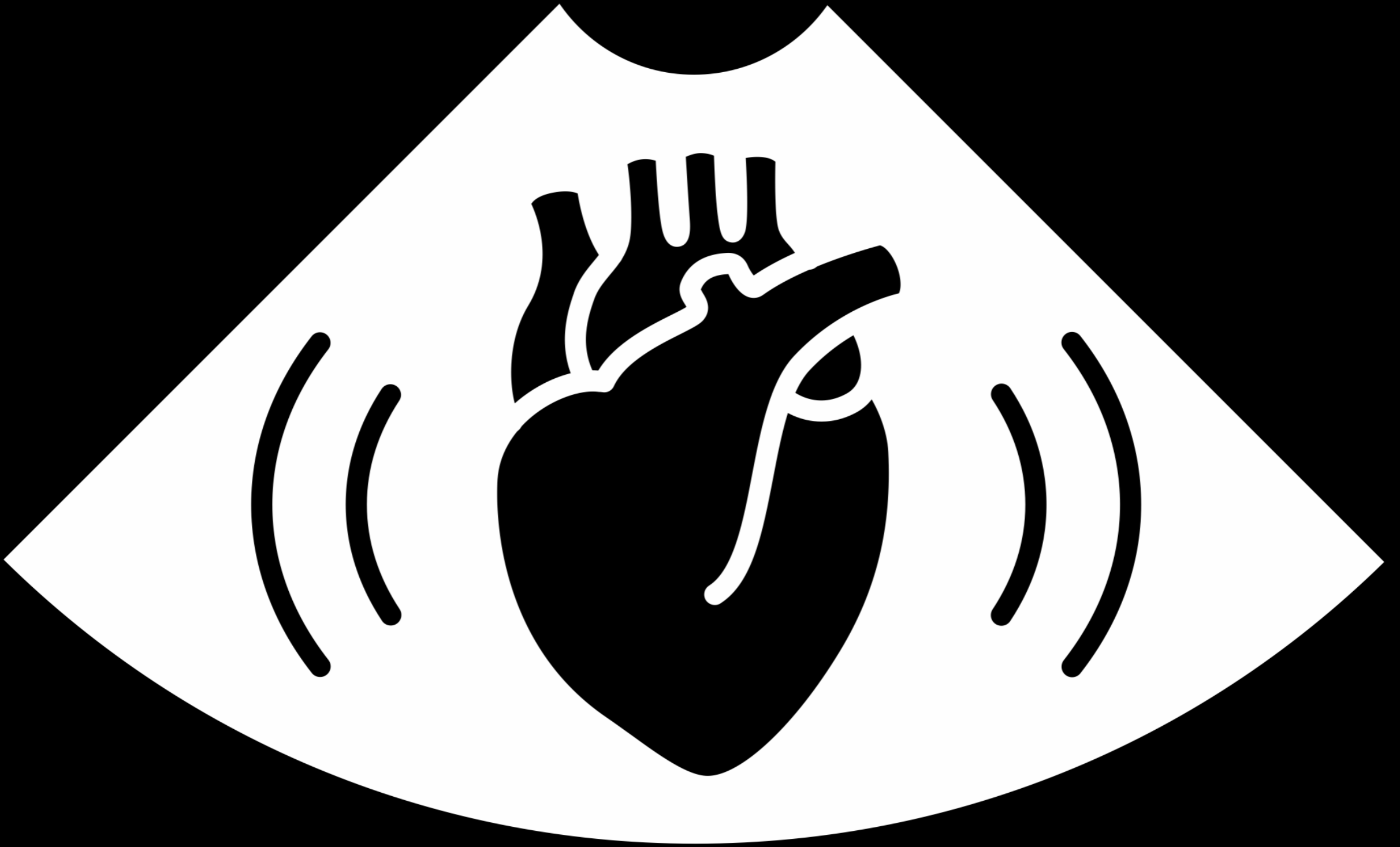




“Among the Blind, the One-Eyed Man Is King”



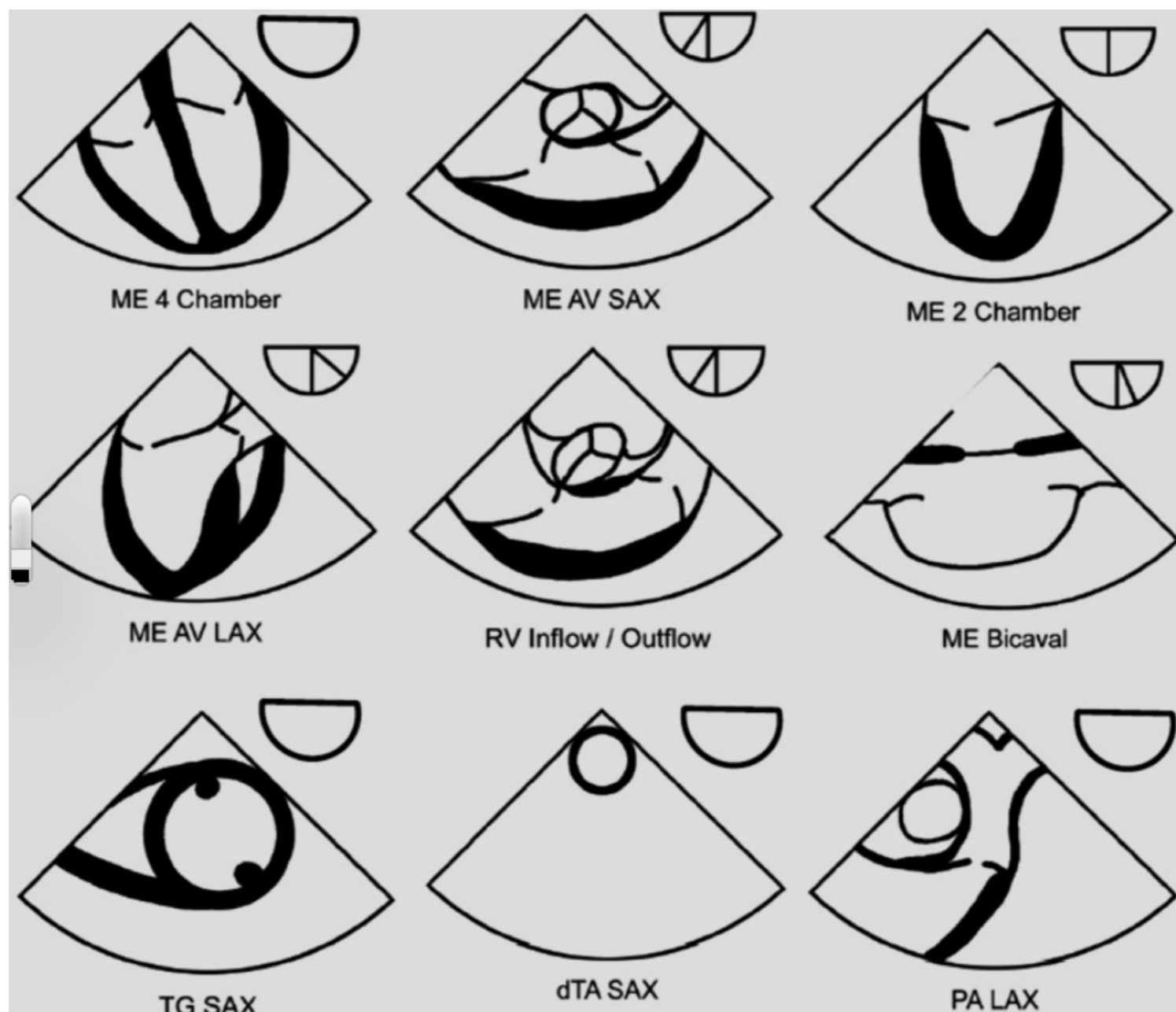
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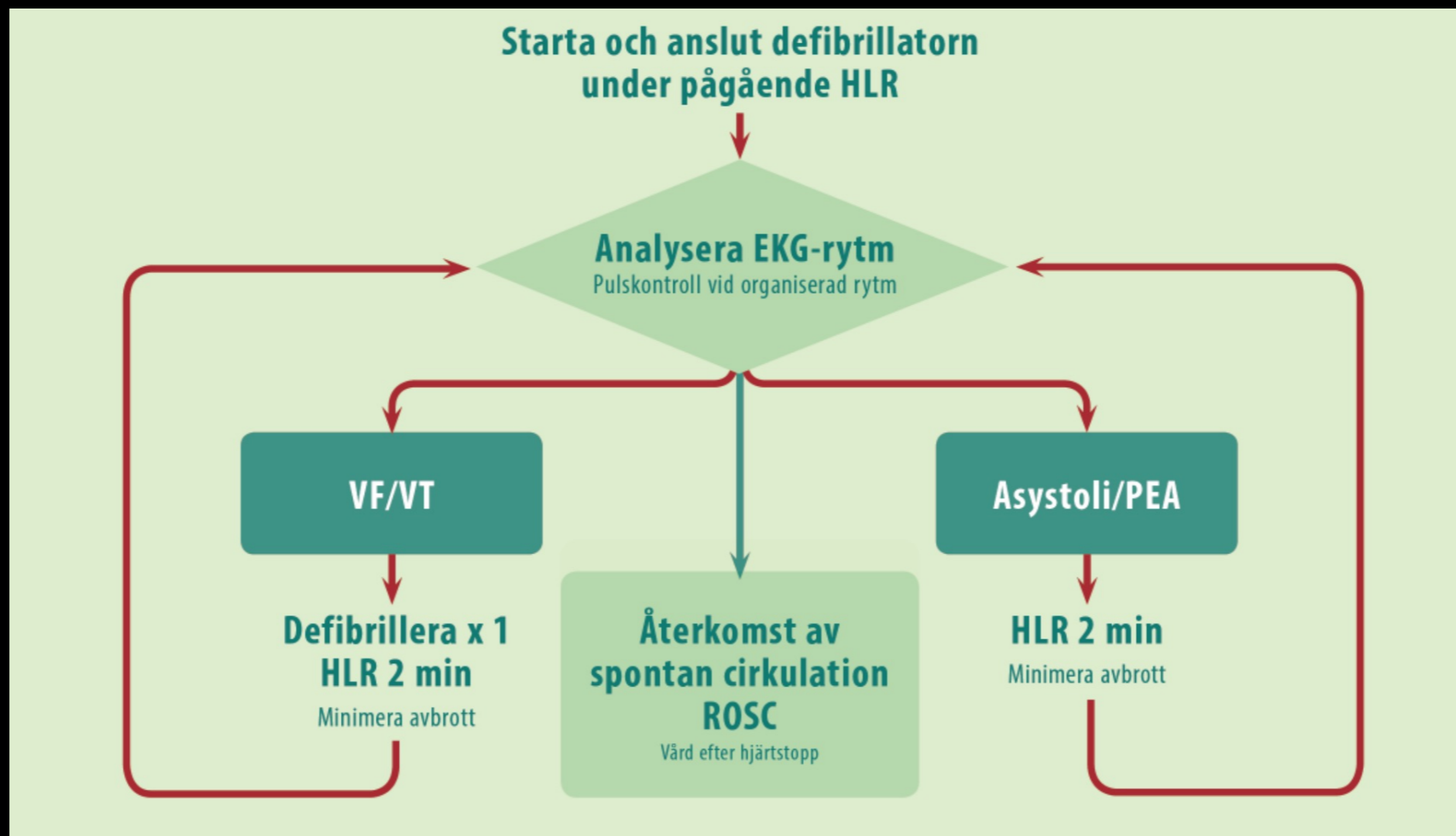


Frågor

CCU TEE / POC TEE

fönster för att värdera och monitorera den hemodynamiskt påve



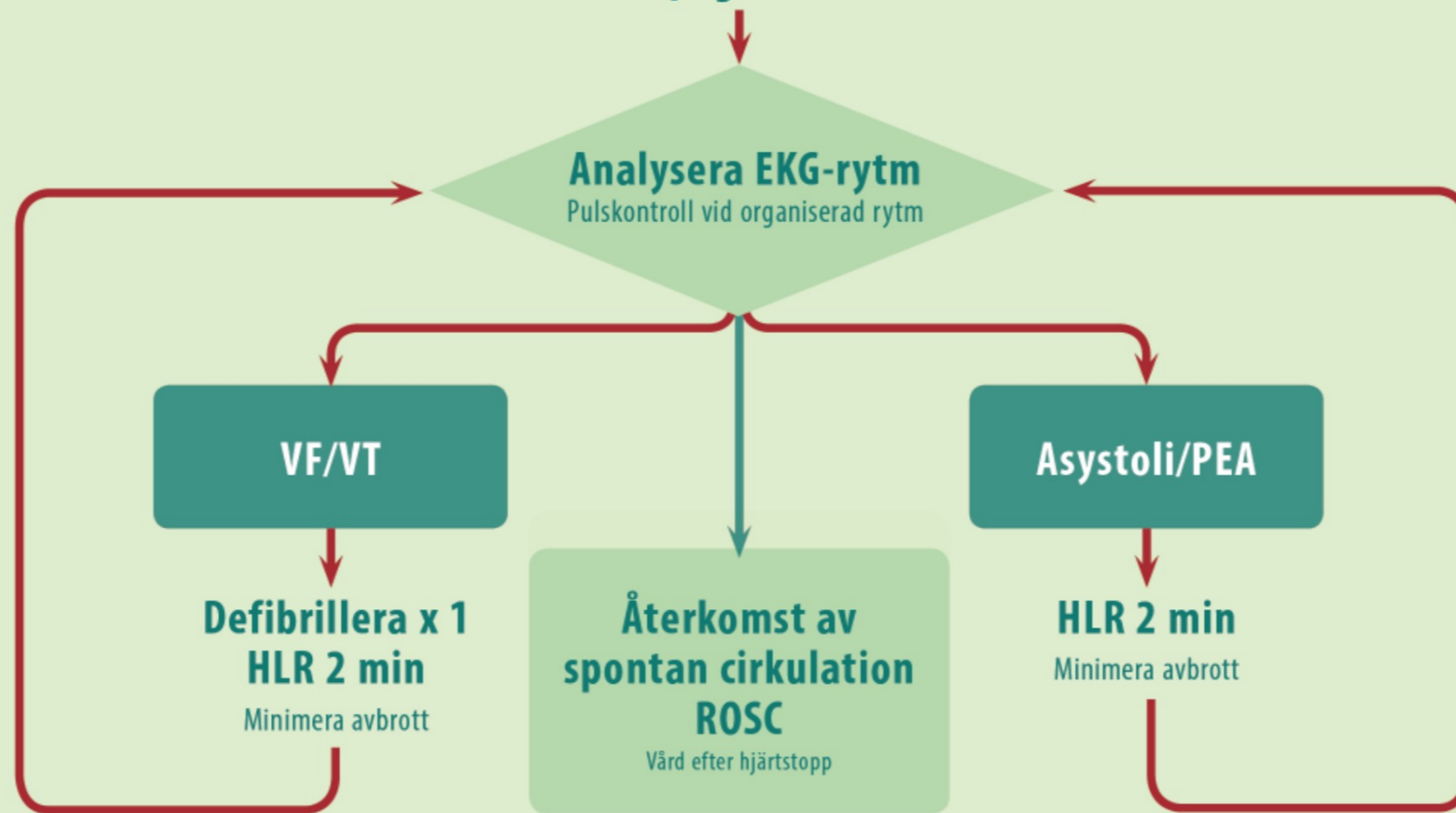


- **Standardiserad algoritm designad för alla hjärtstopp utan info om pat**

Framgångskoncept

- **Med u-ljud kan vi identifiera undergrupper och designa behandlingsalgoritmer för dessa**

Starta och anslut defibrillatorn under pågående HLR



ÅTGÄRDER UNDER PÅGÅENDE HLR

- Använd HLR-bräda vid mjukt underlag
- Överväg larynxmask eller endotrakeal intubation vid förlängd HLR
- Gör kontinuerliga bröstkompressioner på intuberad patient
- Övervaka ETCO₂-kurva på intuberad patient
- Överväg ultraljud för att identifiera reversibla orsaker
- Överväg mekaniska bröstkompressioner när manuella av god kvalitet inte kan tillgodoses, eller vid transport
- Dokumentera åtgärder och tidpunkter
- Ta hand om närstående och erbjud dem att närvara tillsammans med personal

LÄKEMEDEL UNDER PÅGÅENDE HLR

- Skapa intravenös eller intraosseös infart

Vid VF/VT:

- Ge 1 mg adrenalin iv/io efter 3:e defibrilleringen och därefter var 4:e minut
- Ge 300 mg amiodaron iv/io efter 3:e defibrilleringen och ytterligare 150 mg efter 5:e defibrilleringen

Vid asystoli/PEA:

- Ge 1 mg adrenalin iv/io så snart som möjligt och därefter var 4:e minut

KORRIGERA REVERSIBLA ORSAKER UNDER PÅGÅENDE HLR

- Hypoxi
- Hypovolemi
- Hypo/hyperkalemi
- Hypotermi

- Tromboemboli
- Tryckpneumothorax
- Tamponad
- Toxiska tillstånd

OM A-HLR ÄR OTILRÄCKLIG

- Överväg koronarangiografi under pågående HLR i utvalda fall
- Överväg ECMO i utvalda fall

VÅRD EFTER HJÄRTSTOPP

- Bedömning och åtgärder enligt ABCDE
- Normoventilation, SpO₂ 94-98%
- 12-avl-EKG - överväg akut koronarangiografi
- Temperaturkontroll 32-36°C
- Behandla bakomliggande orsak

Starta och anslut defibrillatorn under pågående HLR

Analysera EKG-rytm
Pulskontroll vid organiserad rytm

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Analysera EKG-rytm
Pulskontroll vid organiserad rytm

MEDEL UNDER PÅGÅENDE HLR

1 mg adrenalin iv/io efter 3:e defibrilleringen

VF/VT:

1 mg adrenalin iv/io efter 3:e defibrilleringen
därefter var 4:e minut

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- Hypotermi

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- Tamponad
- Toxiska tillstånd

OM A-HLR ÄR OTILRÄCKLIG

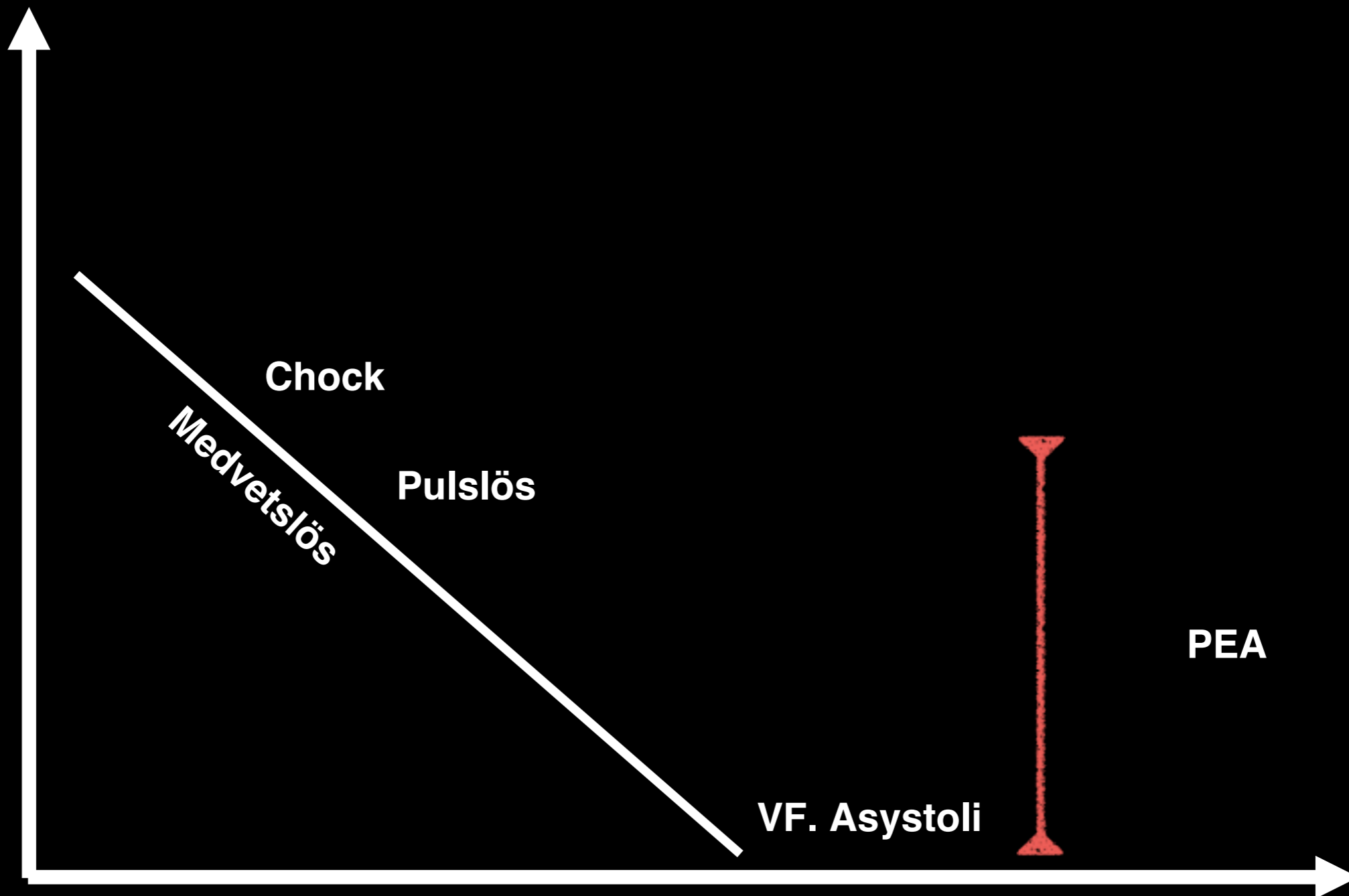
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- 12-avl-EKG - överväg akut koronarangiografi
- Temperaturkontroll 32-36°C
- Behandla bakomliggande orsak

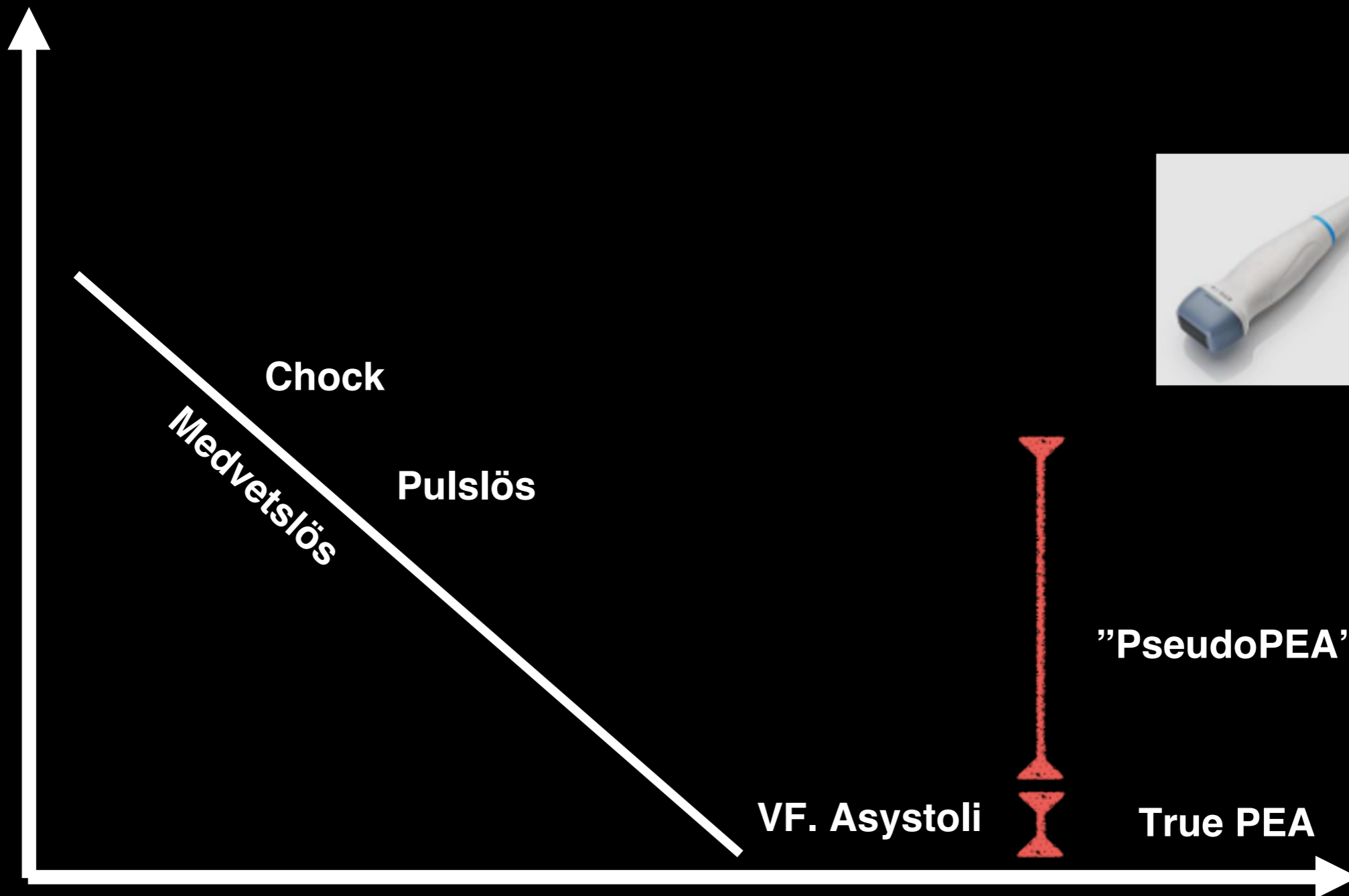
Hjärtstopp

Blodtryck



Hjärtstopp

Blodtryck



Ultrasound in Cardiac Arrest: as a diagnostic tool:

- 2001 UHP undifferentiated hypotensive patient US protocol
- **2007 FEER focused echocardiographic evaluation in resuscitation**
- **2008 C.A.U.S.E. cardiac arrest ultrasound exam**
- 2009 RUSH rapid ultrasound for shock and hypotension
- **2010 FEEL focused echocardiographic evaluation in life support**
- 2010 FOCUS focused cardiac ultrasound in the emergent setting
- 2010 RUSH rapid ultrasound in shock
- 2011 EGLS echo-guided life support
- 2014 CORE concentrated overview of resuscitative efforts

Focused echocardiographic evaluation in life support and peri-resuscitation of emergency patients: a prospective trial

- 2010, Resuscitation. Breitzkreutz et al.
- FEEL: motion, LV function, RV size, pericardial fluid
- 204 patients: 100 cardiac arrest, 104 shock
- Altered management in 78% of cases

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

Approved by the ACEP Board of Directors April 2017 (The American College of Emergency Physicians (ACEP))

Fördel TEE vs TTE vid hjärtstopp / ROSC

- Kontinuerlig med bra bildkvalitet trots HLR
 - TTE: - Svårt att göra under pågående HLR
 - Bedömlar bild på 10 sek (EKG analys/pulskontroll)
 - Kladdigt
- Bra bildkvalitet trots obesitas. KOL. Subcutant emfysem
- Probe kan lämnas i esofagus under pågående HLR
- Minimerar avbrott i HLR
- Följa kvalitet på hjärtkompressioner

2013Sep15 19:23



Crđ
TEE
Res
S

0° 180°
34.6°C



98%

MI

0.6

TIS

0.3

A □ 18

B □ 18

□ 18

□ 18

12



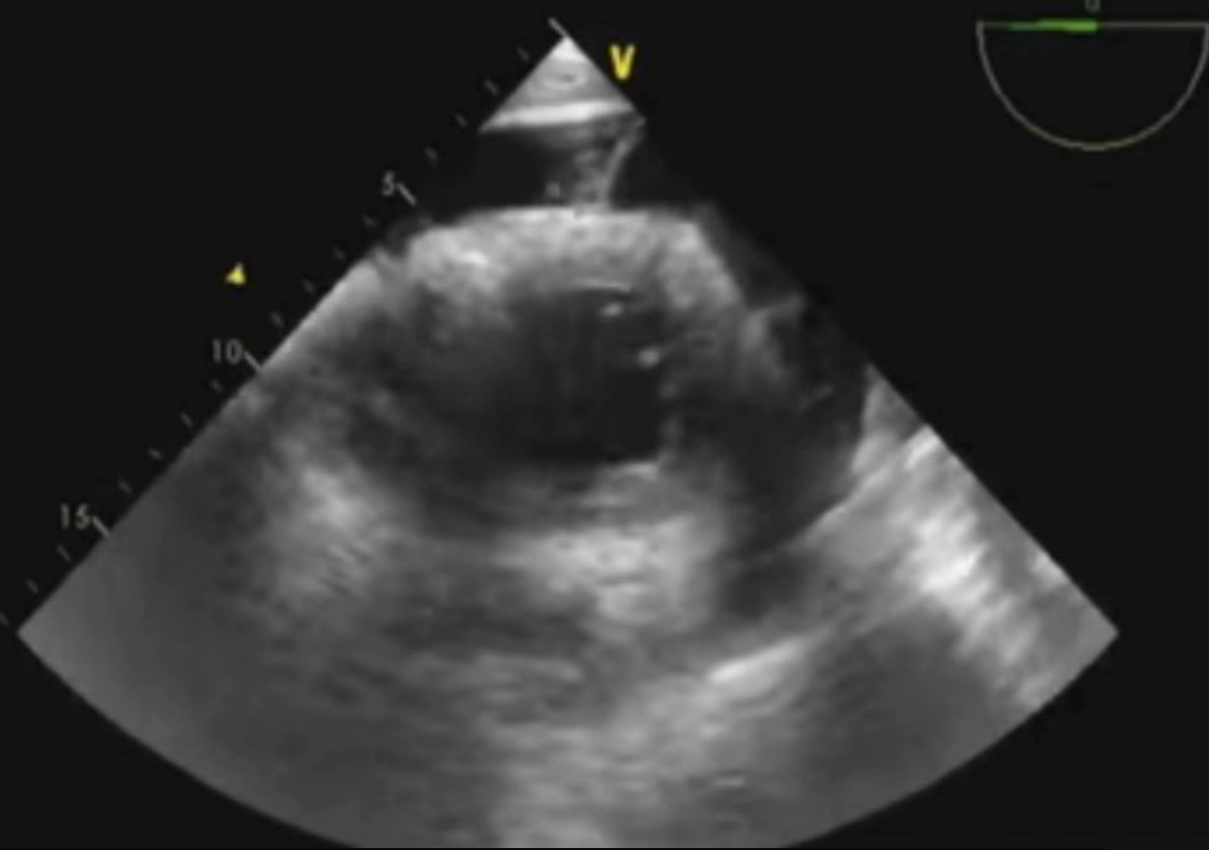
2013Sep15 19:23

GOOD CPR|

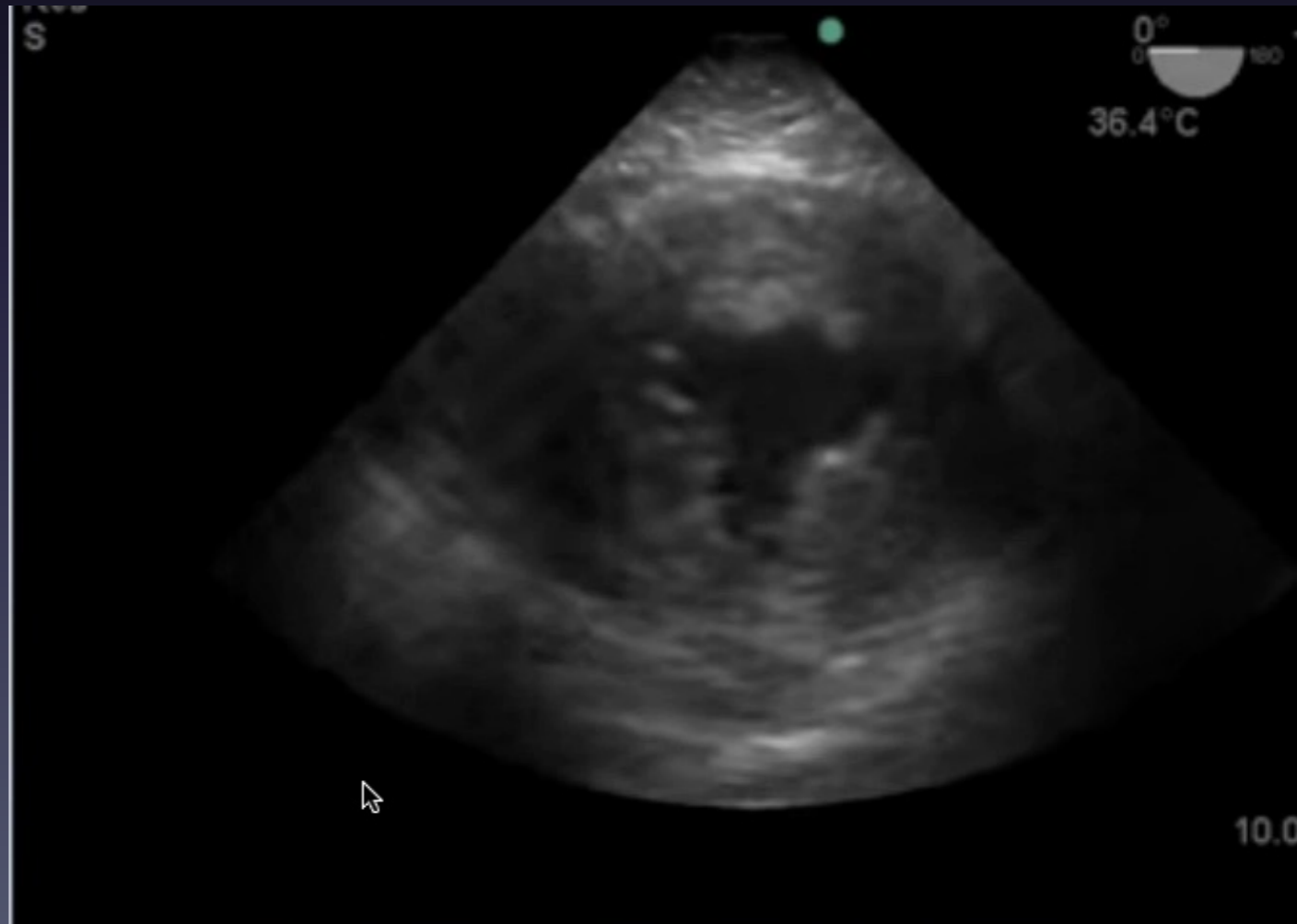
0° 180°
38.6°C



12



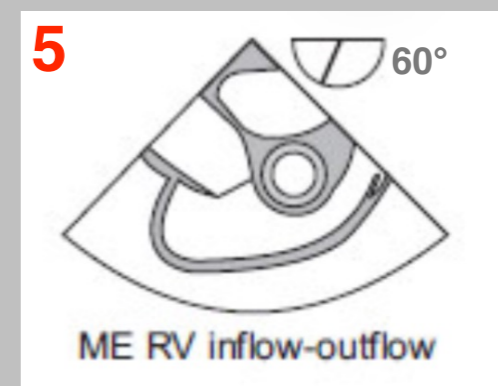
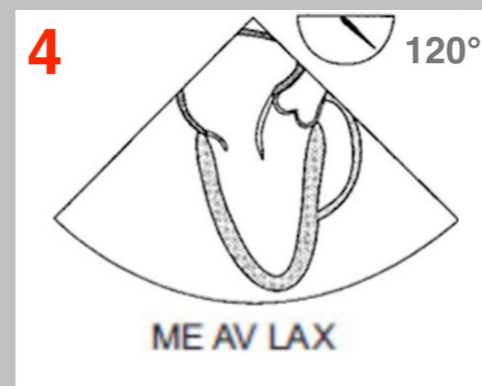
TEE vid resuscitering



Algoritm basal TEE

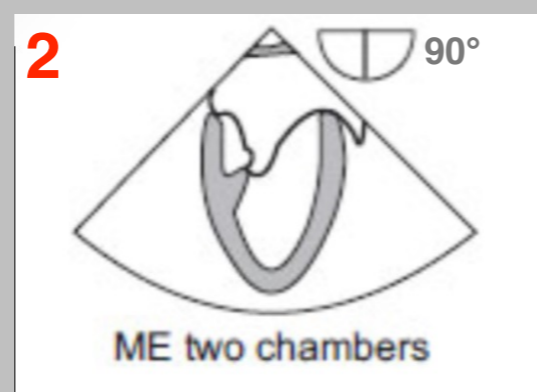
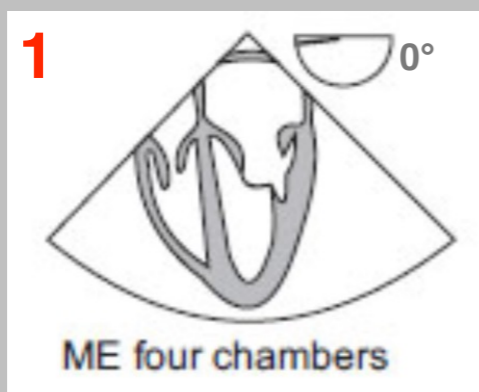
Probedjup
i esofagus

-2 cm

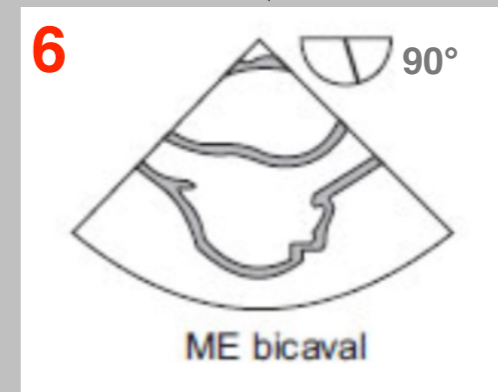


Rotera probe ngt medurs

30-35 cm



Rotera medurs

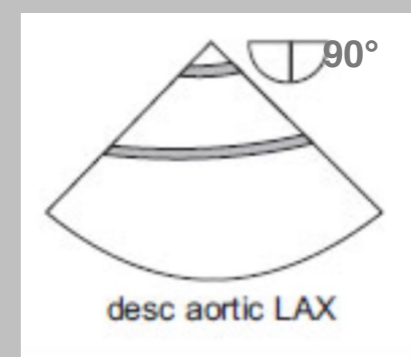
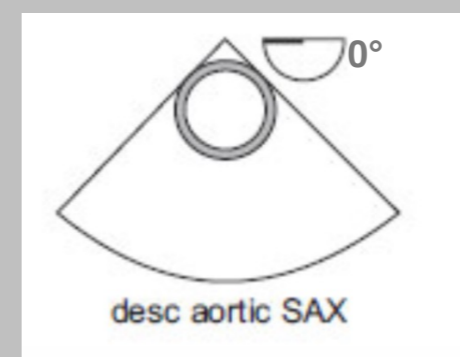


Anteflektera

+5-10 cm



Rotera bakåt mot aorta



TEE-fönster

”Fyslab TEE”

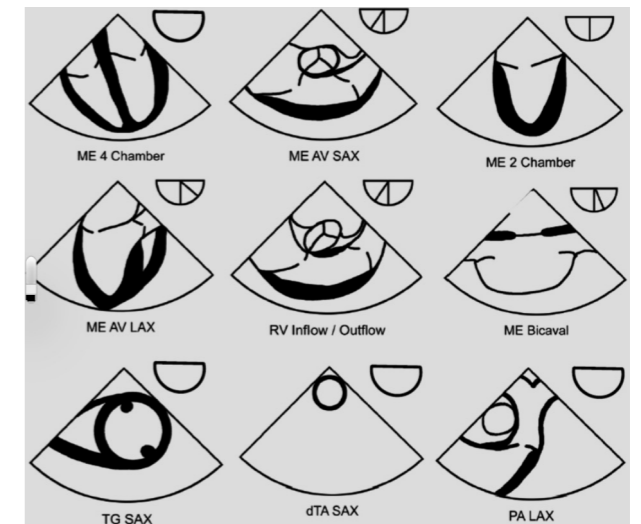
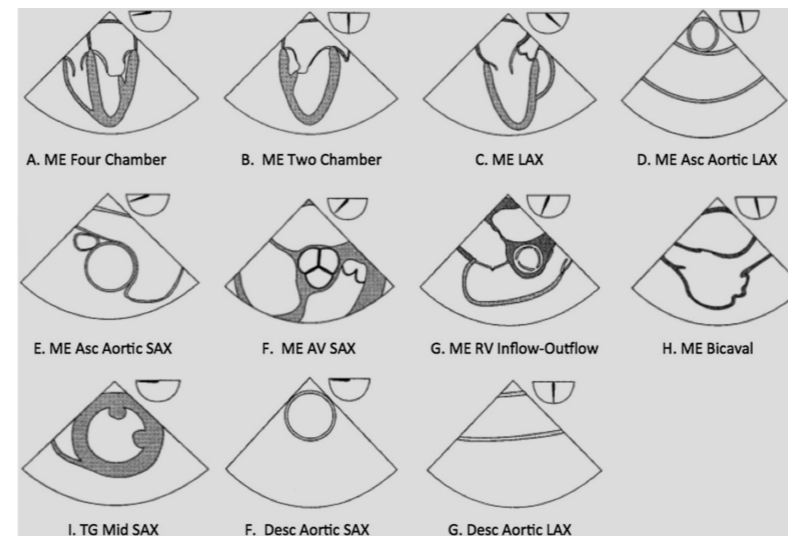
”Thoraxane TEE”

CCU TEE ”POC TEE”

Guidelines for Performing a Comprehensive Transesophageal Echocardiographic Examination:
 Recommendations from the American Society of Echocardiography and the Society of Cardiovascular Anesthesiologists.
 Rebecca T. Hahn. anesthesia-analgesia 2014

EXPERT CONSENSUS STATEMENT
Basic Perioperative Transesophageal Echocardiography Examination: A Consensus Statement of the American Society of Echocardiography and the Society of Cardiovascular Anesthesiologists
 Scott T. Reeves, MD et al
 J Am Soc Echocardiogr 2013;26:443-56.

Critical Care Basic Ultrasound Learning Goals for American Anesthesiology Critical Care Trainees: Recommendations from an Expert Group
 R. Eliot Fagley, MD et al. Anesth Analg 2015



the use of TEE allows fewer and shorter interruptions in cardiopulmonary resuscitation and should probably be the primary echocardiographic choice when equipment is available.

Echocardiographic evaluation of circulatory arrest is appropriate as a diagnostic adjunct when treating any patient who has cardiopulmonary arrest

TEE vid hjärtstopp

Fördel / Nackdel TEE:

- Minimiinvasiv.
- Kräver som regel en sövd och intuberad patient
- Placera probe och låt den vara kvar
- Bra bildkvalitet.
- Minskar tid för puls kontroll

Kontraindikationer:

- Esofaguspatologier men f.ö lågrisk.

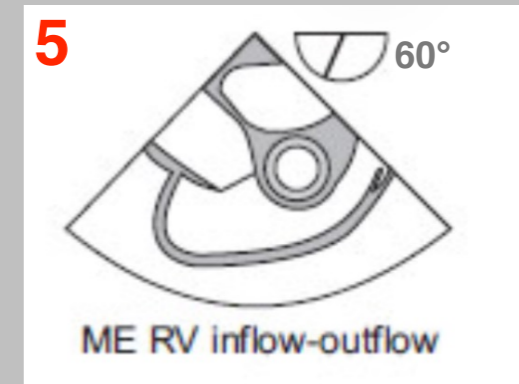
Indikation:

- **Hjärtstopp**
- TTE u-sökn ofullständig pga dåliga fönster
- Peroperativt när åtkomsten till thorax/buk är begränsad.
- Instabil patient: Monitorering av hjärtfunktion och volymsstatus
- Beslutsunderlag inför behandling med inotropi o/e vasoaktiva Im.
- Instabil pat där man överväger invasiv CO-mätning(ex PA/PICCO) men ej hunnit utföra detta

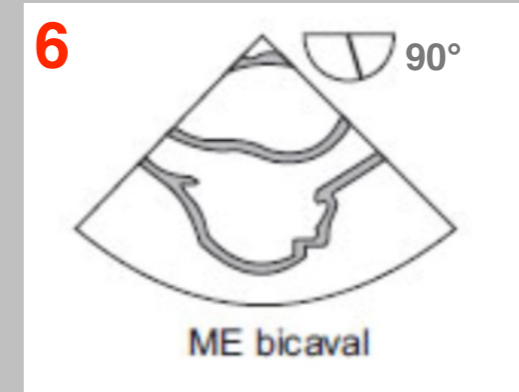
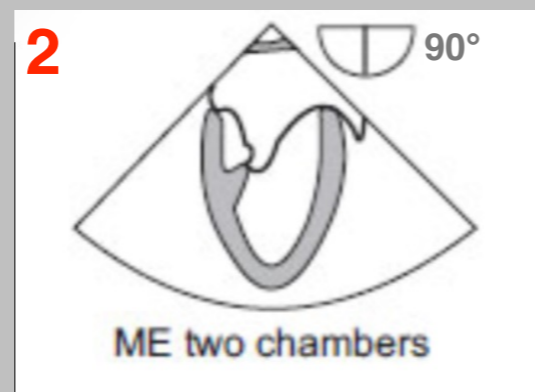
Probedjup i esofagus

Algoritm basal TEE

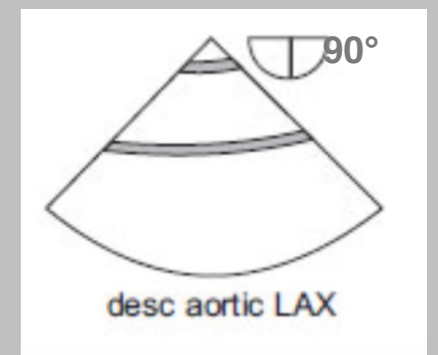
-2 cm



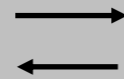
30-35 cm



+5-10 cm



Rotera probe ngt medurs



Rotera medurs



Anteflektera

Rotera bakåt mot aorta



PROGRESSIVE CLINICAL PRACTICE

Bedside Focused Echocardiography as Predictor of Survival in Cardiac Arrest Patients: A Systematic Review

Lacey Blyth, Paul Atkinson MB, BCh, BAO, BSc(Hons), MA(Cantab), MRCP, FCEM, Kathleen Gadd, MLIS, and Eddy Lang, MD, CCFP(EM)

12 studies: 568 patients

	ROSC (Positive Outcome)	No ROSC (Negative Outcome)
Cardiac contractility seen on echo (positive test)	98	92
No cardiac contractility seen on echo (negative test)	9 2.4%	369

Echocardiography for prognostication during the resuscitation of intensive care unit patients with non-shockable rhythm cardiac arrest.

Flato UA¹, Paiva EF², Carballo MT³, Buehler AM³, Marco R⁴, Timerman A⁵.

<u>49 patienter med hjärtstopp:</u>	<u>ROSC</u>	<u>6 mån</u>
35% Asystoli	23%	0%
65% PEA: True PEA(10%)	20%	0 %
Pseudo PEA (55%)	70%	15%