STRUCTURAL HEART DISEASE: LEFT ATRIAL APPENDAGE CLOSURE, PFO CLOSURE Moderators: *D. Rubenson, M. Saric*	
8:00 AM	**Case Studies: Left Atrial Appendage, Thrombus, Spontaneous Echo, Contrast** *D. Rubenson*
8:20 AM	**Left Atrial Appendage Occlusion in the Era of Novel Oral Anticoagulants** *R. Makkar*
8:40 AM	**Case Studies: Role of TEE in Left Atrial Appendage Occluder Device Placement (Pre and Intraprocedure)** *B. Khandheria*
9:00 AM	**Case Studies: Oops, What Went Wrong Here? Thrombus On or Leak Around the Device?** *M. Saric*
9:20 AM	**Patent Foramen Ovale: Diagnosis and Treatment: Master Clinician and Former Editor Perspective** *A. DeMaria*
9:45 AM	**Case Studies: 2D/3D TEE in Evaluation of Atrial Septum** *R. Lang*
10:05 AM	**Case Studies: Closure of Paravalvular Regurgitation** *R. Hahn*
10:25 AM	**Question and Answer**
10:45 AM	**Refreshment Break and Visit Exhibits**

31st Annual State of the Art Echocardiography | San Diego, CA

February 19, 2018 | 9:00 – 9:20 PM | 20 min

Oops… What Went Wrong: Thrombus or Device Leak

Muhamed Sarić MD, PhD, MPA
Director of Noninvasive Cardiology | Echo Lab
Associate Professor of Medicine

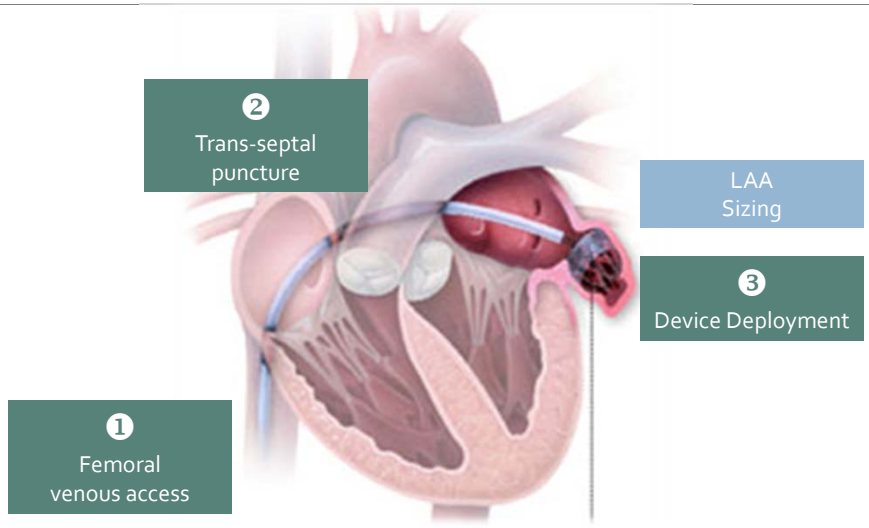
NYU Langone MEDICAL CENTER

Disclosures

Speakers Bureau (Philips, Medtronic)
Advisory Board (Siemens)

Use of experimental devices in approved clinical trials will be discussed

Percutaneous LAA Occlusion: Procedural Steps



Percutaneous LAA Closure Devices

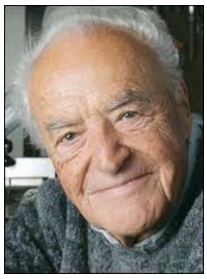
WATCHMAN AMULET

LARIAT

ENDOCARDIAL
LAA EXCLUSION

EPICARDIAL
LAA EXCLUSION

Percutaneous LAA Closure Devices



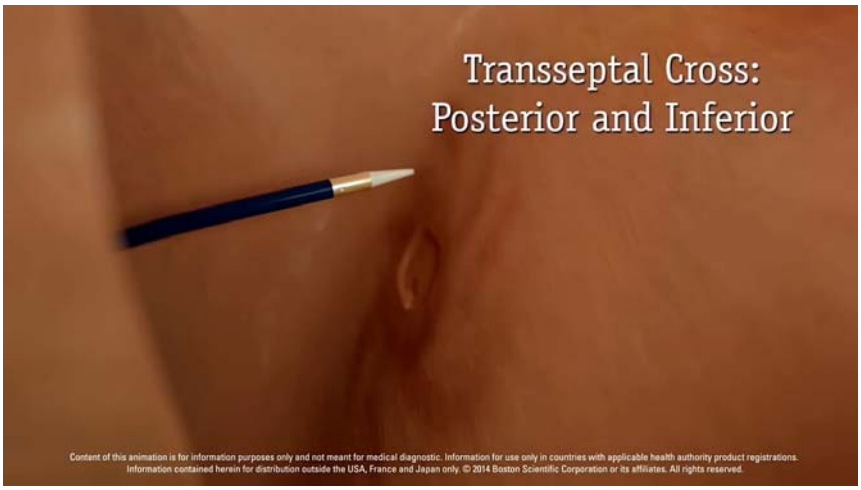
Karl Eugen Hauptmann **Eberhard Grube** **Kurt Amplatz** **William E. Cohn**

WATCHMAN
First to implant a Watchman device in 2002 in Germany

AMULET
Inventor of Amplatzer family of devices

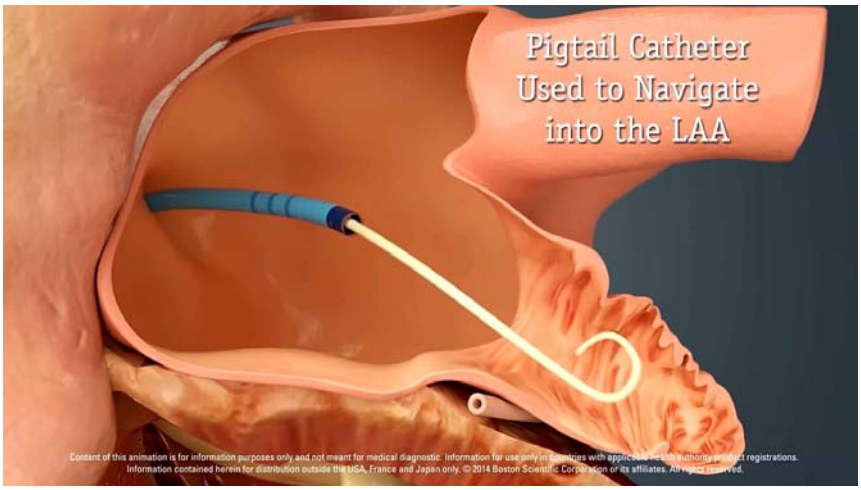
LARIAT
Inventor of Lariat device at Texas Heart Institute

WATCHMAN PROCEDURE



WATCHMAN PROCEDURE

WATCHMAN PROCEDURE

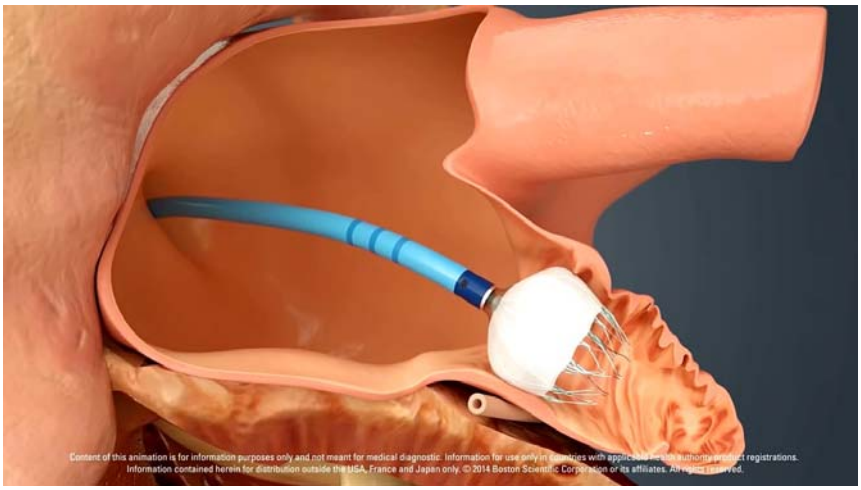


WATCHMAN PROCEDURE

WATCHMAN PROCEDURE

WATCHMAN PROCEDURE

WATCHMAN PROCEDURE



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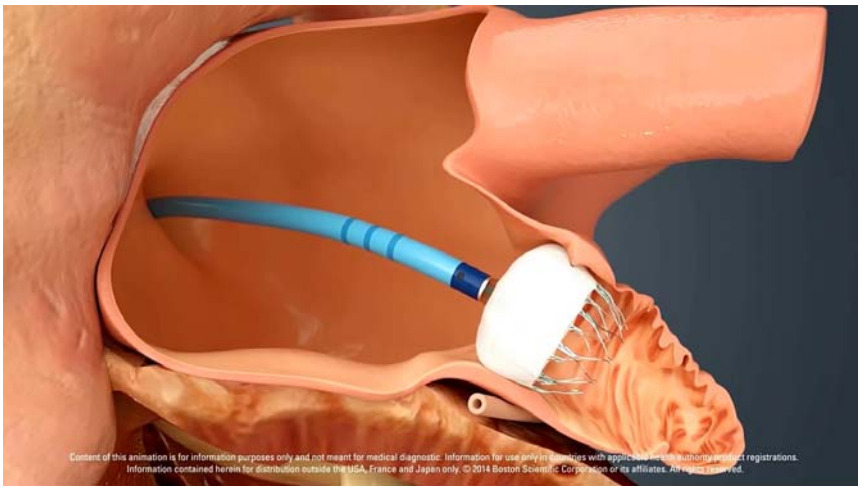
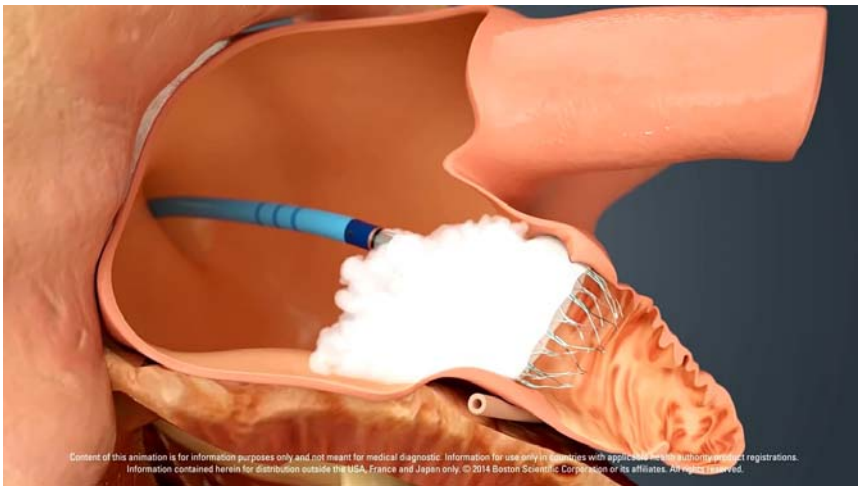
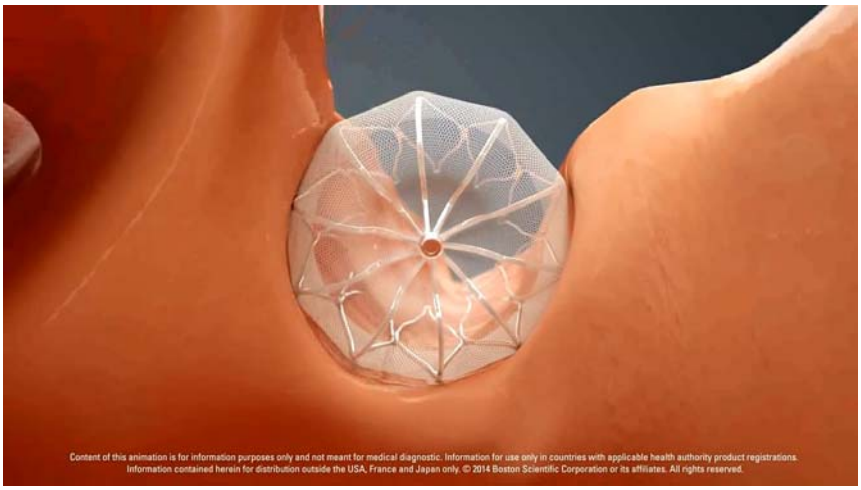


WATCHMAN PROCEDURE



WATCHMAN PROCEDURE

WATCHMAN PROCEDURE



WATCHMAN PROCEDURE

WATCHMAN PROCEDURE

IMAGING OF LAA DEVICE CLOSURE PROCEDURE

Real-time complementary & collaborative use of
fluoroscopy + **transesophageal echocardiography**

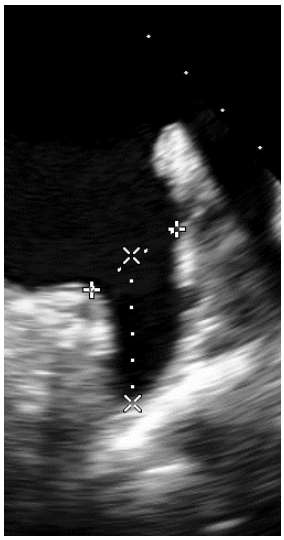
LAA Device Closure Procedure: Road Map

1. Left atrial appendage (LAA) sizing
2. Trans-septal puncture
3. Device deployment in LAA

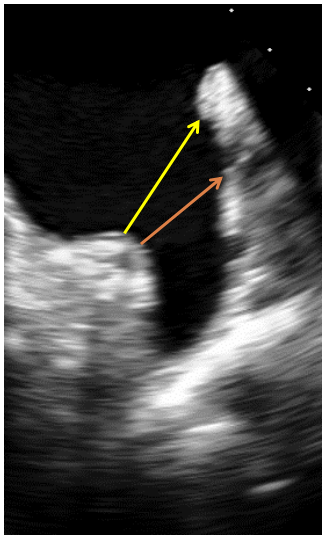
Step #1

- LAA Sizing
- Demonstration of exclusion criteria

LAA Sizing: Endocardial Devices



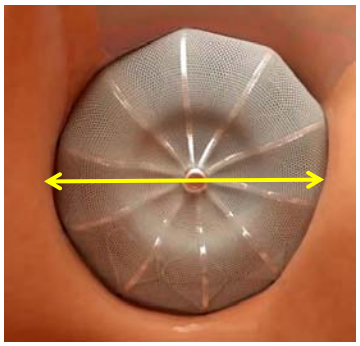
Sizing based on LAA **diameter** and **depth**.



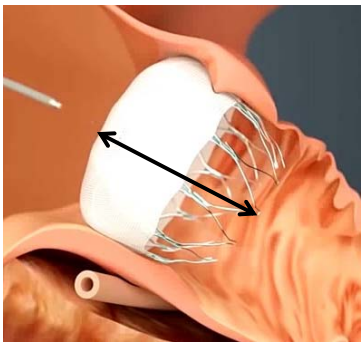
Anatomic orifice diameter

Sizing orifice diameter

WATCHMAN Device Sizing



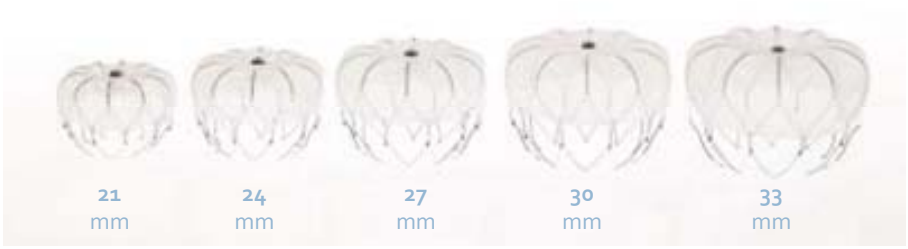
DIAMETER
Watchman devices come in 5 diameter sizes:
21, 24, 27, 30, 33 mm



LENGTH
Watchman length is proportional to diameter

Watchman Device Sizes

Watchman comes in **5 dimeter sizes**, with **3-mm diameter increments**.



US QUARTER
Diameter
24 mm

Watchman Device Sizing

STEP #1

Measure LAA diameter at TEE angles **0, 45, 90 & 135°**

STEP #2

Select the **largest LAA diameter** measured.

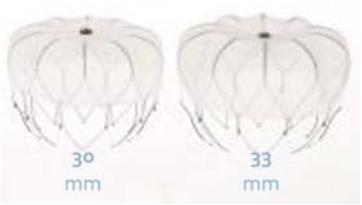
STEP #3

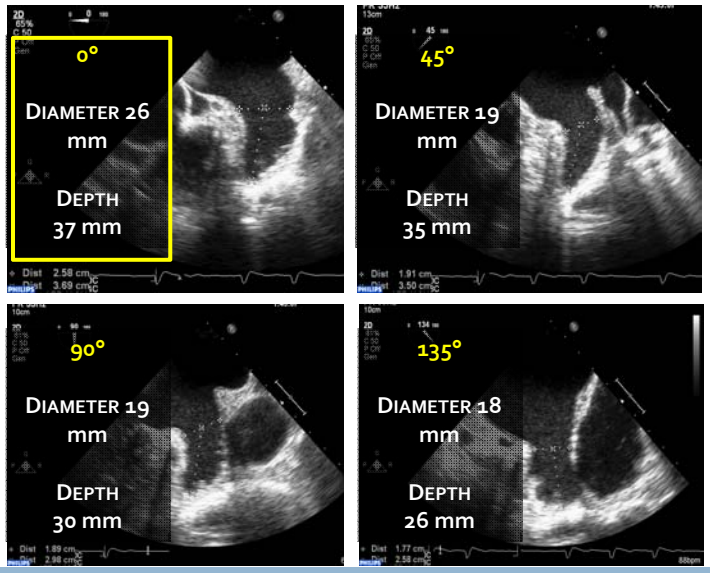
Use a lookup table to select appropriately **oversized device**.

LAA Diameter	Device Diameter	Device Compression
17-19	21	16.8-19.3
20-22	24	19.2-22.1
23-25	27	21.6-24.8
26-28	30	24.0-27.6
29-31	33	26.4-30.4

LA Appendage Sizing: 2D TEE

Select the **largest LAA measurements** for Watchman device sizing.

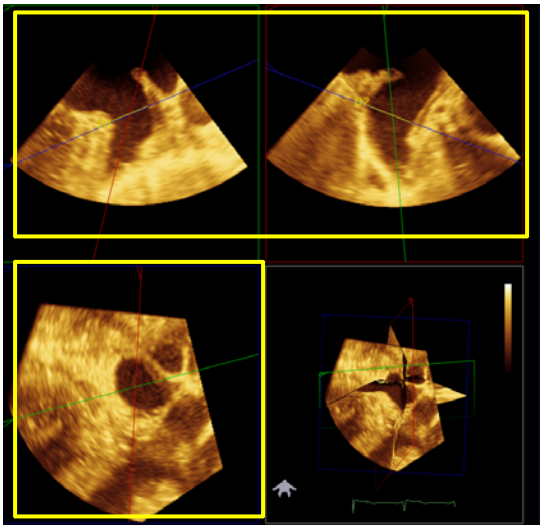




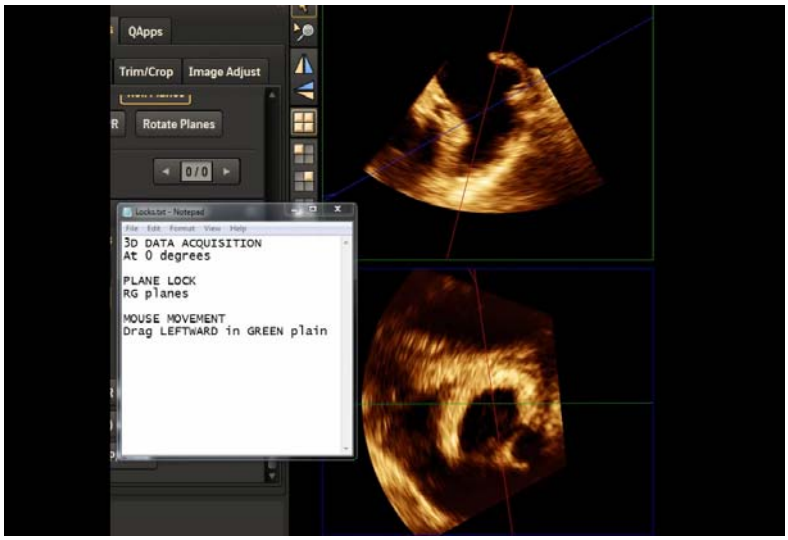
LA Appendage Sizing
3D TEE | Multiplane Reconstruction (MPR)

Long Axes
MPR assures measuring **LAA diameter at same level** in all long-axis views.

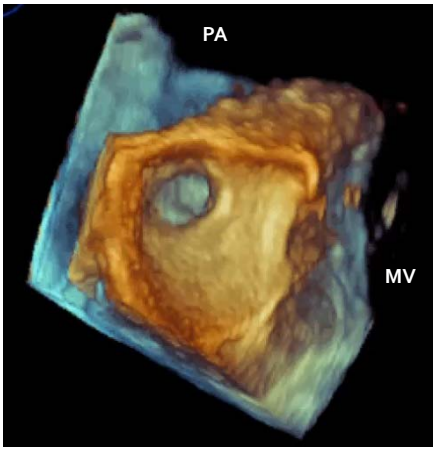
Short Axis
MPR allows for visualization of **LAA orifice shape** in short-axis views.



LAA on 3D TEE: 'NYU Twirl'



LA Appendage Sizing on 3D TEE



Dynamic **change in size & shape of LAA orifice** during the cardiac cycle.

Direct on-image LAA diameter measurements may **NOT** be precise.

Watchman

FDA Indication for Watchman LAA Occluder

The WATCHMAN Device is indicated to reduce the risk of thromboembolism from the left atrial appendage in patients:

- With non-valvular AF who are at increased risk for stroke and systemic embolism based on CHADS2 or CHA2DS2-VASc scores;
- Are deemed by their physicians to be suitable for warfarin; and
- Have an appropriate rationale to seek a non-pharmacologic alternative to warfarin

Watchman Device Sizes

- Watchman comes in 5 different sizes, 3 mm apart
- Size is based on the device diameter
- Available sizes 21, 24, 27, 30, 33 mm
- Implanted Watchman should be appropriately oversized for a given LAA diameter

LAA Anatomic Exclusion Criteria

- **Largest LAA orifice diameter < 16.8 mm OR > 30.4 mm**
  That is, the largest LAA orifice size cannot be smaller the smallest diameter required for the 21-mm Watchman and cannot be larger than the largest diameter required for the 33-mm Watchman.

  LAA diameter and depth are measured on TEE at 0, 45, 90 and 135 degrees. The largest diameter and depth obtained from these 4 angles is then used. At 0 degrees, measure from left coronary artery to 2 cm from tip of LAA coumadin ridge. At other angles from top of MV annulus to 2 cm from tip of LAA coumadin ridge.

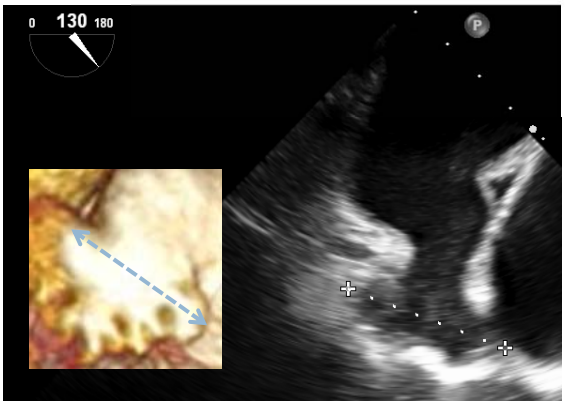
- **LAA depth < Largest LAA orifice diameter**
  That is, a patient's LAA cannot be too shallow.

- **The depth of the secondary LAA lobe (if present) from the LAA orifice plane < 1 cm**
  That is, the secondary lobe cannot be too close to the LAA orifice.

- **Presence of intracardiac thrombus or LAA dense smoke**

saric.us/echonomy

LAA Sizing: Lariat Device



LARIAT DIAMETER
(40 mm)

LAA WIDTH
Should be less than
Lariat diameter
(< 40 mm)

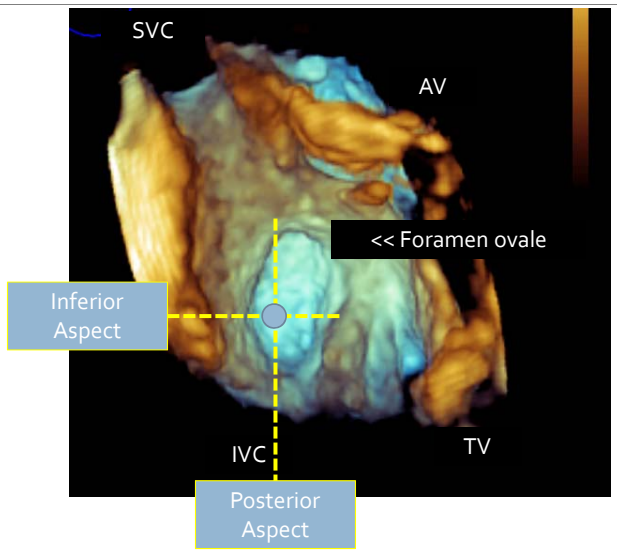
Step #2

- Transseptal puncture

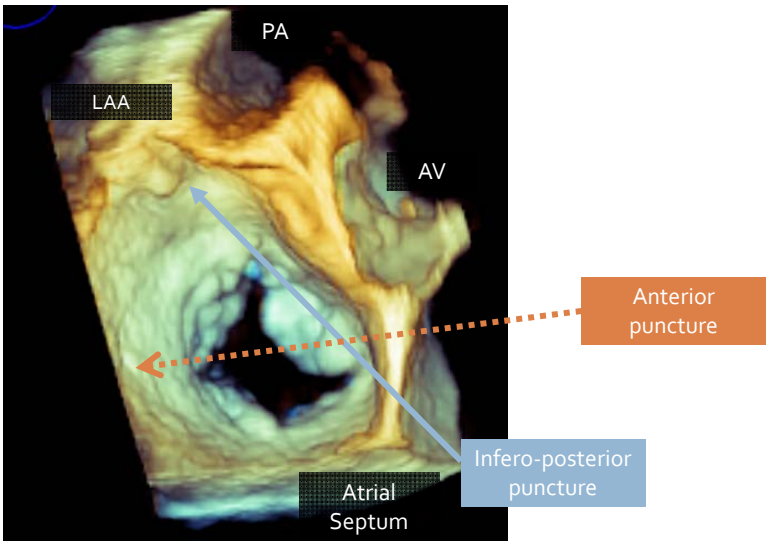
Trans-septal Puncture

TEE provides guidance for trans-septal puncture
in the **posterior** & **inferior** aspect of the interatrial septum.

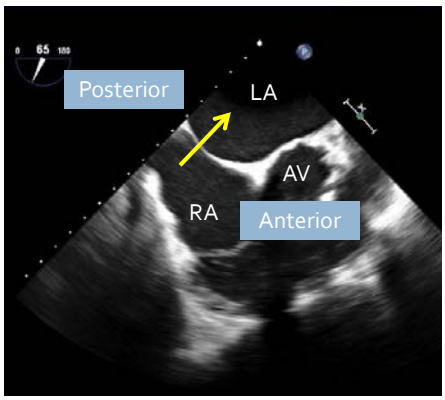
Fossa Ovalis | Right Atrial Perspective



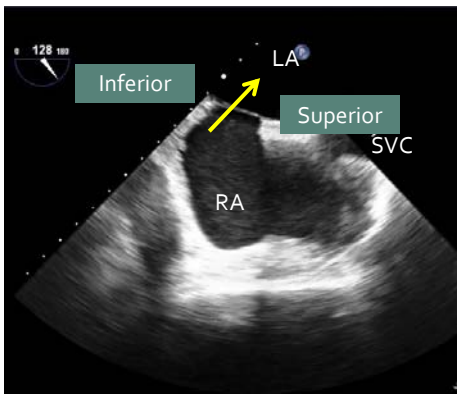
Trans-septal Puncture | Optimal Location



Trans-septal Puncture | Optimal Location

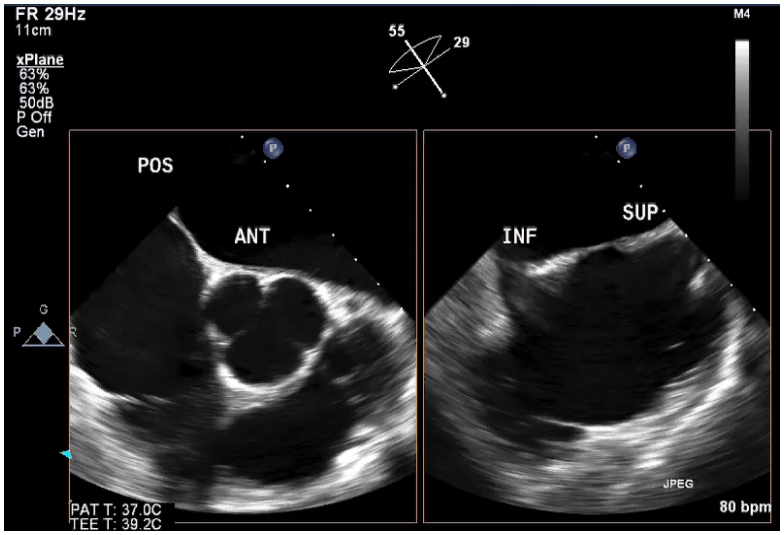


TEE | **AV SHORT AXIS**

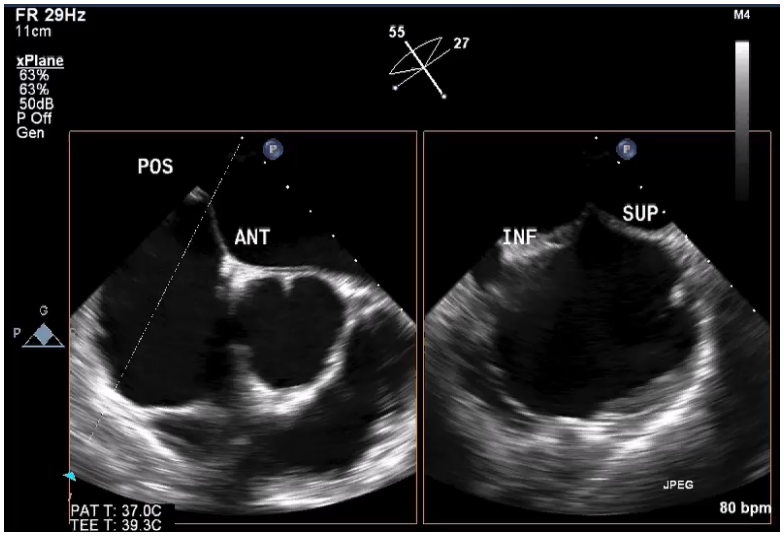


TEE | **BICAVAL VIEW**

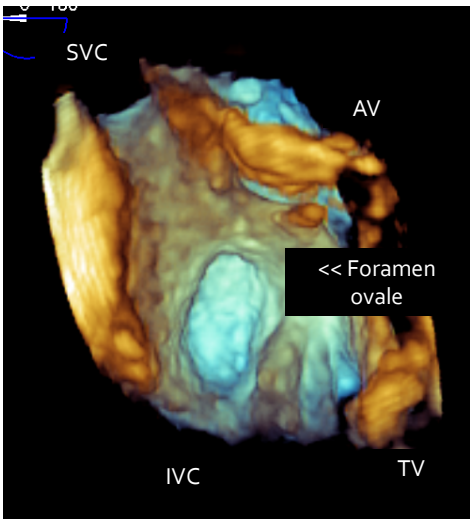
Trans-septal Puncture | Optimal Location

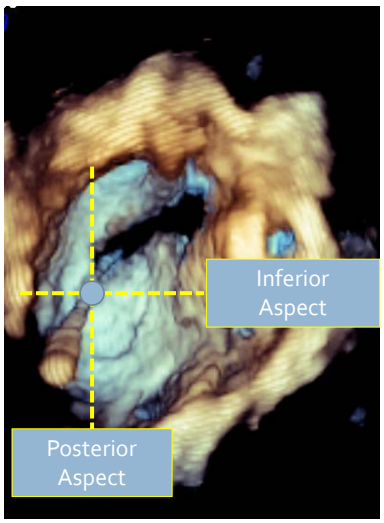


Trans-septal Puncture | Optimal Location



Trans-septal Puncture | Optimal Location





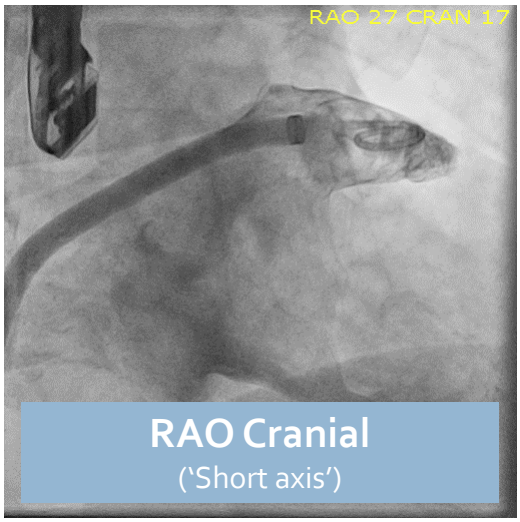
Step #3

- LAA Occluder Device Deployment

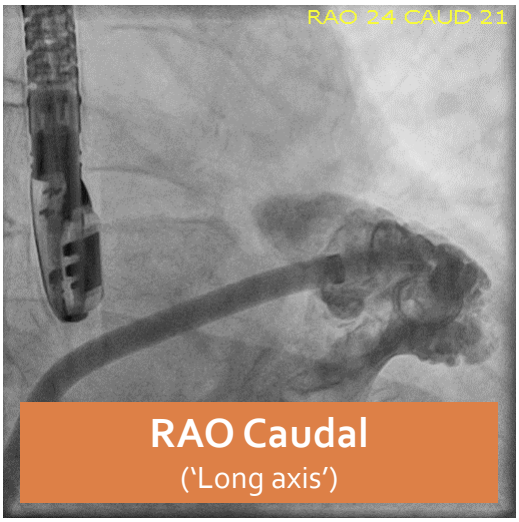
LAA Occluder Device Deployment

Complementary roles of **echocardiography** and **fluoroscopy** during device deployment.

LAA Fluoroscopy View



RAO Cranial
('Short axis')

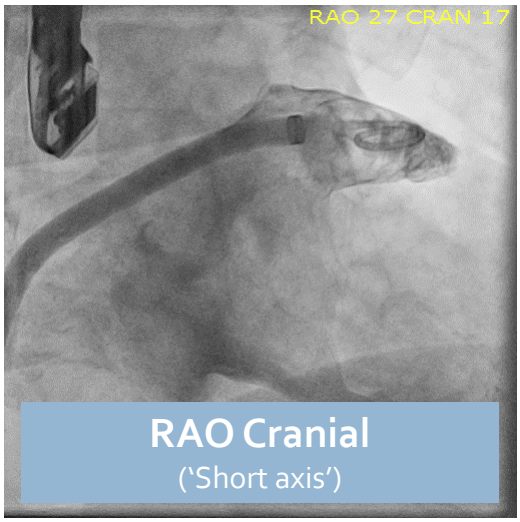


RAO Caudal
('Long axis')

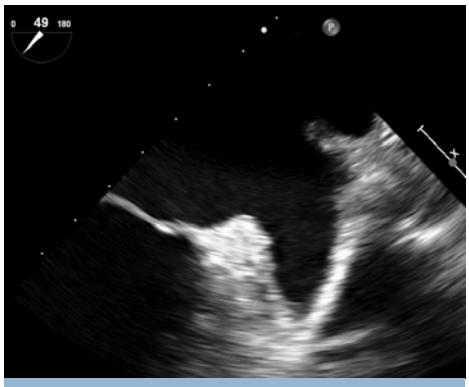
Equivalent Views

What TEE views are equivalent to fluoroscopic RAO views?

Fluoroscopy vs. TEE

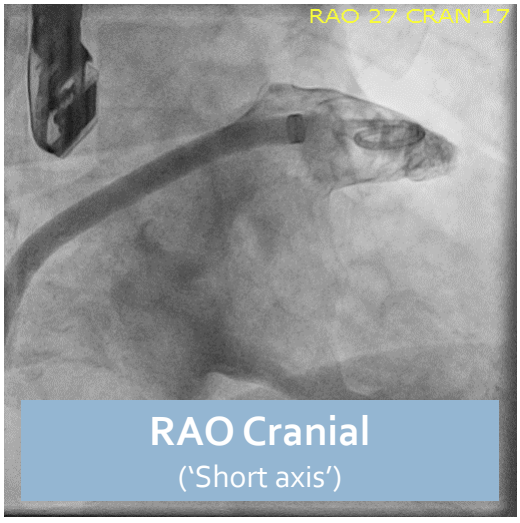


RAO Cranial
('Short axis')

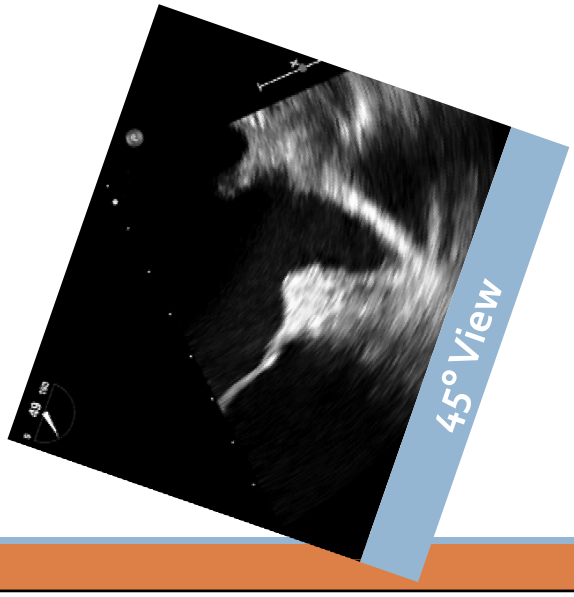


45° View

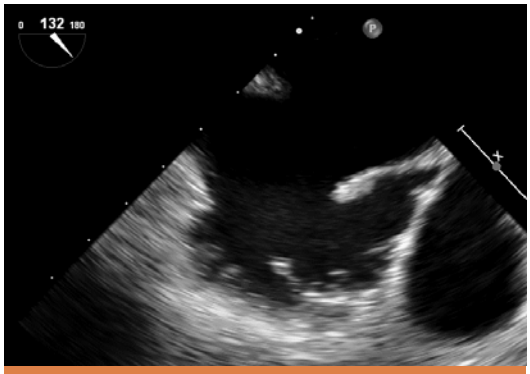
Fluoroscopy vs. TEE



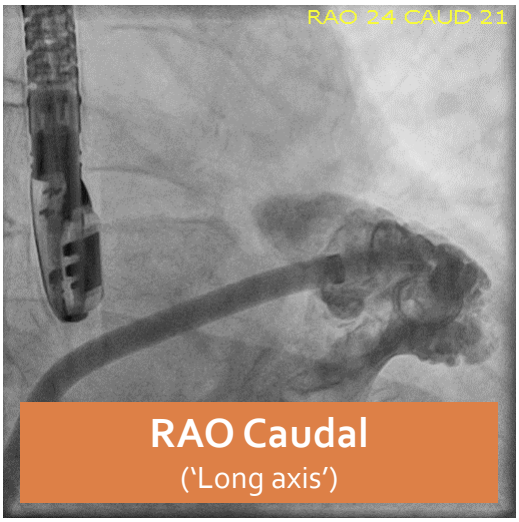
RAO Cranial
('Short axis')



LAA Fluoroscopy View

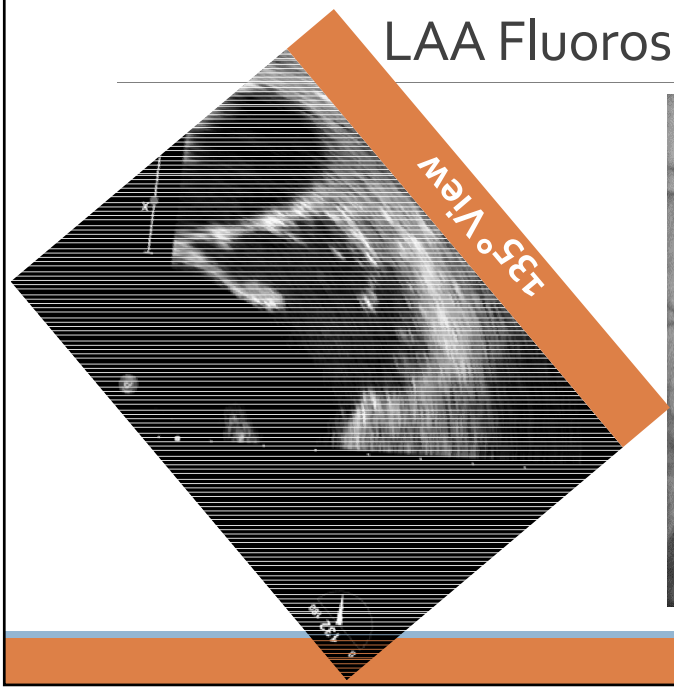


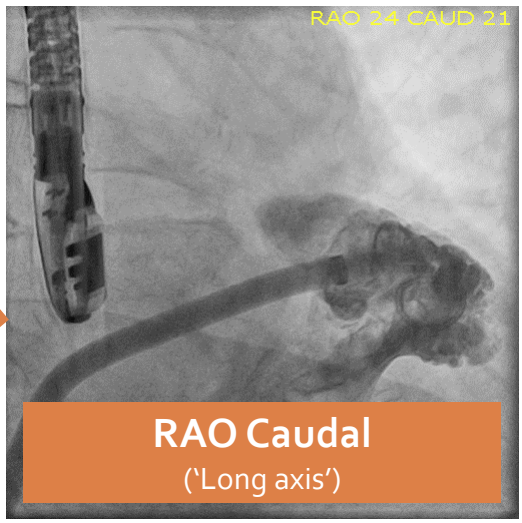
135° View



RAO Caudal
('Long axis')

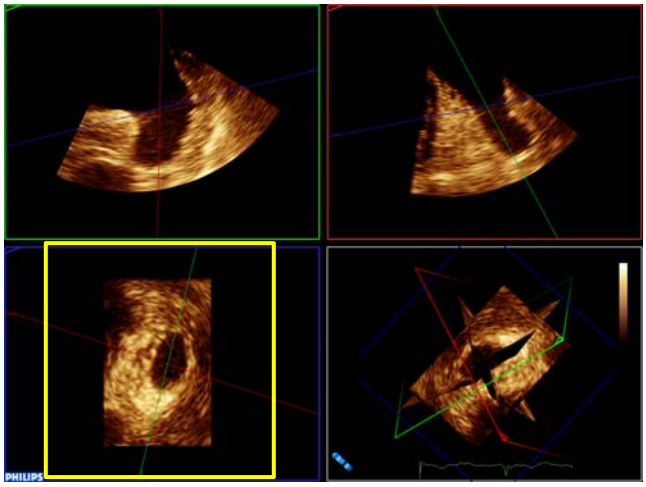
LAA Fluoroscopy View

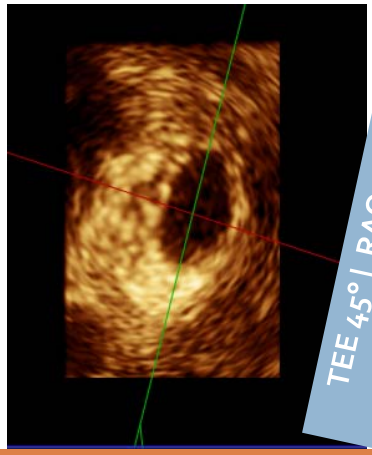




RAO Caudal
('Long axis')

TEE vs. Fluoroscopy



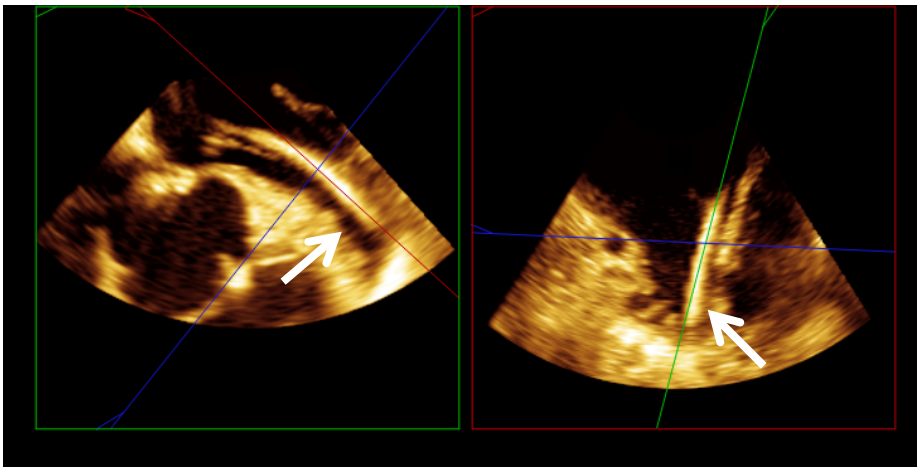


TEE 45° | RAO Cranial
('Minor or Short axis')

TEE 135° | RAO Caudal
('Major or Long axis')

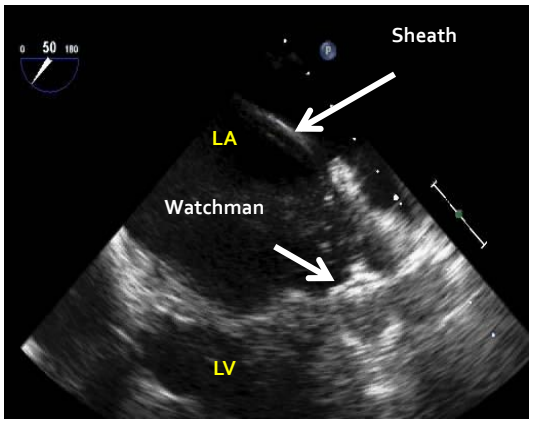
Watchman Device Deployment

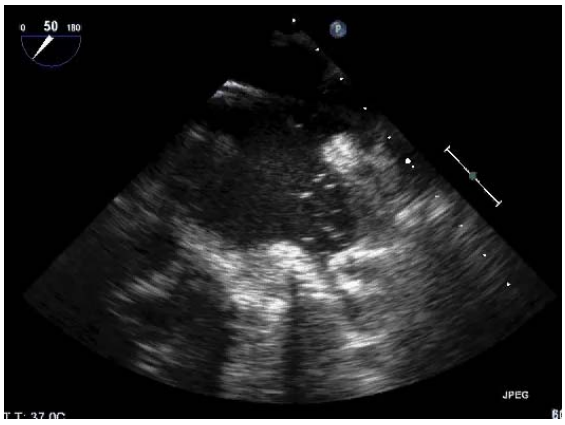
Watchman Deployment



Biplane TEE | Assessing for Catheter Tip Position

Watchman Deployment



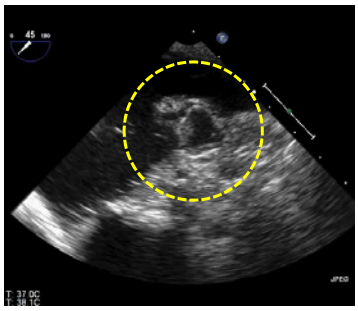


Watchman Deployment

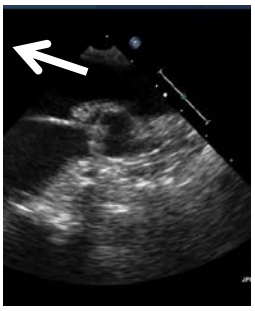
While the Watchman is still attached to its delivery cable, perform the **PASS** check.

PASS Check

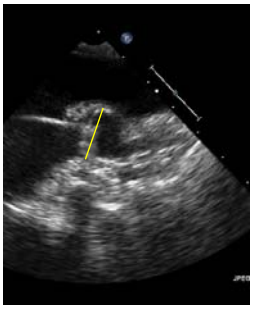
Position
Anchoring
Size
Seal



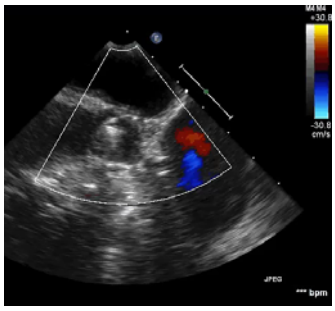
POSITION
Properly positioned; no tilt



ANCHORING
Tug Test

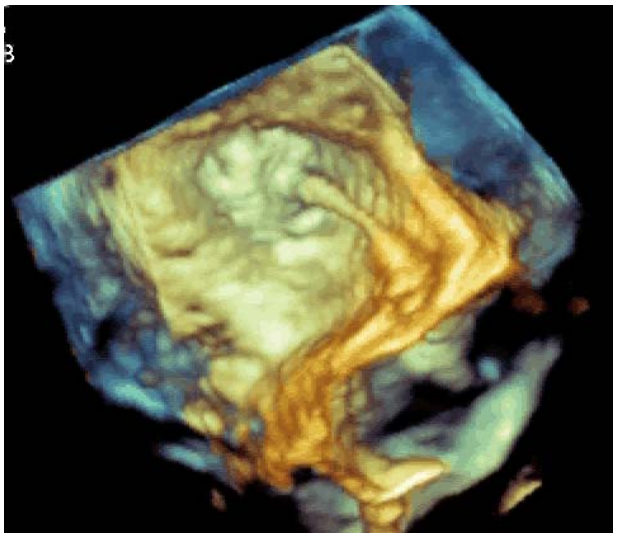


SIZE
15-30% Compression

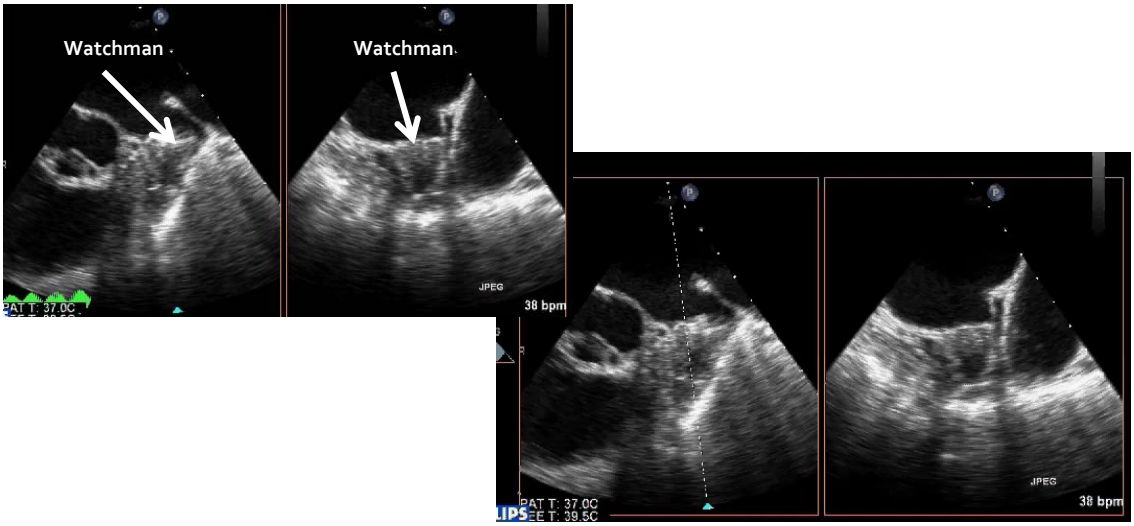


SEAL
No para-device leak

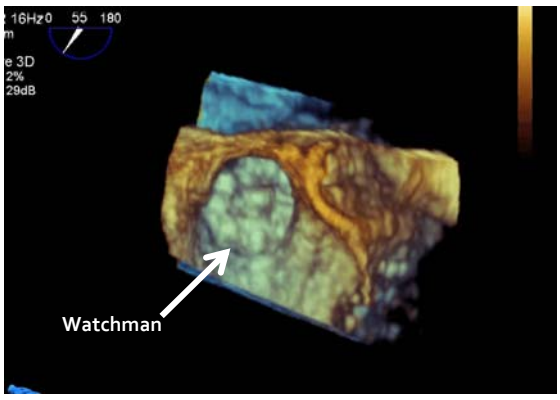
3D TEE | Watchman Release

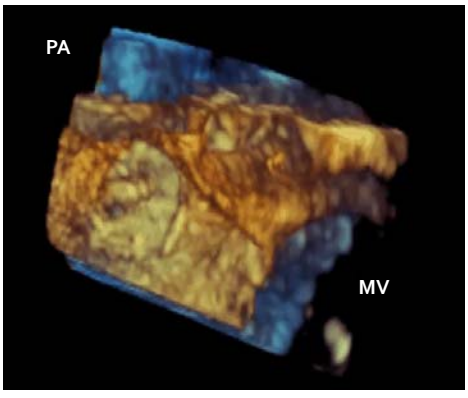


Biplane TEE | Watchman Deployed



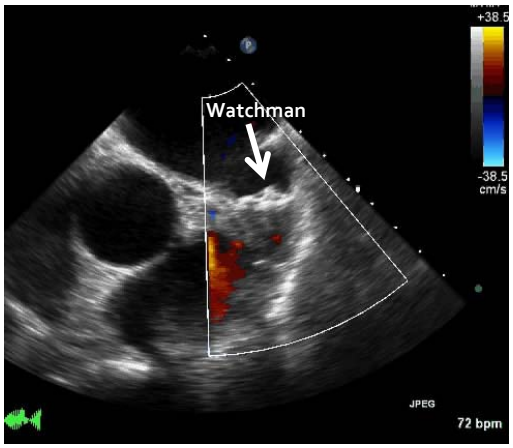
Biplane TEE | Watchman Deployed

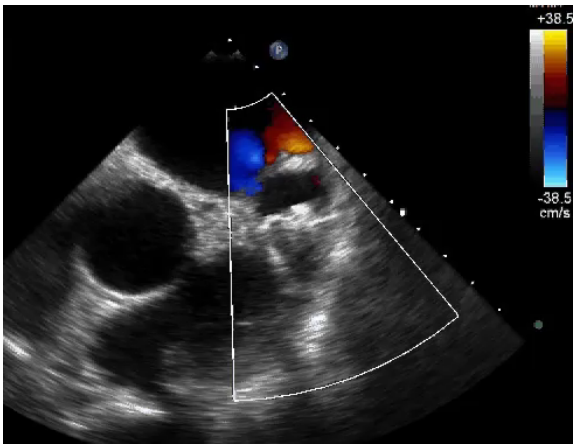




Properly placed Watchman device
at the orifice of the LA appendage

TEE | Watchman Deployed

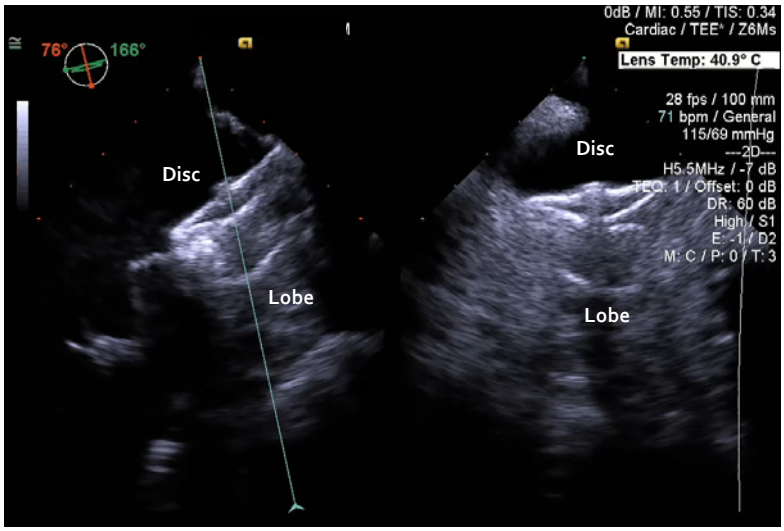




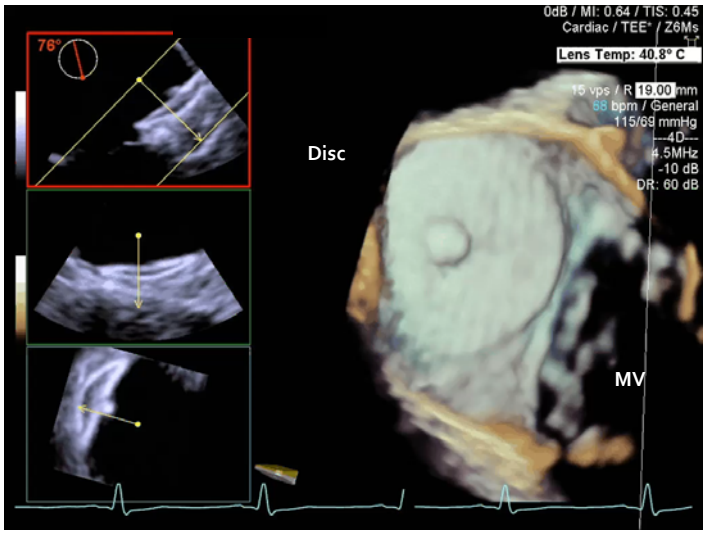
Watchman device properly
seals the LAA orifice
(No color flow around the device)

Amulet Device Deployment

3D TEE | Amulet Deployed



3D TEE | Amulet Deployed



Lariat Procedure

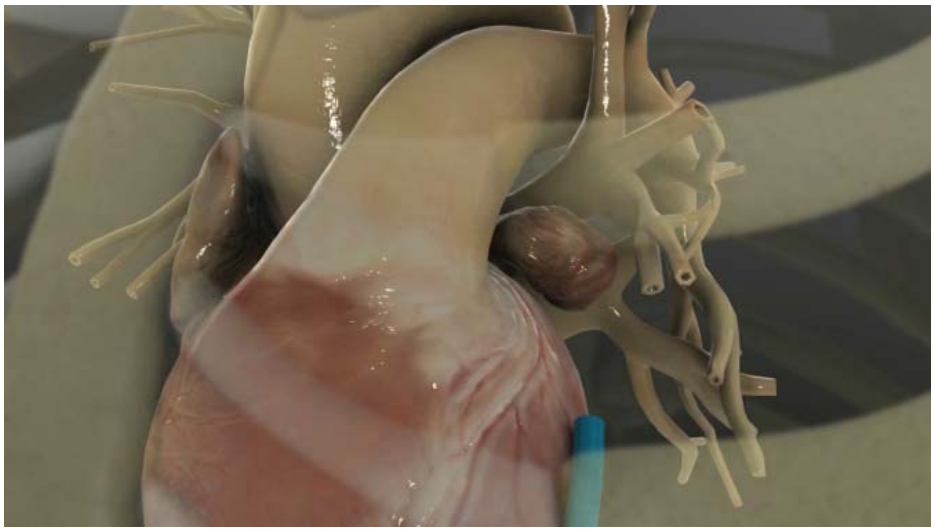
STATE-OF-THE-ART REVIEW ARTICLE

The Role of Multimodality Imaging in Percutaneous Left Atrial Appendage Suture Ligation with the LARIAT Device

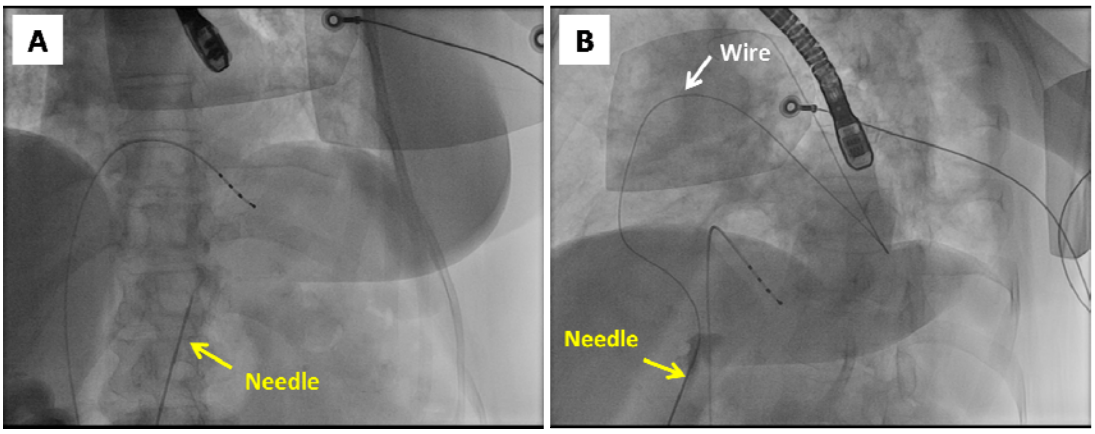
Diana M. Laura, BA, Larry A. Chinitz, MD, Anthony Aizer, MD, MSc, Douglas S. Holmes, MD, Ricardo Benenstein, MD, Robin S. Freedberg, MD, Eugene E. Kim, MD, and Muhamed Saric, MD, PhD,
New York, New York

J Am Soc Echocardiogr. 2014 Jul;27(7):699-708.

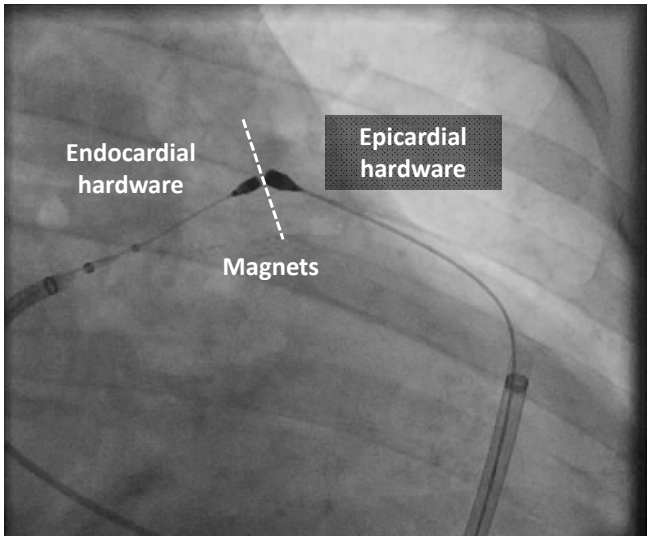
Lariat Procedure



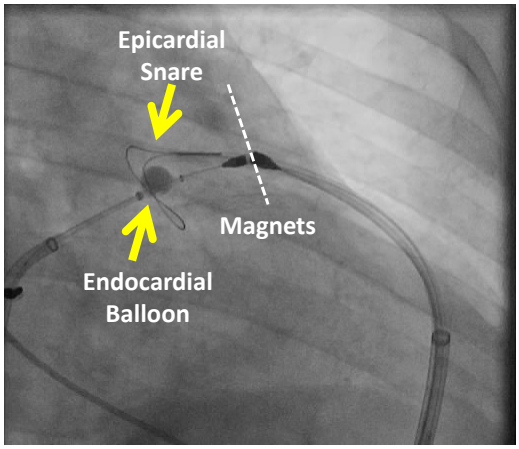
LARIAT Procedure: Pericardial Access



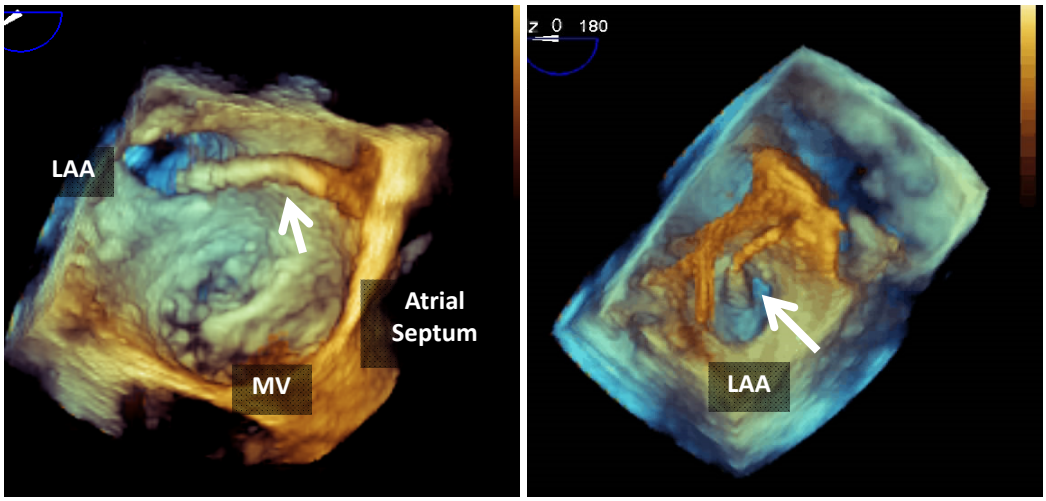
LARIAT Procedure: Fluoroscopy



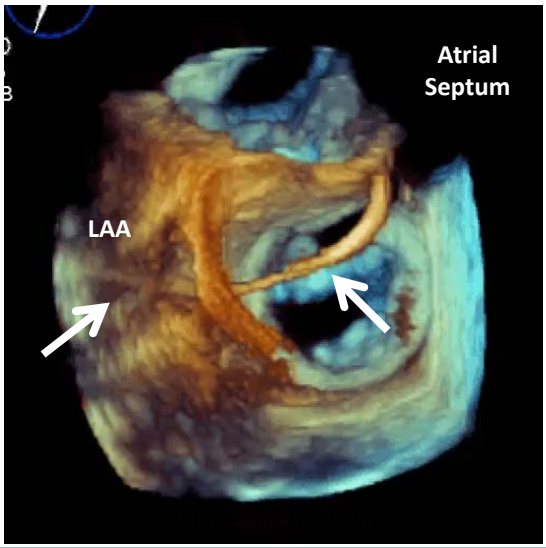
LARIAT Procedure: Fluoroscopy



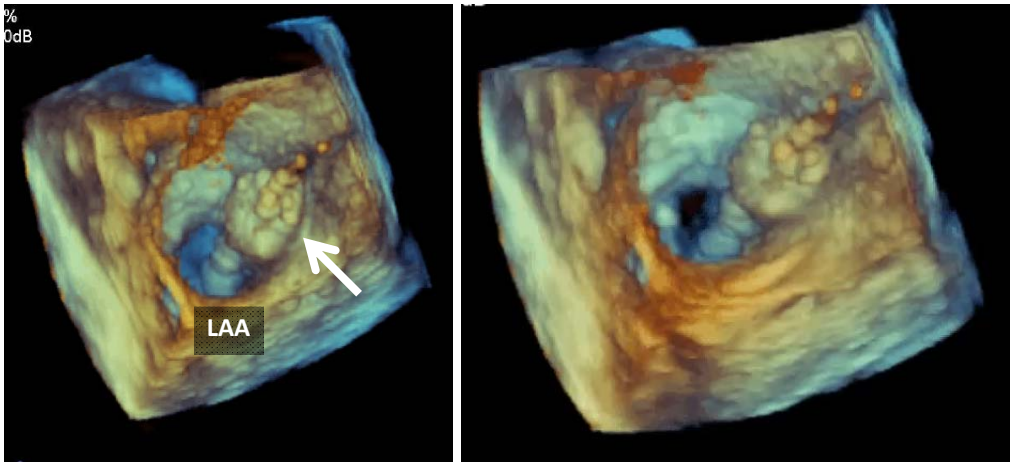
Lariat Procedure: 3D TEE



Lariat Procedure: 3D TEE

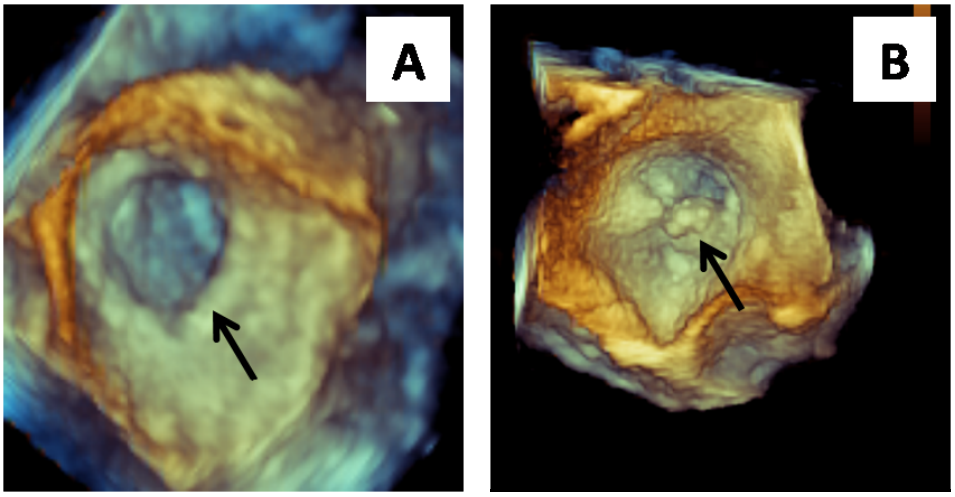


Lariat Procedure: 3D TEE



Balloon inflation at LAA orifice

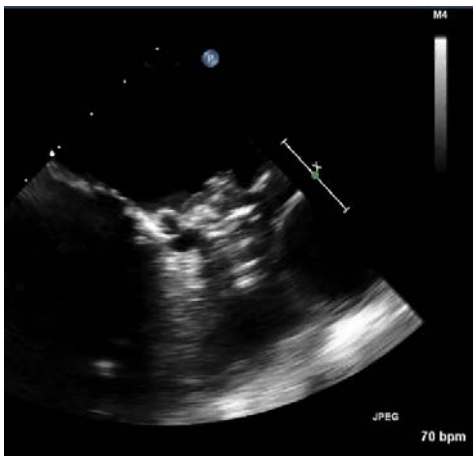
LARIAT Procedure: 3D TEE

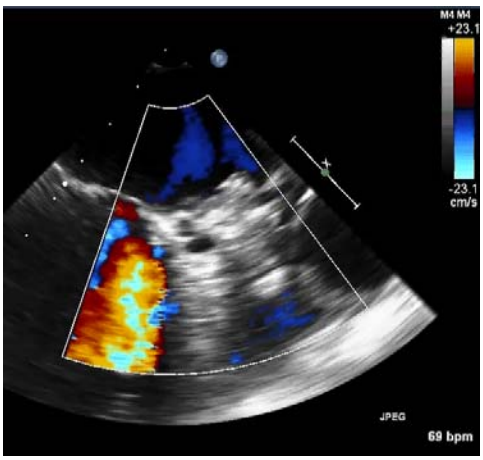


LAA Prior to Ligation

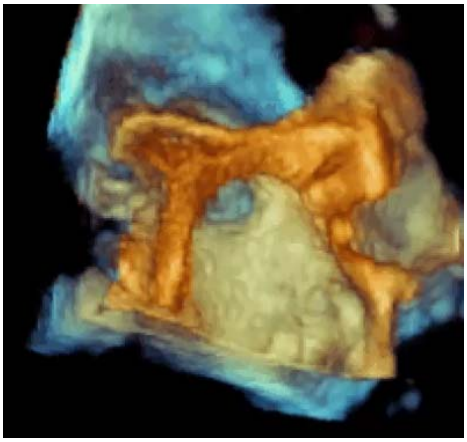
LAA Post Ligation

LARIAT Procedure: Ligated LAA

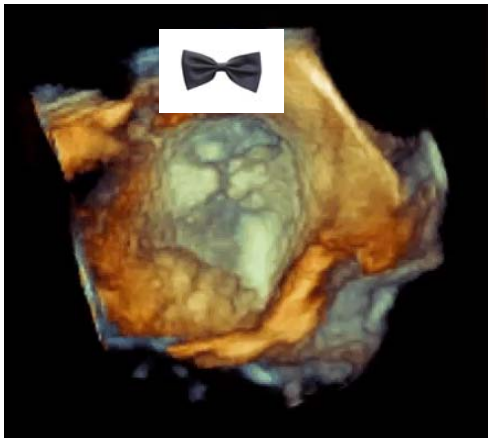




LARIAT Procedure: 3D TEE



LAA Prior to Ligation



LAA Post Ligation

Thank You!

New York University Langone Medical Center