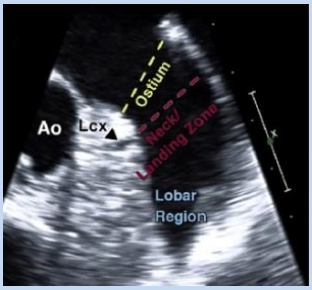
Intra-Procedure TEE during WATCHMAN device deployment

1. Pre-implant LAA images:

Exclude: intracardiac thrombus or dense spontaneous echo contrast
significant pericardial effusion

- Obtaining LAA measurements to confirm anatomy conducive for Watchman device implantation and to determine the device size

Left atrial appendage anatomy: divided into 3 parts. 1) The ostium is typically oval and diameters range from 10-40 mm, is well characterized by 3D imaging and is separated from the left upper pulmonary vein by the posterolateral ridge. 2) The neck of the LAA is the tubular junction between the ostium and lobar portions, neighbors the circumflex and LAD coronaries and the sinus node artery in one third. 3) The lobar region is the largest and most variable portion. Two or more lobes are found in >50%.

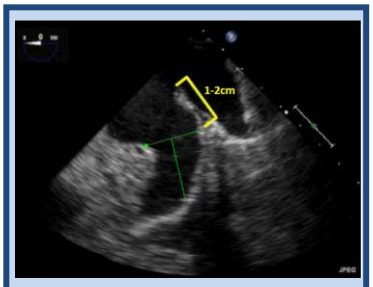


LAA anatomy

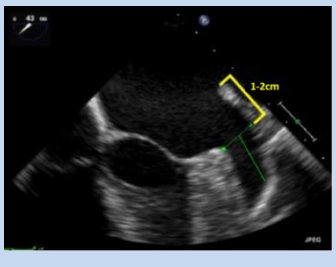
LAA images: Obtain 2D images of the LAA at decreased depth or zoom to optimize LAA assessment.

Obtain 2D images of the LAA at decreased depth or zoom to optimize LAA assessment.

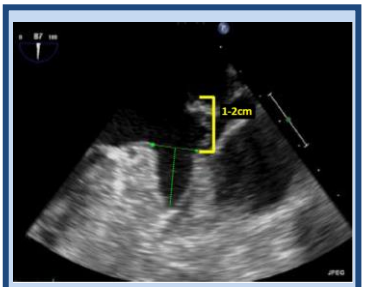
- Views should be obtained at 0, 45, 90 and 135 degrees
- Obtain the maximal measurements of the ostium diameter, width & length of the primary LAA lobe
- At 0 degrees, a measurement in the plane from left coronary artery to a point approximately 2 cm from the tip of the postero-lateral ridge is possible. (See diagram below)
- At 45, 90, 135 degrees appropriate 2D views such that a measurement in the plane from the top of the MV annulus to a point approximately 2 cm from the tip of the postero-lateral ridge is possible. (See diagrams below)



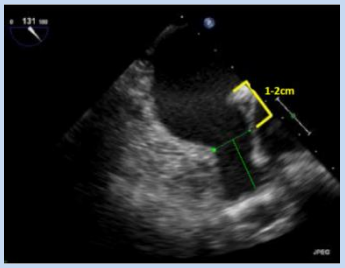
LAA width and height at 0°



Width and height at 45°



Width and height at 90°

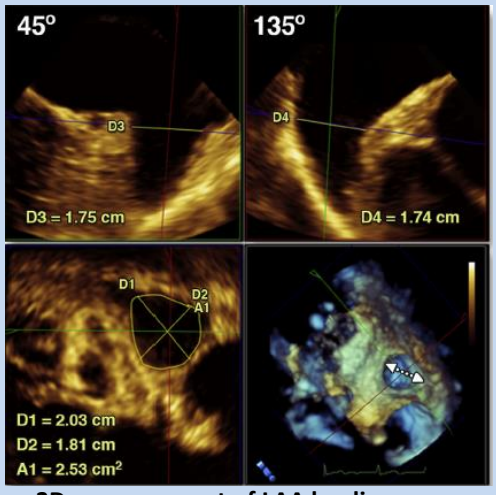


Width and height at 135°

Intra-Procedure TEE during WATCHMAN device deployment

Recommended images to be obtained: ***(measures of the LAA should be performed when LAA size is largest at end ventricular systole)***

- 2D 4 chamber, 2 chamber and 3 chamber views optimizing the LV
- Multiple 2D imaging planes of the LA
- Multiple 2D imaging planes of LAA device at decreased depth or zoom mode (at a minimum record views at 0°, 45°, 90° and 135°) – as described above.
- Color Doppler of the LAA at decreased depth or zoom mode, at best angle visualized. Reduce the Nyquist limit to optimize color flow (include the full width of the LAA ostium surrounding the borders and tip of LAA).
- Pulsed wave Doppler within the LAA (sampled volume at least 1cm into the LAA);
- 3D of the LAA ostium with diameter and area measures. Off-line measures performed in Q-lab with a similar measurement approach to the LVOT diameter measures.
- 2D Mitral Valve w/w'out color in multiple images planes (include views such as 4ch, 3ch and 2ch)
- CW Doppler through the mitral valve for MS
- 2D and color Doppler of Interatrial Septum at 45°, 90° and 135°. If atrial septal aneurysm is present: measure the atrial septal total excursion and the ASA length
- 2D of agitated saline passage to assess for intraatrial shunt
- 2D imaging from the esophagus and / or stomach to assess for pericardial effusion
- 2D of Ascending Aorta, Aortic Arch and Descending Aorta



3D measurement of LAA landing zone, with diameters and area.

Use of echo contrast with low MI imaging (0.1-0.3) should be considered, as appropriate, to differentiate pectinate muscle from thrombus.

LAA Occluder Device Requirements (5 device sizes: 21, 24, 27, 30 and 33 mm)

- **Landing zone** should be measured from the inferior part of the LAA ostium at the level of the circumflex coronary artery to a point 1-2 cm distal to the tip of the posterolateral ridge.
- **Required landing zone diameters:** 17-31 mm.
- **Choice of device size:** 2-4 mm larger than the largest measured diameter.
- **Required depth of main anchoring lobe:** needs to be ≥ the maximum LAA ostium size to be able to implant any given size device.

2. Imaging of the deployed device prior to device release

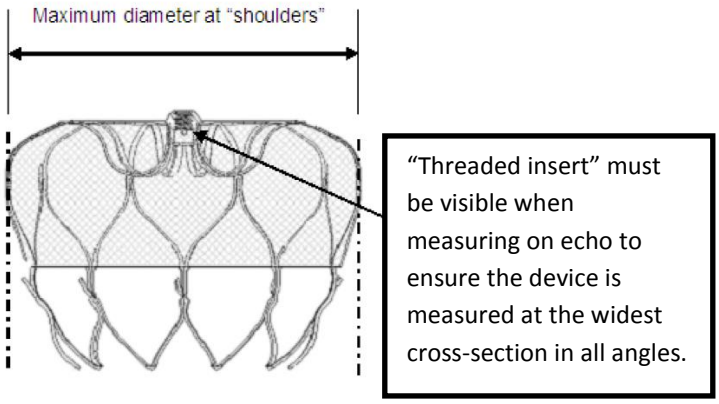
Check Device Position: Perform slow sweep from 0 to 135 degrees to observe device position from all views / angles.

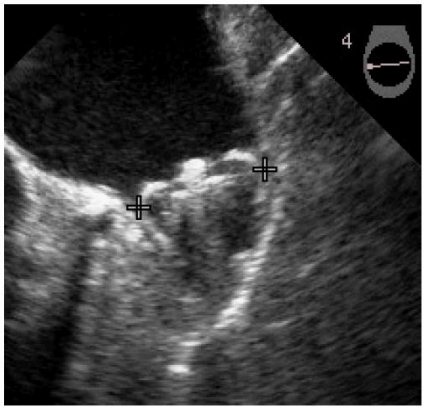
- Optimal device position: The plane defined by the maximum diameter of the device should be at or just distal to the plane of the ostium in the majority of views
- If device position is too proximal (significant protrusion of device into the LA), the device should be fully recaptured, removed and re-placed more distally
- If device position is too distal in LAA, the device may be partially recaptured and repositioned more proximally

CAUTION: A distally placed device may leave secondary LAA lobes patent. Ensure all lobes of the LAA are covered with device. Note that some extra lobes may only be visible at multiplane angles of 90-180 degrees.

Tips for obtaining LAA images at 0 degrees: Begin in mid-esophageal view; withdraw the probe until just above the mitral valve; counter clock slightly; flex slightly; adjust the depth of the probe until the LAA is visualized; Adjust the "right-left" wheel to optimize the image.

Device Size: Measure deployed device diameter in multiple views (measure greatest device width, see image). Protocol guidelines of 8-20% final device compression apply. A calculated value of device compression which is too low or too high may require device repositioning or device resizing.

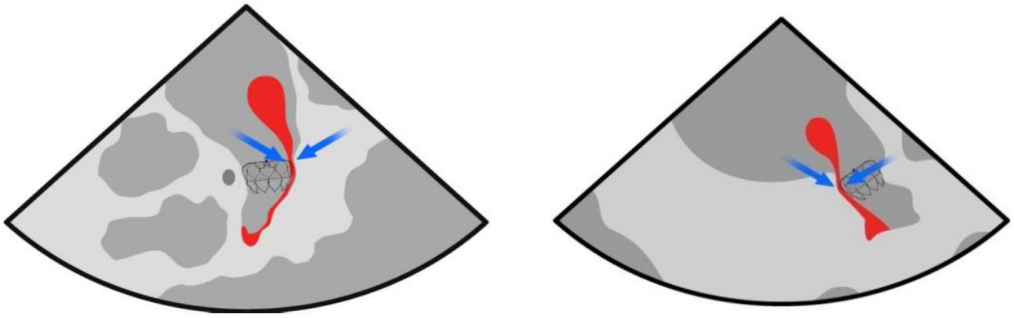




Device Stability: A device stability check is performed by observing the appendage / device relationship in multiple views. The device and LAA should move in unison. Device movement / displacement in LAA may require device repositioning or resizing.

Device Seal: Perform color Doppler assessment prior to the device release by interrogating the entire device /LAA border. Perform a slow sweep from 0° to 180° to fully visualize the placement of the device while performing color Doppler. **Include stops at approximately 0°, 45°, 90° and 135° to record clips**. Check for residual flow around the device borders.

Significant flow around device edge (>5 mm in diameter) or significant flow into any uncovered secondary lobe(s) will require device repositioning or resizing. Injection of Echo contrast (with the MI index set at (0.1-0.3) may aid in assessing flow around the device. If a leak is visualized, the width of the leak should be measured at the plane of the device at the vena contracta and should exclude any color bleed over the device and/or myocardial structures.



Imaging of released device (immediately after device release):

- Multiple 2D imaging planes of the LA
- Multiple 2D imaging planes of LAA device at decreased depth or zoom mode to optimize LAA device placement (at a minimum record views at 0°, 45°, 90° and 135°).
- Color Doppler of device at decreased depth or zoom mode, reduce the Nyquist limit to optimize color flow (include the full width of the LAA ostium surrounding the borders and tip of the appendage) (at a minimum record views at 0°, 45°, 90° and 135°).
- Repeat color Doppler interrogation around the device borders to include the entire device/ LAA border. Perform a slow sweep from 0° to 180° to fully visualize placement of the device while performing color Doppler.
- Record PW of LAA inside (distal to) the device; optimize scale to show both antegrade and retrograde flow
- Color Doppler of Interatrial Septum at 45°, 90° and 135°

Imaging of released device (immediately after device release) - continued

- PW of the left upper pulmonary vein (sample volume should be at least 1cm into pulmonary vein); optimize scale to show both antegrade and retrograde flow
- 2D Mitral Valve in multiple images planes (include views such as 4ch, 3ch and 2ch) with and without color
- 2D imaging from the esophagus and or stomach to assess for pericardial effusion
- 2D of Ascending Aorta, Aortic Arch and Descending Aorta