Left Atrial Appendage Closure Devices

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Disclosures

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

Use of experimental devices in approved clinical trials will be discussed
Upcoming JASE Issue

Left Atrial Appendage Occlusion/Exclusion: Procedural Image Guidance with Transesophageal Echocardiography (TEE)

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Percutaneous LAA Occlusion: Procedural Steps

1. Femoral venous access
2. Trans-septal puncture
3. LAA Sizing
4. Device Deployment
Percutaneous LAA Closure Devices

Watchman  Amulet  Lariat

Endocardial  Epicardial
LAA Exclusion  LAA Exclusion

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

Karl Eugen Hauptmann  Eberhard Grube  Kurt Amplatz  William E. Cohn
WATCHMAN PROCEDURE

Pigtail Catheter Used to Navigate into the LAA

Align appropriate marker band to be at, or just distal to, LAA Ostium
WATCHMAN PROCEDURE
WATCHMAN PROCEDURE

To release the WATCHMAN Device, unscrew the core wire
WATCHMAN PROCEDURE
WATCHMAN PROCEDURE

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

IMAGING OF LAA DEVICE CLOSURE PROCEDURE
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.

Watchman Device Sizes

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

<table>
<thead>
<tr>
<th>Diameter (mm)</th>
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<tbody>
<tr>
<td>21</td>
</tr>
<tr>
<td>24</td>
</tr>
<tr>
<td>27</td>
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<tr>
<td>30</td>
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<tr>
<td>33</td>
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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.

<table>
<thead>
<tr>
<th>LAA Diameter</th>
<th>Device Diameter</th>
<th>Device Compression</th>
</tr>
</thead>
<tbody>
<tr>
<td>17-19</td>
<td>21</td>
<td>16.8-19.3</td>
</tr>
<tr>
<td>20-22</td>
<td>24</td>
<td>19.2-22.1</td>
</tr>
<tr>
<td>23-25</td>
<td>27</td>
<td>21.6-24.8</td>
</tr>
<tr>
<td>26-28</td>
<td>30</td>
<td>24.0-27.6</td>
</tr>
<tr>
<td>29-31</td>
<td>33</td>
<td>26.4-30.4</td>
</tr>
</tbody>
</table>

**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.

LAA Morphologies

Windsock  Chicken Wing  Cactus  Cauliflower
LAA Sizing: Lariat Device

**Lariat Diameter**
(40 mm)

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

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**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 CHA2DS2 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**
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

![Image of ultrasound with labels POS, ANT, INF, SUP, LA, IVC, RA, AV, SVC]
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')

45° View

TEE Equivalent View of Fluoroscopic RAO Cranial View
LAA Fluoroscopy View

135° View

RAO Caudal ('Long axis')

LAA Fluoroscopy View

135° View

RAO Caudal ('Long axis')
TEE vs. Fluoroscopy
Watchman

Watchman Deployment
Watchman Deployment

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

- **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

Properly placed Watchman device at the orifice of the LA appendage
Watchman device properly seals the LAA orifice
(No color flow around the device)

Watchman: Optimal vs. Suboptimal Results
Amplatzer Amulet

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

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Lariat Procedure

LARIAT Procedure: Pericardial Access

A

B

Needle

Wire

Needle
LARIAT Procedure: Fluoroscopy

Endocardial hardware

Epicardial hardware

Magnets

LARIAT Procedure: Fluoroscopy

Epicardial Snare

Magnets

Endocardial Balloon
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

LAA Prior to Ligation | LAA Post Ligation

LARIAT Procedure: 3D TEE

LAA Prior to Ligation | LAA Post Ligation
Thank You!

New York University Langone Medical Center