Ruolo della TC nella valutazione pre e post impianto

Dr. Marco Mennuni

Chiusura percutanea dell'auricola sinistra: dalle linee guida alla pratica clinica.

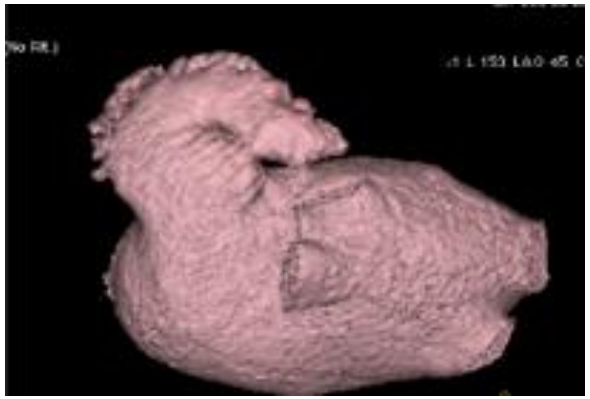
Torino 8 Maggio 2018

Left atrial appendage (LAA) Anatomy

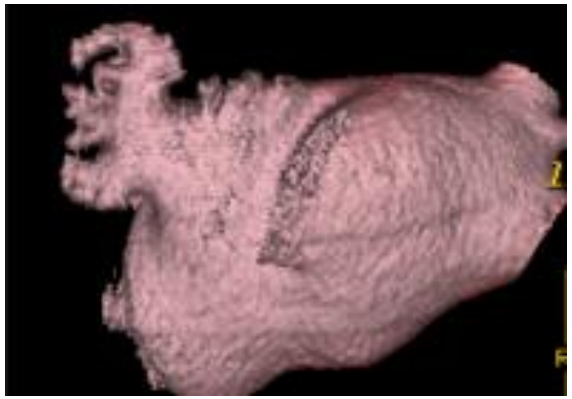
- Highly variable structure (size and shape)
- Orifice is usually elliptical (not round)
- Lies in more than 1 imaging plane
- 80% multi-lobed

1) Assessment of shape and morphology

LAA Shape



The Chicken Wing Type LAA is an anatomy whose main feature is a sharp bend in the dominant lobe at some distance from the LAA ostium



The Broccoli Type LAA is an anatomy whose main feature is an LAA that has limited overall length with more complex internal characteristics

Chicken wing

Sharp bend in dominant lobe

More complex LAA occlusion

Cauliflower

Limited length and more complex internal characteristics

Higher risk of stroke

Di Biase J Am Coll Cardiol 2012; 60:531-538

1) Assessment of shape and morphology

LAA position

High, middle or low on the Left Atrium

LAA Orientation

Posterior or anterior facing

2) Assessment of LAA thrombus presence

Early enhanced phase

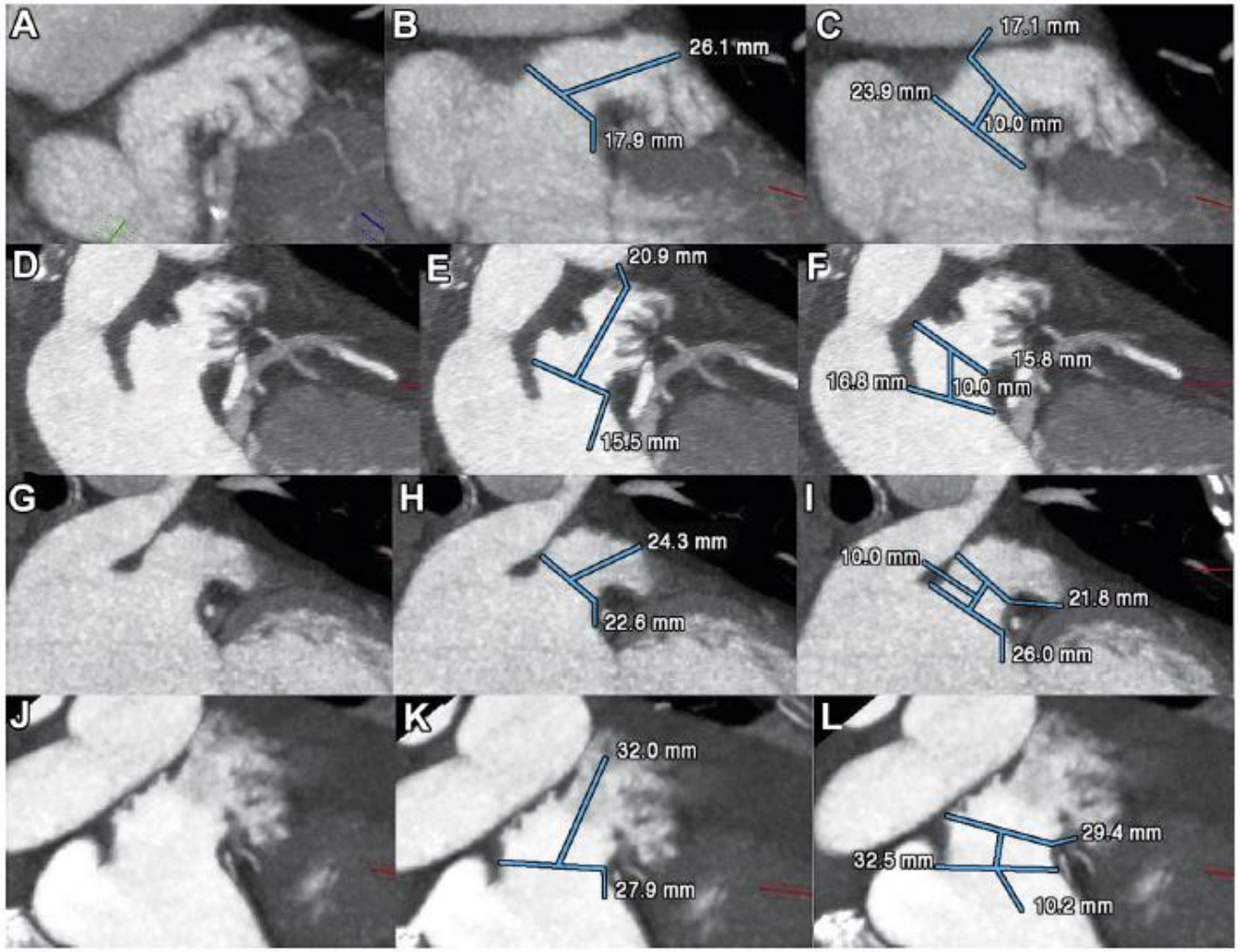
Late enhanced phase

3) LAA Sizing

- Identify and size the landing zone and main lobe depth

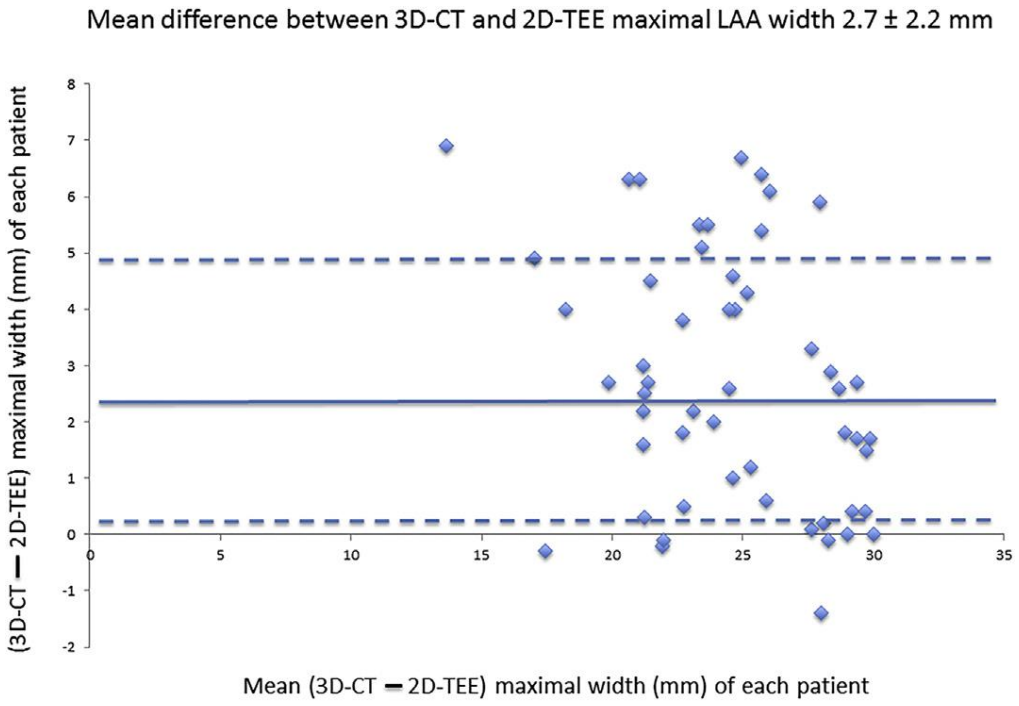
Max LAA ostium size should be ≥11 mm and <31 mm (Amulet)

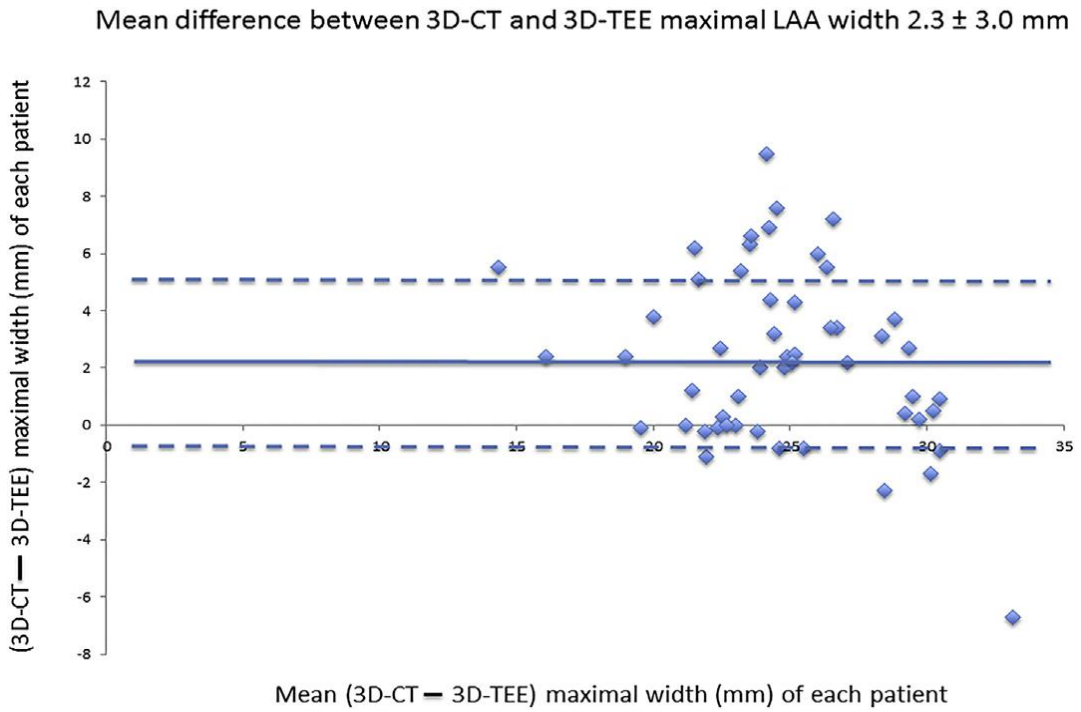
LAA length should be equal to or greater (Watchman) and 10-12 mm (Amulet)



3) Sizing

Comparison between CT scan and 2D/3D TEE





Wang, JACC Cardiovasc Interv. 2016; 2329-2340

3) Sizing

Comparison between CT scan and 2D/3D TEE

24 patients prospectively randomized to undergo LAAO planning using either TEE or 3D-CT.

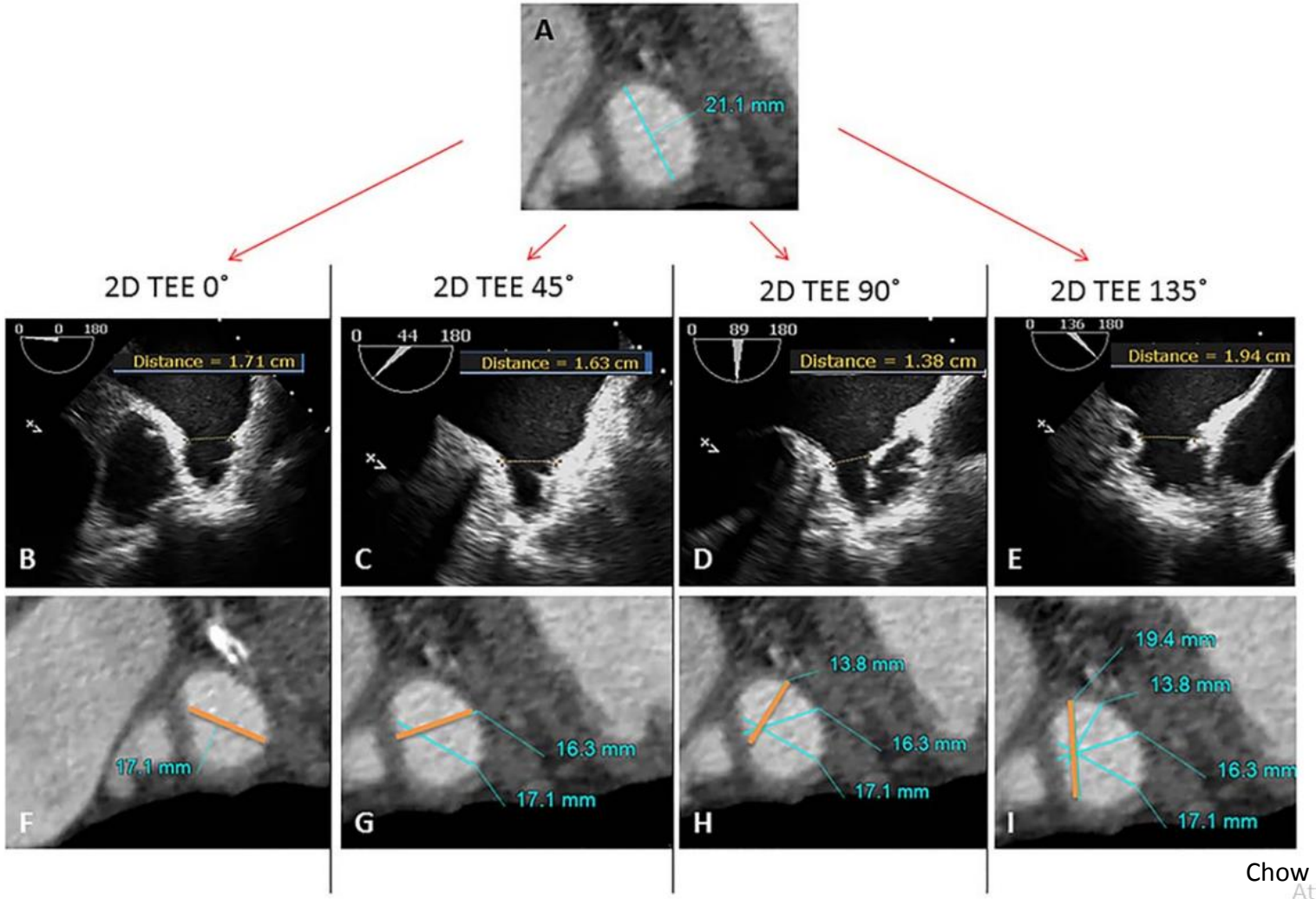
	CT N= 12	TEE N=12	P-value
Succesfull implantation	12 (100%)	11 (92%)	1.0
Access to device release time (min)	**47 ± 16**	**67 ± 24**	**0.03**
Total procedural time (min)	**55 ± 17**	**73 ± 24**	**0.05**
Devices used	**1.3 ± 0.7**	**2.5 ± 1.2**	**0.01**
Contrast (ml)	63 ± 33	79 ± 28	0.27
Fluoroscopy time (min)	**19.8 ± 7.7**	**25.3 ± 10.8**	**0.07**
Major adverse events Perforation MI Death Stroke	0 0 0 0 0	1 (8.3%) 0 0 0 1 (8.3%)	1.0

The mean difference between 3D-CT and 2D-TEE for widest LAA dimension was **2.2 ± 1.8 mm**

Eng et al, CCI 2018; 1-7.

3) Sizing

Comparison between CT scan and 2D/3D TEE

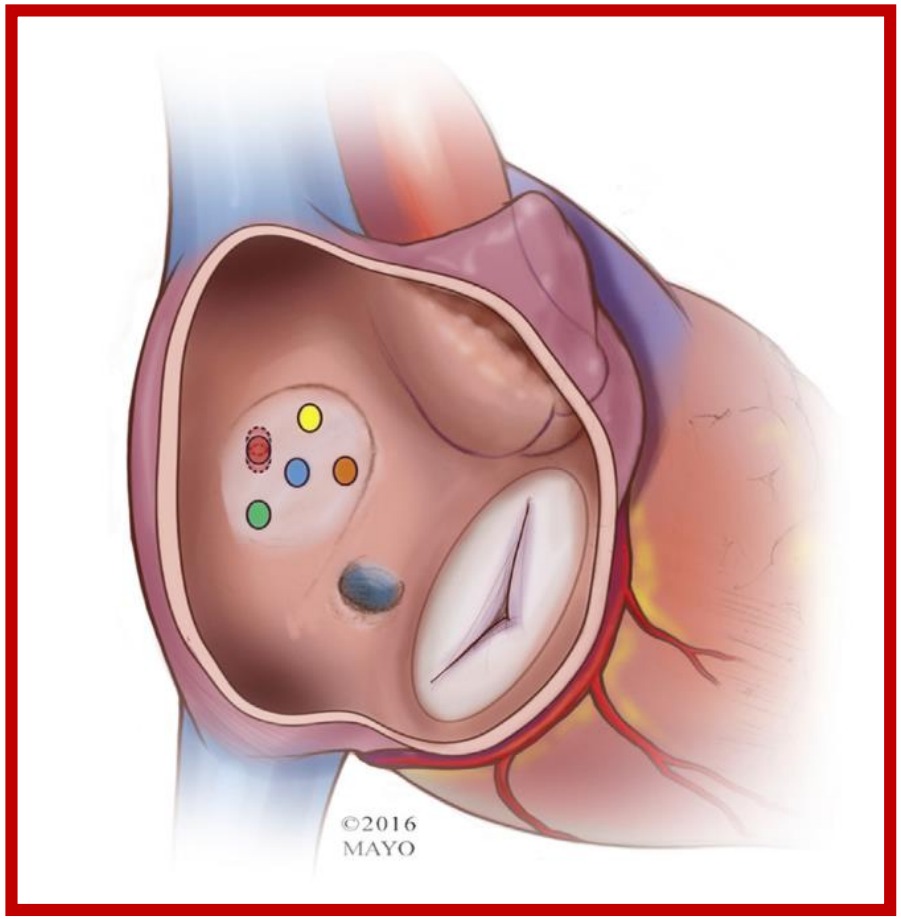


Eng et al, CCI 2018; 1-7.

Chow DH et al. Open Heart, 2017;4:e627.

4) Assessment of atrial septal anatomy

Looking for
ASD
PFO
septum lipomatosus



- **Transseptal PFO closure**
- **Paravalve leak closure**
  (higher crossing site for medial leaks; lower site for lateral leaks)
- **LVAD placement**
- **Hemodynamic studies**
- **LA-appendage closure**
- **Pulmonary vein interventions**

Alkhouli J Am Coll Cardiol 2016;9(24):2465-80

5) Case planning

- Identify septal puncture site
- Generate fluoroscopic view
- 3D printing

CT scan analysis

3mensio
MEDICAL IMAGING

Report Details

Creation Date:	31/05/2016	**Physician:**	Pr Splaulding Dr Otmani
Created By:		**Hospital:**	HEGP
Received Date:		**City:**	Paris
Reviewed Date:		**Country:**	

Patient Information

Name:	MON, B	**Height:**	m	**NYHA:**	
Sex:	Male	**Weight:**	kg	**Euro Score:**	
Year Of Birth (Age):	1944 (72)	**BMI:**			

Comments:

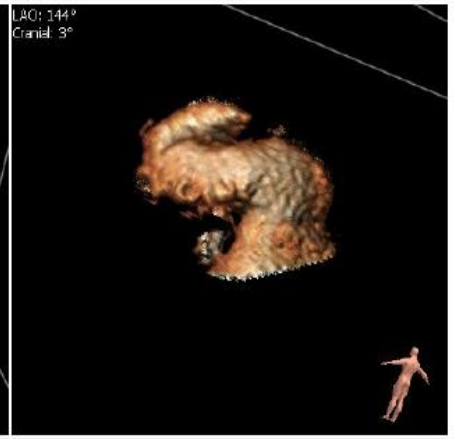
LAA

Comments: Ostium : 22mm
Landing zone : 16mm
Amulet 20mm

Conclusion

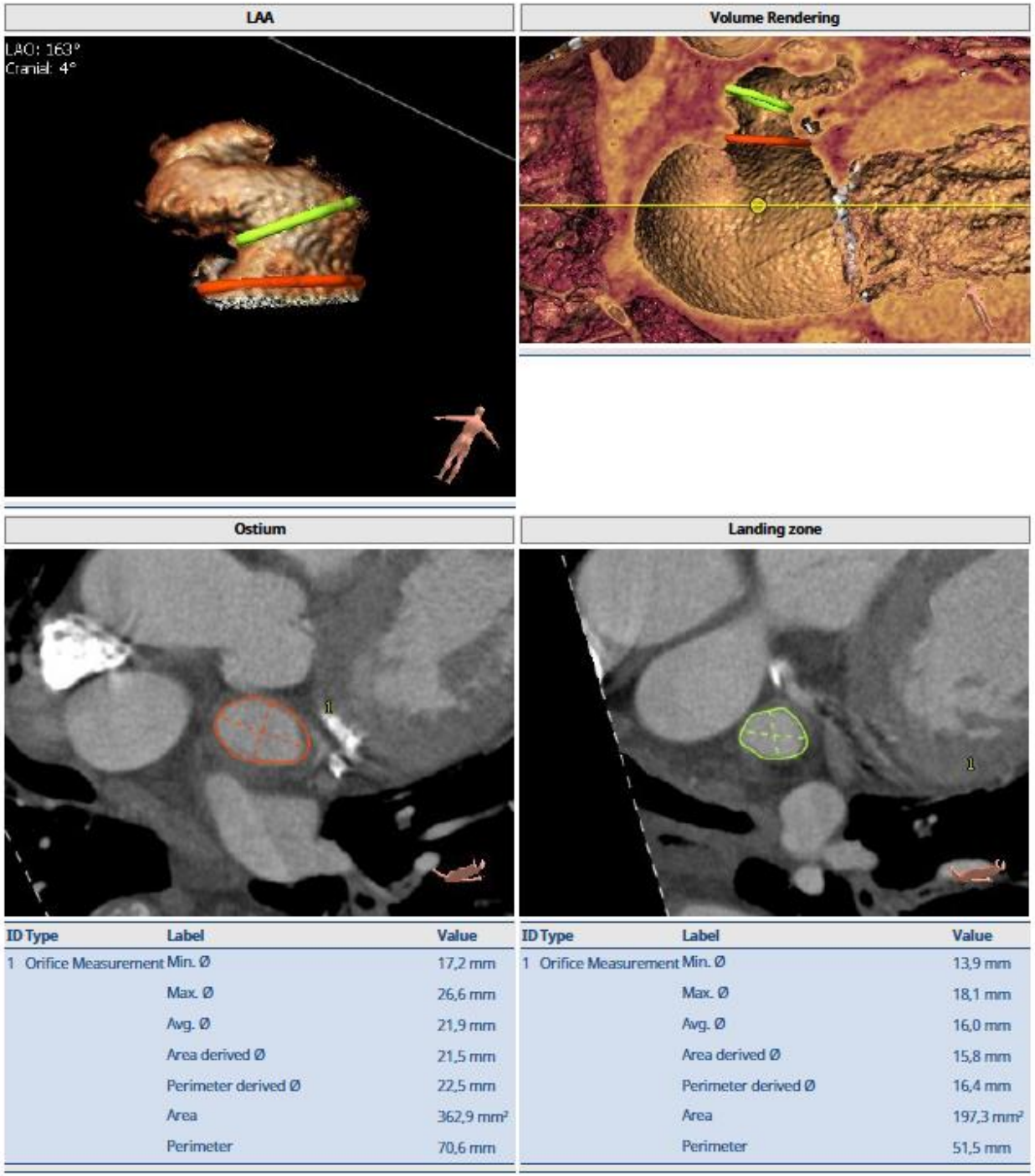
Conclusion: Implantation d'une Amulet de 20 mm
9-ACP2-007-020 lot 5259024
Gaine 12F : 9-TV45X45-12F-100 lot 5402083

Screenshots

Segmentation only	LAA
	

MPR and intra cardiac view

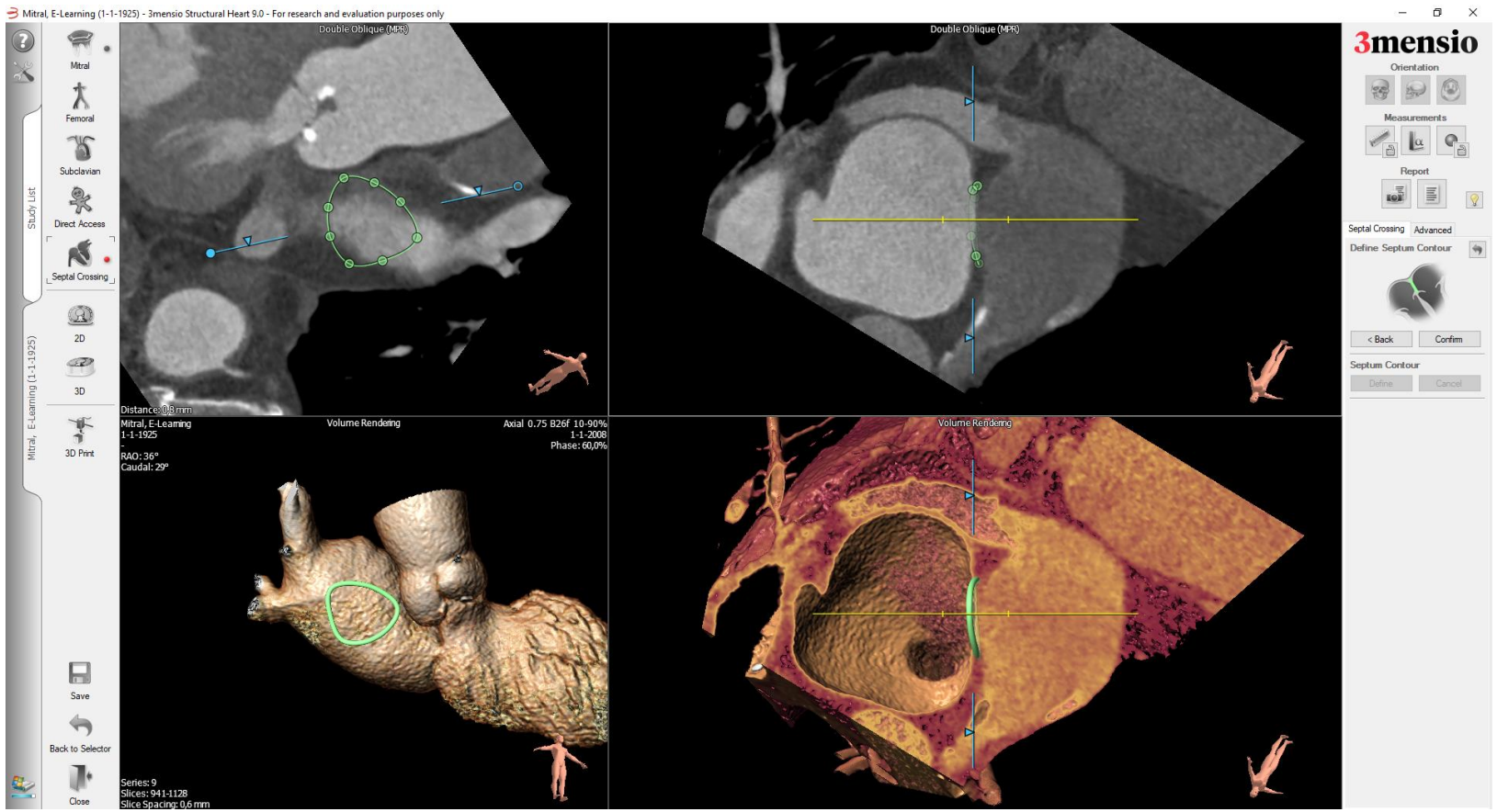
- ✓ Assess the landing zone
- ✓ LAA lobes
- ✓ Surround structures
  - Mitral Valve
  - Pulmonary Ridge



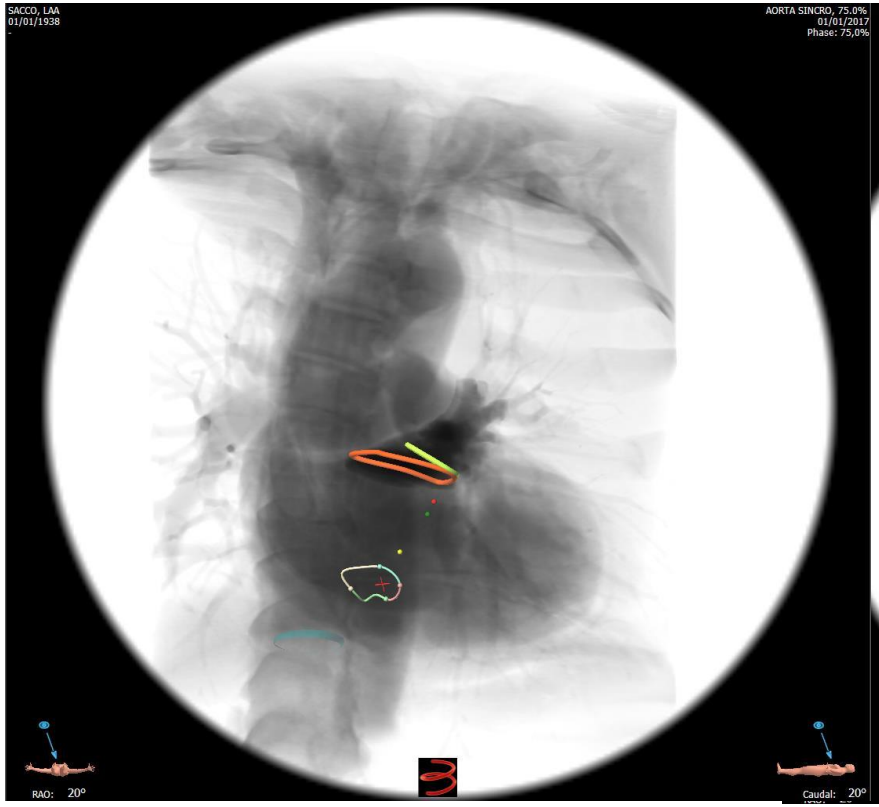
ID	Type	Label	Value
1	Orifice Measurement	Min. Ø	17,2 mm
		Max. Ø	26,6 mm
		Avg. Ø	21,9 mm
		Area derived Ø	21,5 mm
		Perimeter derived Ø	22,5 mm
		Area	362,9 mm²
		Perimeter	70,6 mm

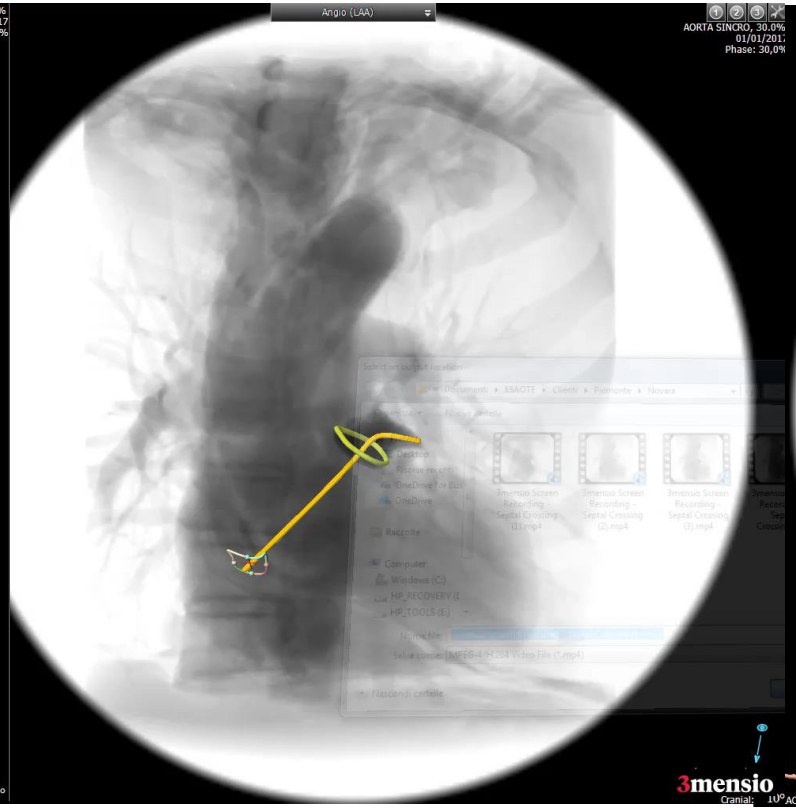
ID	Type	Label	Value
1	Orifice Measurement	Min. Ø	13,9 mm
		Max. Ø	18,1 mm
		Avg. Ø	16,0 mm
		Area derived Ø	15,8 mm
		Perimeter derived Ø	16,4 mm
		Area	197,3 mm²
		Perimeter	51,5 mm

Identify septal puncture site



Generate fluoroscopic view
& Find optimal projection

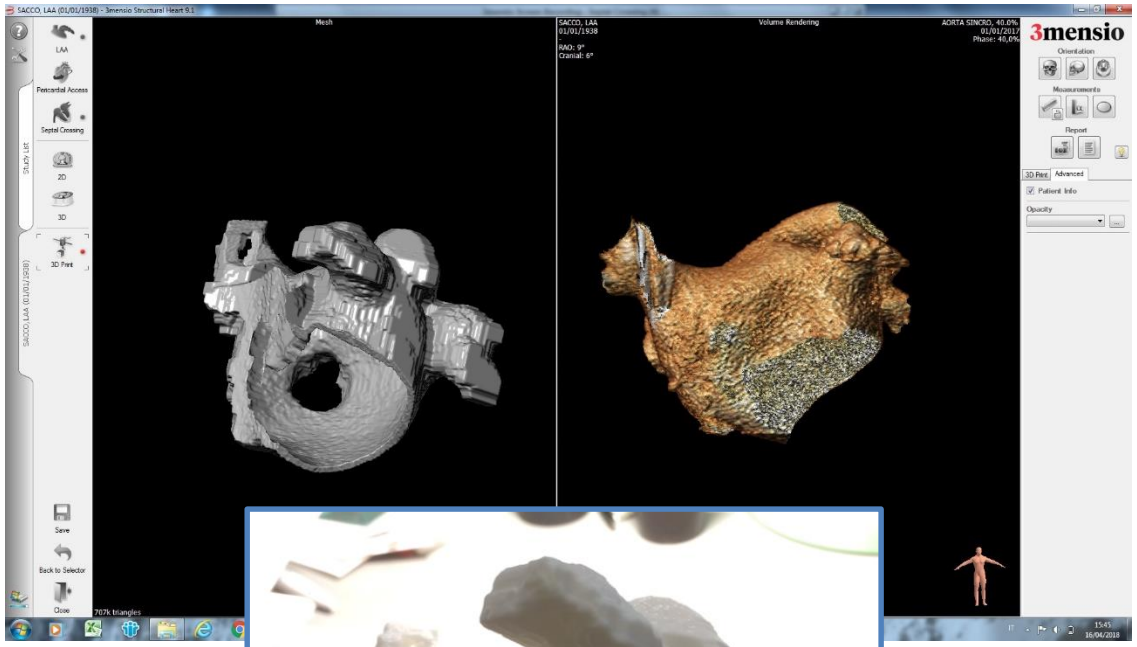




RAO 20° CAUD 20°

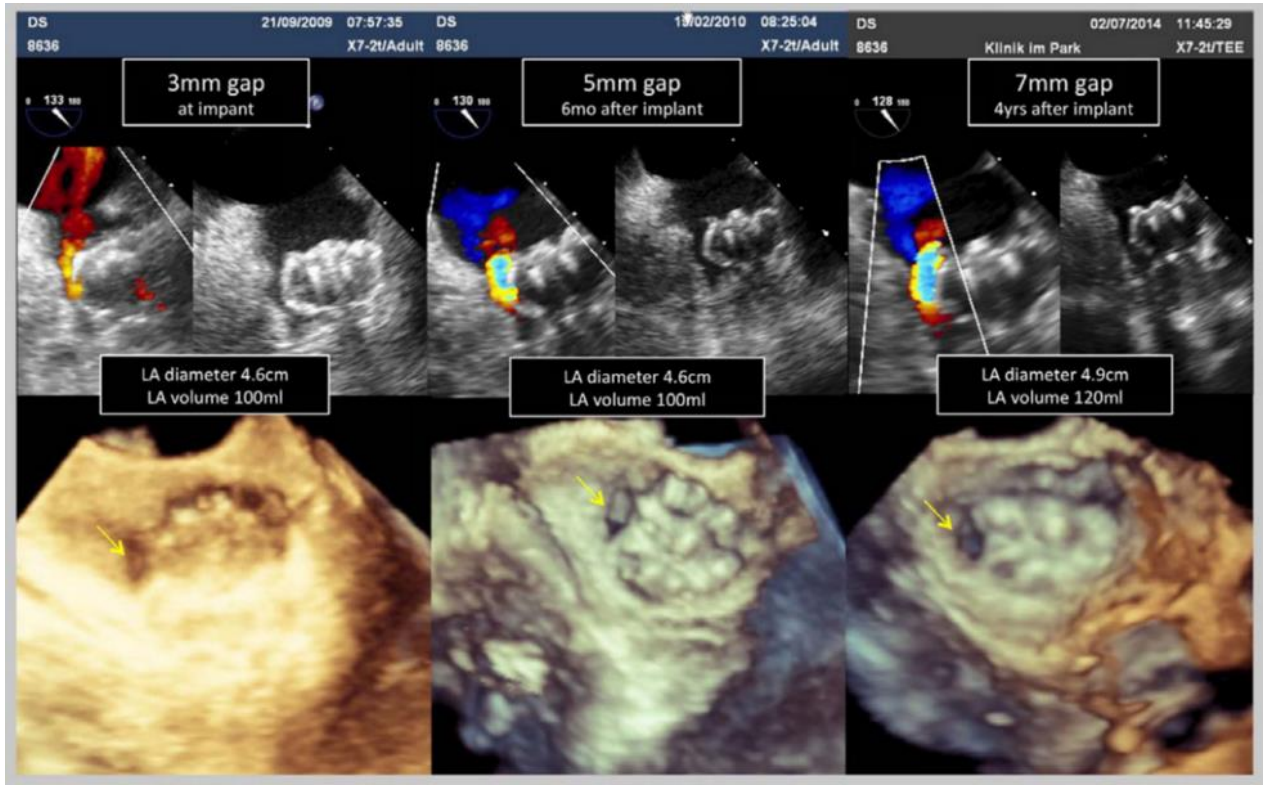
LAO 20° CAUD 15°

3D printing



Pt-tailored bench test for device sizing
Bench simulation of catheter and device positon (coaxiality between septum and LAA)

5) Follow-up



- TEE and MDCT in detection of a LAA thrombus have similar sensitivity. (1,2)
- A substudy of the PROTECT-AF trial showed a peridevice gap of ≤5 mm in 32% of patients, not associated with an increased risk of thromboembolism. (3)
- Using TEE and MDCT at 3 months to evaluate peridevice gap after ACP implantation resulted in gap underdetection using TEE. (4)

1. Homsi et al. Rofo. 2016;188:45–52.
2. Budoff et al. Am J Cardiol. 2014;113:173–177.
3. Viles-Gonzalez et al. JACC 2012;59:923–929.
4. Jaguszewski et al. Catheter Cardiovasc Interv. 2015;85:306–312.

Conclusions

The role of CT scan pre-implantaion of LAA occluder is central.

- Clinical/Anatomic informations
- Procedural planning
- Prevention of complications

The role of CT scan post-implantation may be alternative to echo TEE or complementary if TEE is inconclusive.

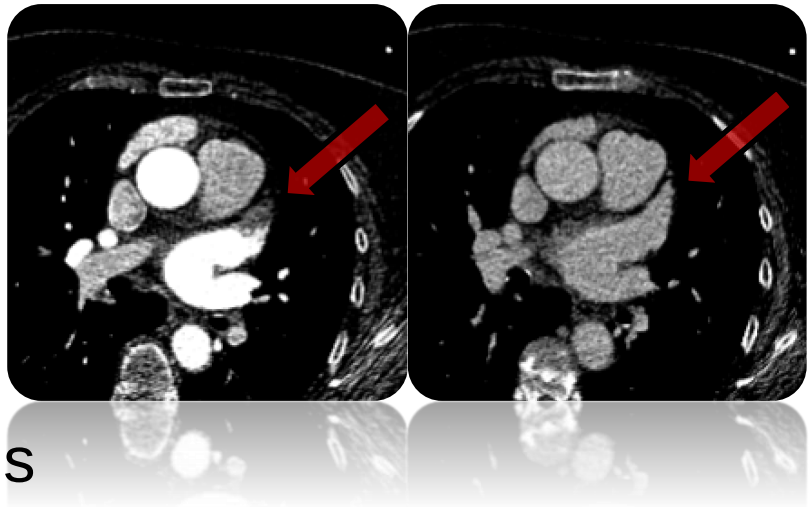
Thanks!

CT Protocol

Image Quality is key

Acquiring high qualitative CT images is an 'art'

- ✓Contrast enhanced CT of the heart (CCTA)
- ✓ECG-gated (HR as low as possible!!)
- ✓Preferably submillimeter slices
- ✓Time the scan for the LAA
- ✓Different protocols used for LAA:
  - Multiphase or single phase
  - Late enhanced phase for ruling out thrombus



Why CT for planning and sizing?

Current limitations of LAA imaging with TEE

- ✓ Difficult to get a full 3D overview of the LAA and surrounding structures
- ✓ Variability of measurements
  - Inter-operator variability
  - Inter-patient variability
- ✓ Discomfort for the patient
  - Either LAA procedure under GA
  - Either swallowing the tube
- ✓ Experienced operator needed ie availability
- ✓ Time consuming

Why CT for planning and sizing?

Disadvantages of using CT images

- ✓Radiation: <5mSv in prospective acquisition
- ✓Use of contrast agent
- ✓Reimbursement?

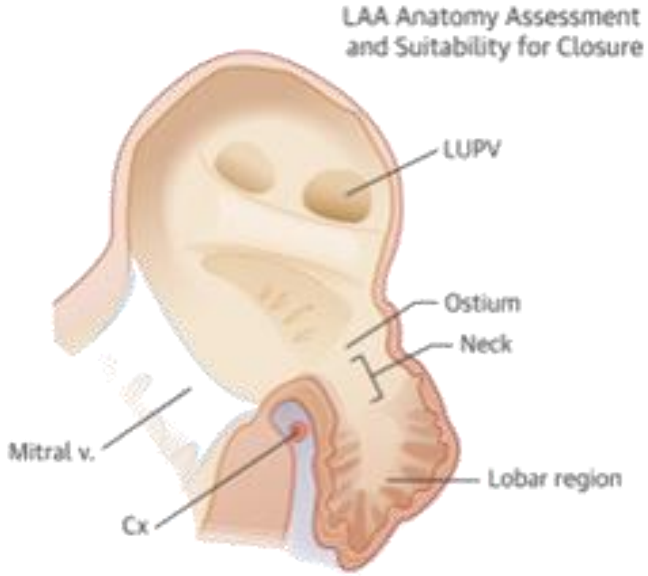
What is 3mensio - LAA

- ✓**Start to end product**
  - Local database with PACS connectivity
  - Dedicated workflows
  - Reporting tool (iPad reports)

- ✓**Pre-procedural planning for LAAO**
  - ✓LAA workflow
    - 3D volume rendering of the LAA
    - Measurement of the LAA
    - Relationship with surrounding structures
  - ✓Approach Route assessment
    - Visualize the intra atrial septum and the LAA

Information present in the CT

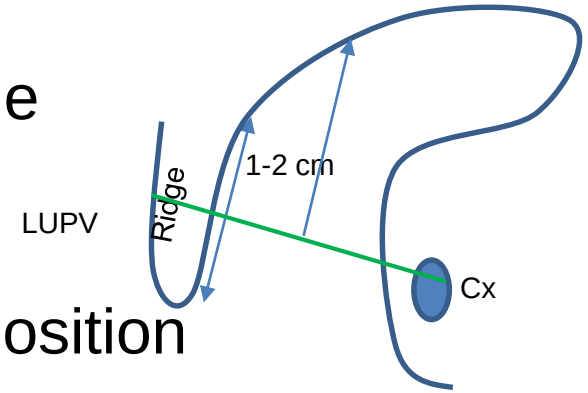
- ✓LAA anatomy
  - ✓Shape
  - ✓Position and orientation
  - ✓Relationship with surrounding structures
- ✓Landing zone measurement
- ✓LAA working depth
- ✓Optimal fluoroscopic projection angles
- ✓Assessment Septal Crossing

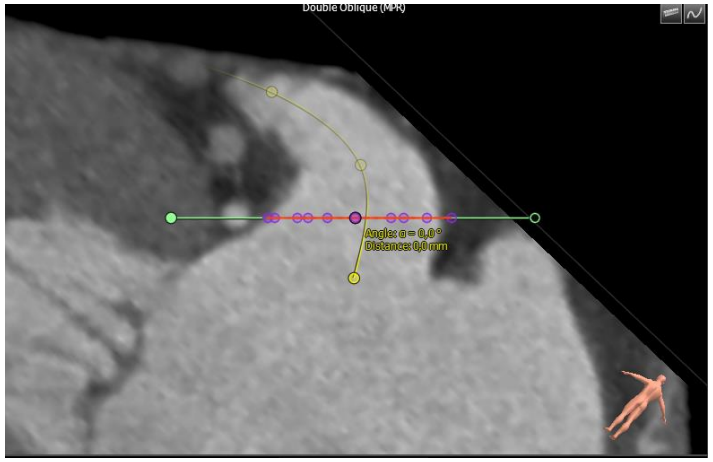


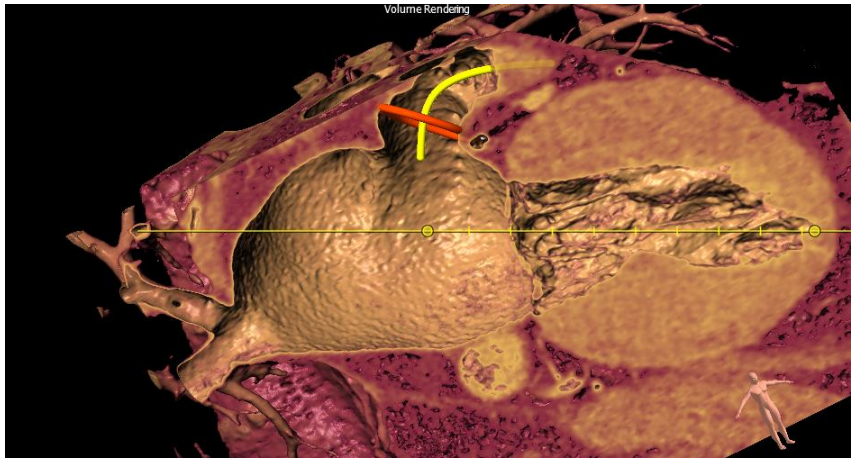
FAQ

✓How to plan for Watchman?

- Plane is defined by going from the circumflex to the pulmonary ridge
- Point along the ridge is 1-2 cm of the ostium
- Direction of the catheter is leading to finding this position
  - Centerline can be used to help find that direction



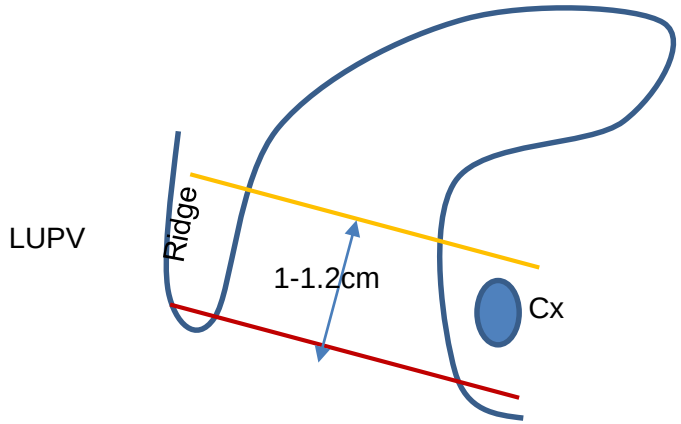


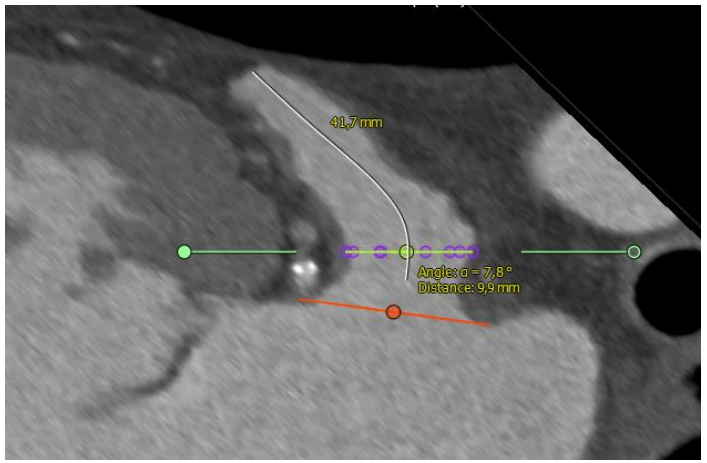


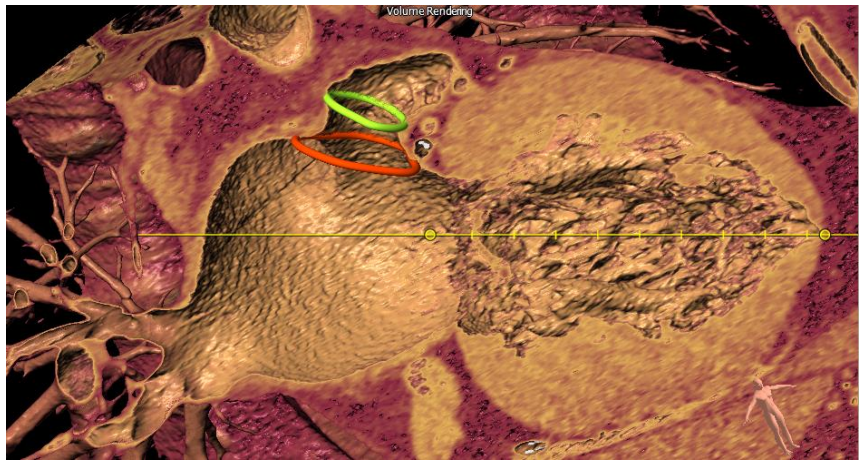
FAQ

✓How to plan for Amulet?

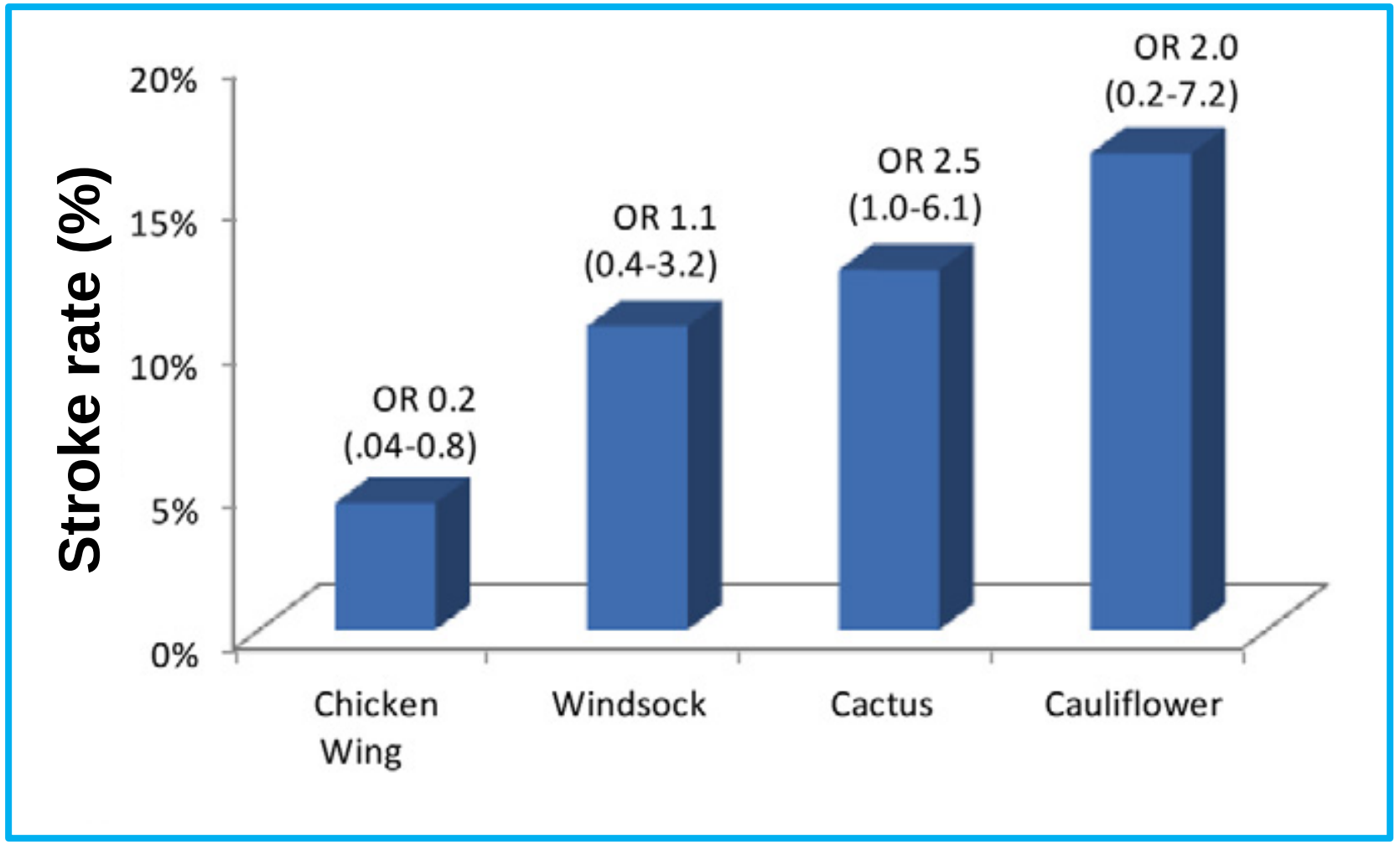
- Determine the ostium of the LAA
- Landing zone is 1-1.2 cm’s distal
  - 1 cm in case of 16-22 mm device
  - 1.2 cm in case of 25-33 mm device







Prevalence of Prior Stroke/TIA According to LAA Morphology



Di Biase J Am Coll Cardiol 2012; 60:531-538