Anatomic features of the LAA and the risk of stroke

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LAA and stroke

- 30% to 40% of ischemic stroke is of unknown cause
- Biomarkers of atrial dysfunction, or atrial cardiopathy, have been associated with embolic stroke risk even in the absence of AF, suggesting that the presence of AF is not required for left atrial thromboembolism to occur
- Most left atrial thrombi (> 90%) occur in the LAA
- But there is limited use of LAA dysfunction parameters, such as LAA flow velocity and morphology, to predict ischemic stroke risk

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LAA and stroke

ESC European Society of Cardiology
European Journal of Preventive Cardiology
doi:10.1093/eurjpc/zwab018

FULL RESEARCH PAPER
Risk prediction

Utility of the CHA_2DS_2-VASc score for predicting ischaemic stroke in patients with or without atrial fibrillation: a systematic review and meta-analysis

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Criteria		Poss. Point
Congestive heart failure Signs/symptoms of heart failure confirmed with objective evidence of cardiac dysfunction	Yes / No	+1
Hypertension Resting BP > 140/90 mmHg on at least 2 occasions or current antihypertensive pharmacologic treatment	Yes / No	+1
Age 75 years or older	Yes / No	+2
Diabetes mellitus Fasting glucose > 125 mg/dL or treatment with oral hypoglycemic agent and/or insulin	Yes / No	+1
Stroke, TIA, or TE Includes any history of cerebral ischemia	Yes / No	+2
Vascular disease Prior MI, peripheral arterial disease, or aortic plaque	Yes / No	+1
Age 65 to 74 years	Yes / No	+1
Sex **C**ategory (female) Female gender confers higher risk	Yes / No	+1

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LAA and stroke

without NVAF.

Methods and results

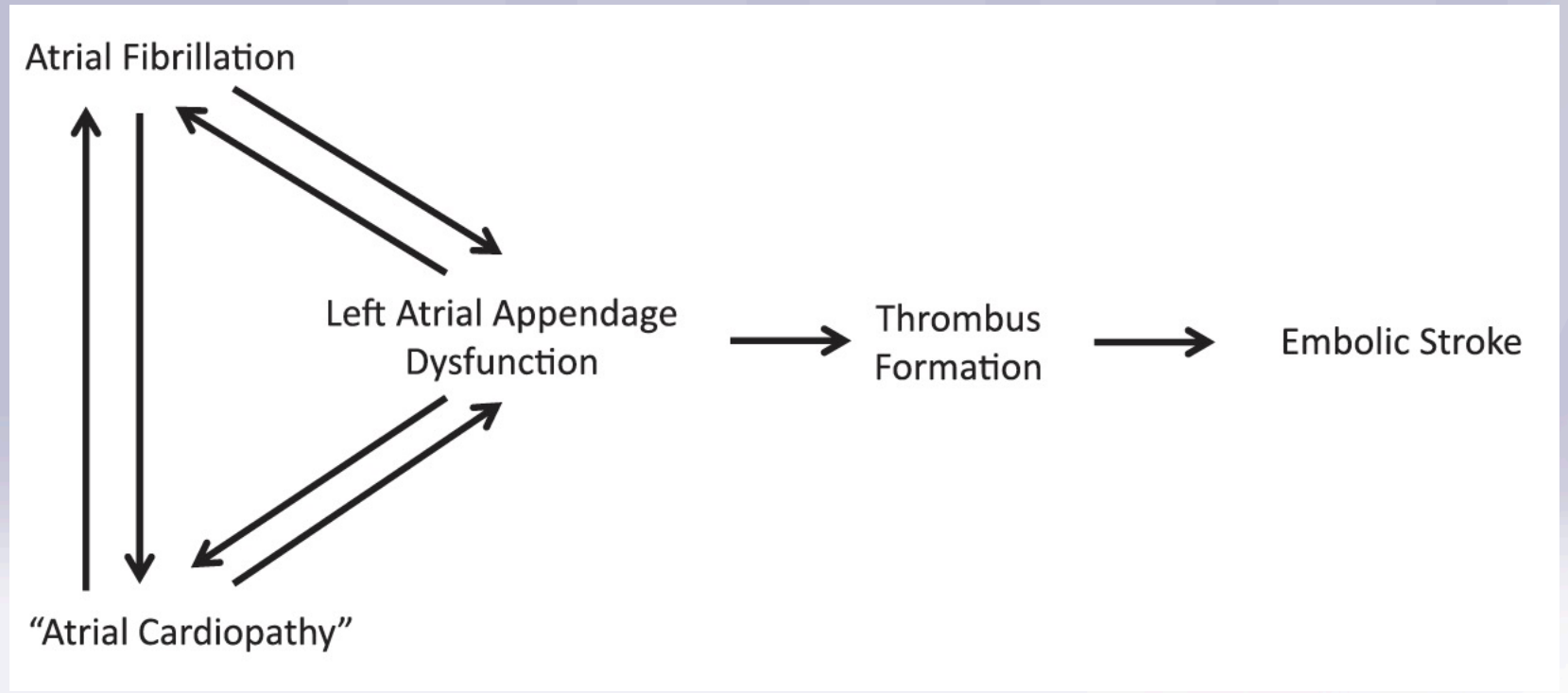
PubMed and Embase databases were searched till June 2020 for published articles that assessed the discrimination ability of CHA_2DS_2-VASc, as measured by C-statistics, during mid-term (2–5 years) and long-term (>5 years) follow-up. Summary estimates were reported as random effects C-statistics with 95% confidence intervals (CIs). Seventeen articles were included in the analysis. Nine studies ($n = 453\ 747$ patients) reported the discrimination ability of CHA_2DS_2-VASc in NVAF patients, and 10 studies ($n = 138\ 262$ patients) in patients without NVAF. During mid-term follow-up, CHA_2DS_2-VASc predicted stroke with modest discrimination in the overall cohort [0.67 (0.65–0.69)], with similar discrimination ability in patients with NVAF [0.65 (0.63–0.68)] and in those without NVAF [0.69 (0.68–0.71)] (*P*-interaction = 0.08). Similarly, at long-term follow-up, CHA_2DS_2-VASc had modest discrimination [0.66 (0.63–0.69)], which was consistent among patients with NVAF [0.63 (0.54–0.71)] and those without NVAF [0.67 (0.64–0.70)] (*P*-interaction = 0.39).

Conclusion

This meta-analysis suggests that the discrimination power of the CHA_2DS_2-VASc score in predicting ischaemic stroke is modest, and is similar in the presence or absence of NVAF. More accurate stroke prediction models are thus needed for the NVAF population.

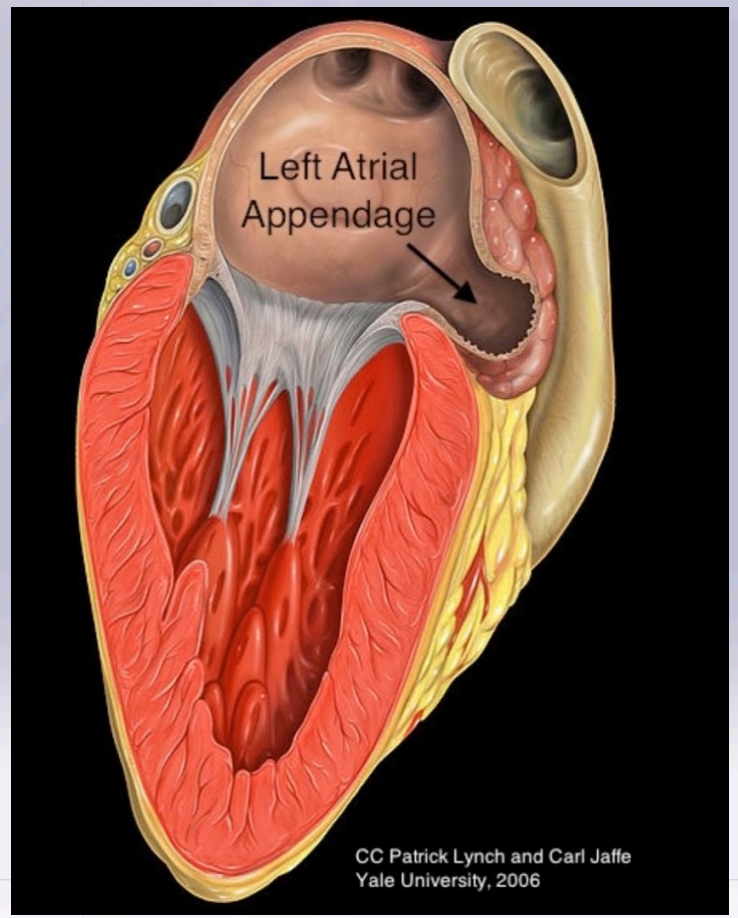
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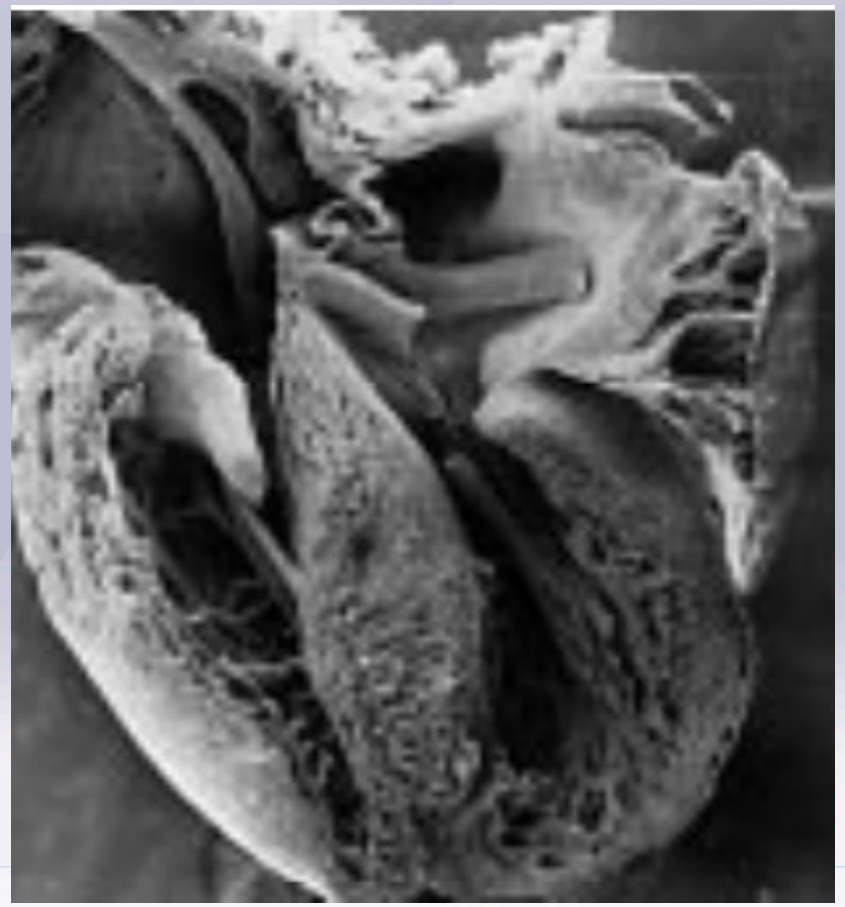
Atrial Cardiopathy



↑ Nt-ProBNP, "p"dispersion on ECG, ↑ left atrial size, paroxismal SVT

Clinical and radiologic anatomy



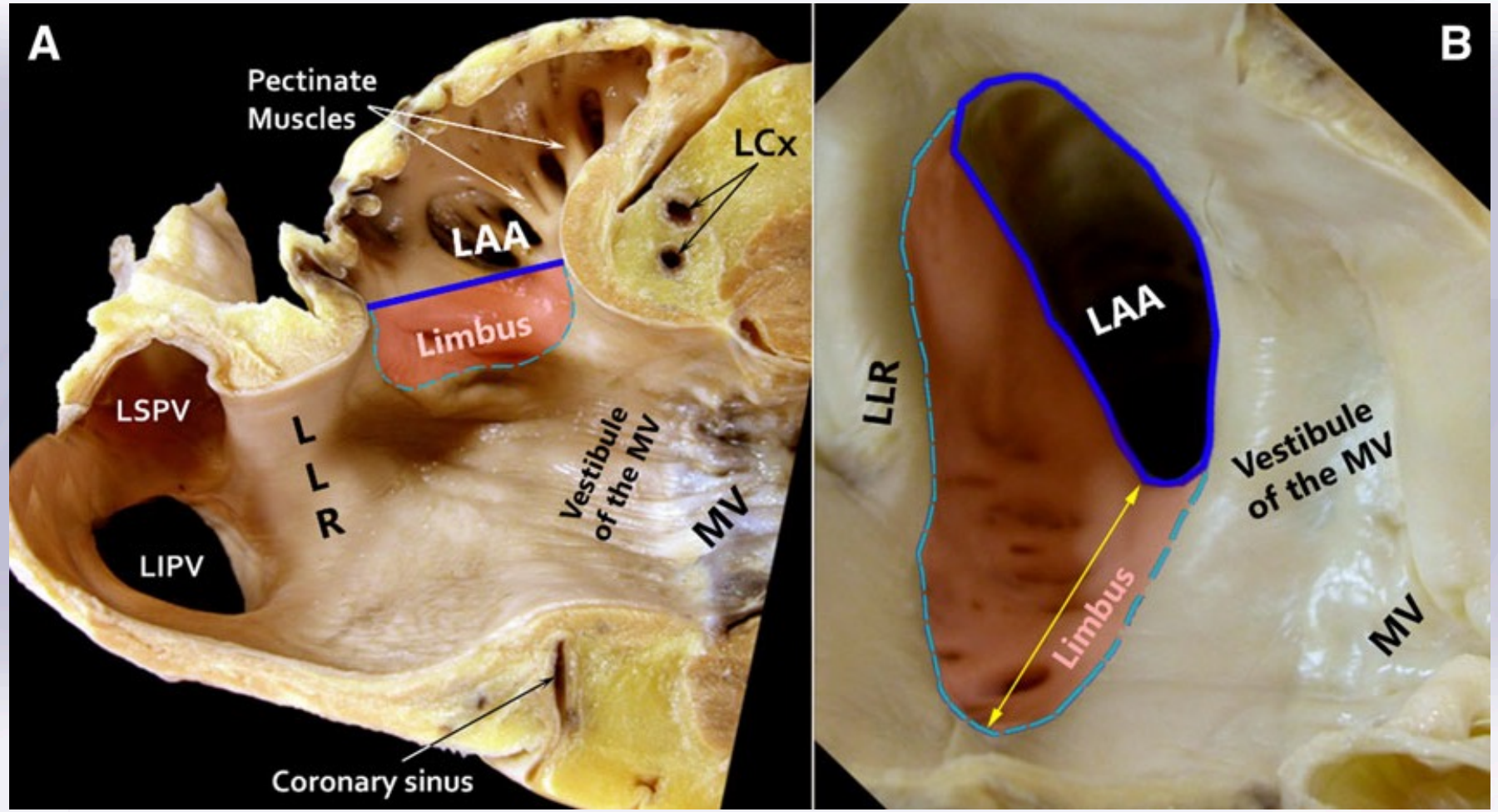




LLA= finger-like projection from the left atrium and forms part of the left border of the heart, superior to the left ventricle and inferior to the main pulmonary trunk

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LAA Anatomy



LLR = Left lateral ridge – Crista lateral esquerda ou crista cumadínica

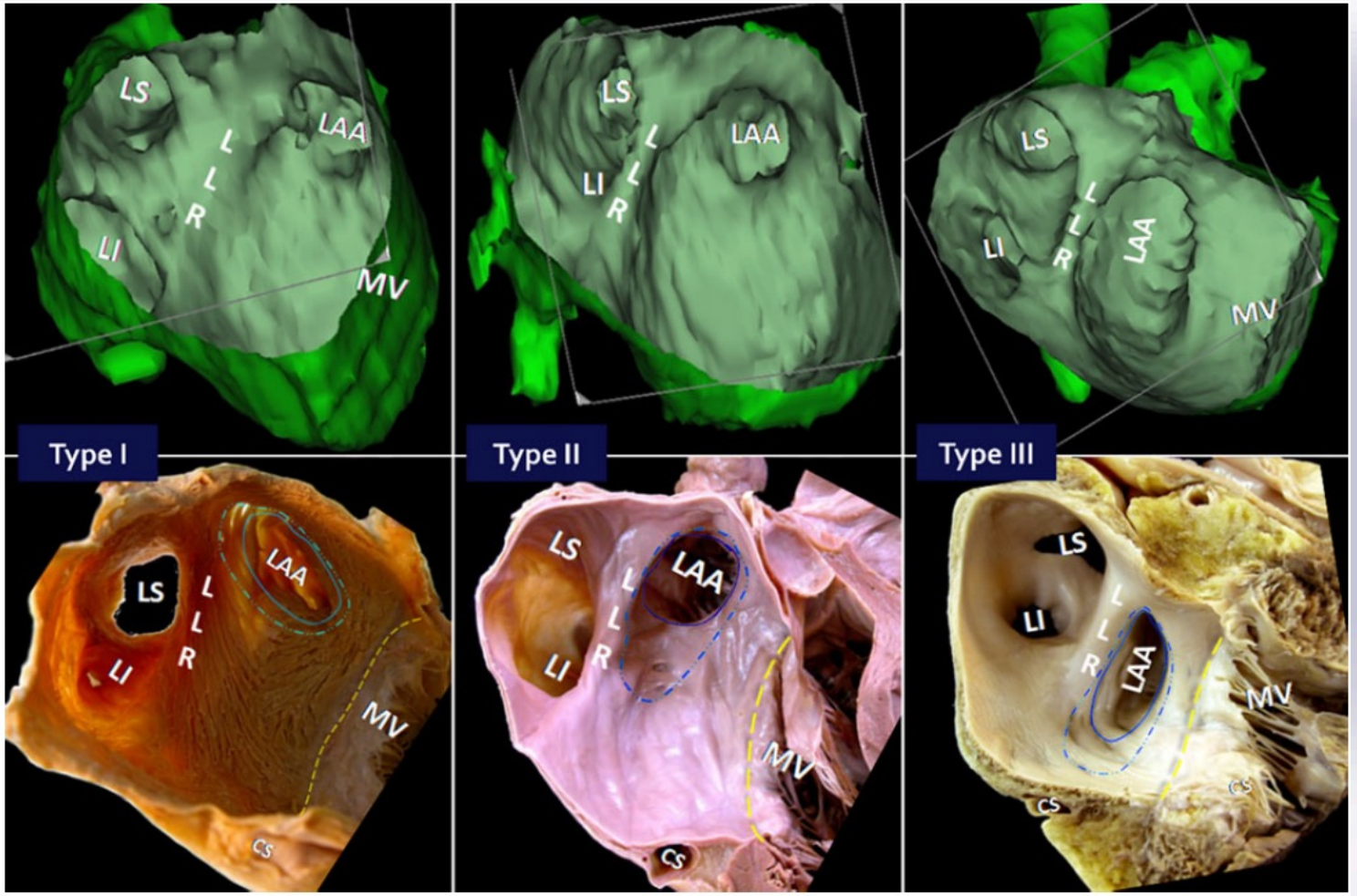
LSPV = Veia pulmonar Superior Esquerda

LIPV = Veia Pulmonar inferior Esquerda

MV = Valva Mitral

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Classification of the LAA Ostium with Respect to Location, LLR, Limbus, and Vestibule of the Mitral Annulus



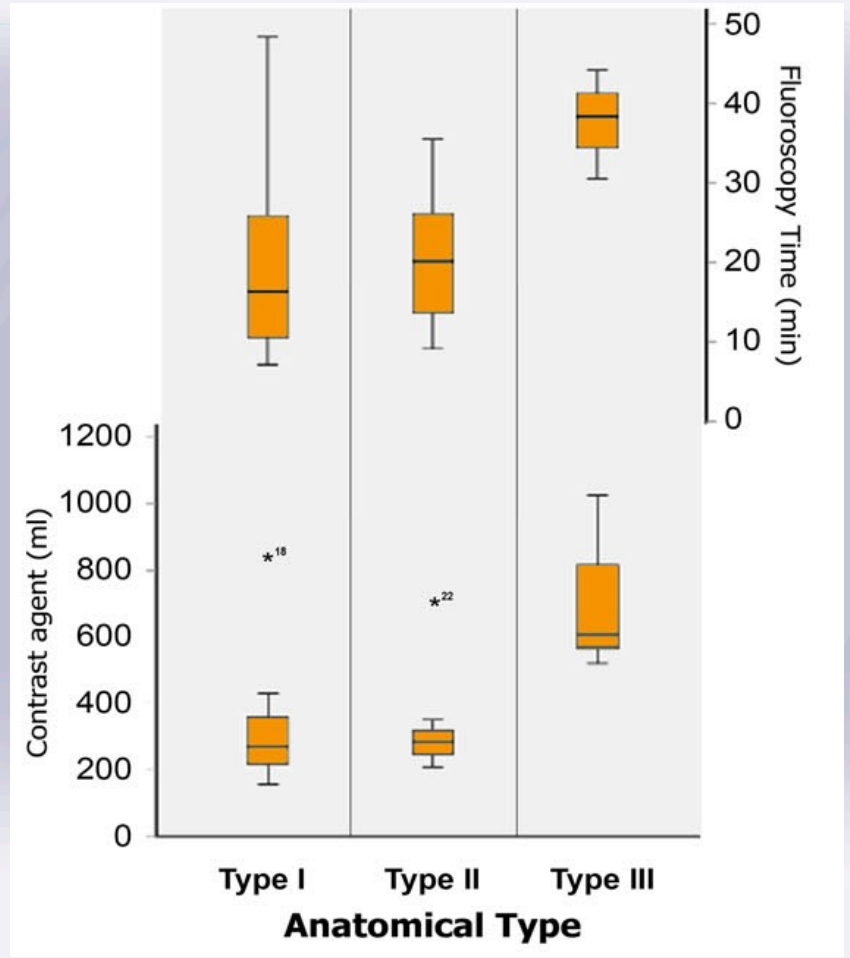
Type I: the left lower LAA ostium is cephalad and anterior to the left superior pulmonary vein (LS) and usually separated by a wide LLR.

Type II: the most posterior part of the ostium is very close to the LLR, which is thinner and more marked than in type I and demarcates a well-defined limbus.

Type III: the ostium is at the level of the left inferior pulmonary vein (LI). It has a short oval limbus, which is near the floor of the left atrium, and a short vestibule to the mitral annulus

Journal of Cardiovascular Electrophysiology Vol. 25, No. 9, September 2014

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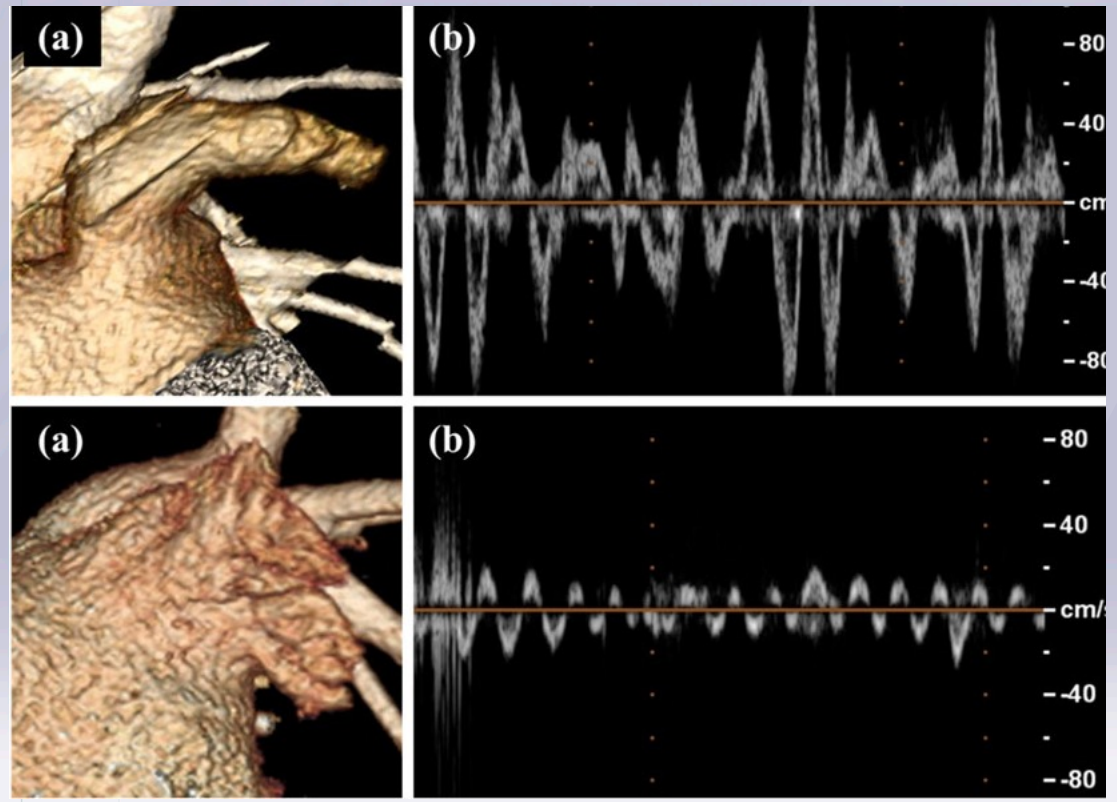


The difficulty in implant procedure, assessed by fluoroscopy time and volume of contrast, is significantly higher for the type III LAAs than for I or II

Journal of Cardiovascular Electrophysiology Vol. 25, No. 9, September 2014

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LAA Function in Relation to Thromboembolism



Mean LAA contraction velocity was lower in patients with LAA thrombus versus
those without (10±4 vs 22±7 cm/s, P<0.001)

About one third of patients with an LAA flow velocity ≤11 cm/s had evidence of LAA thrombus

Peak LAA anterograde flow velocity <20 cm/s was independently associated with thrombus formation and risk of cardioembolism.

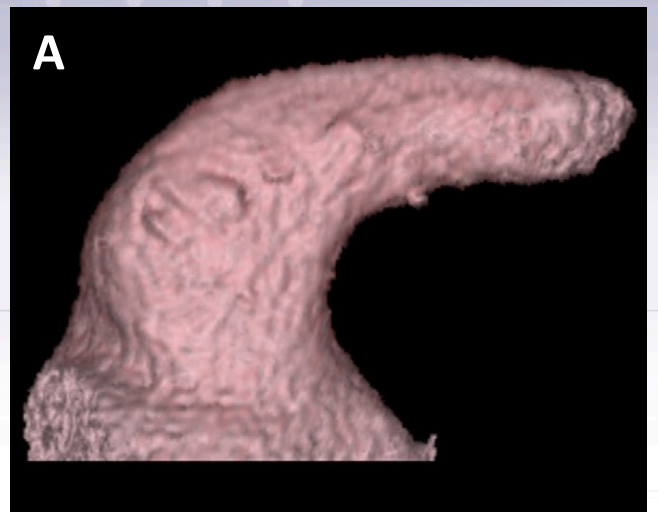
Lower left atrial appendage flow velocity was associated with ischemic stroke.

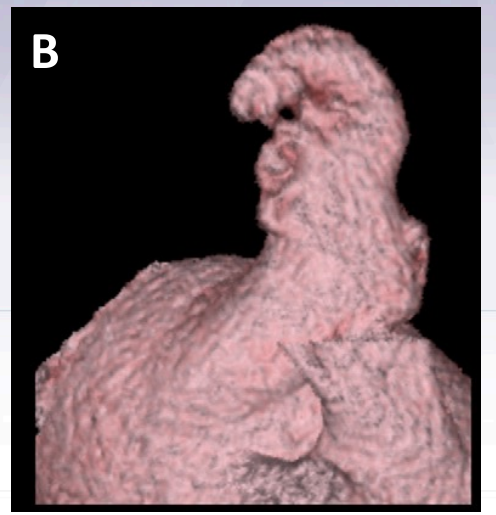
Di Tulio MR, et al. Stroke, 1999.
De Biasi. J Am Coll Cardiol, 2012.
Yaghi s, et al. Stroke 2015.

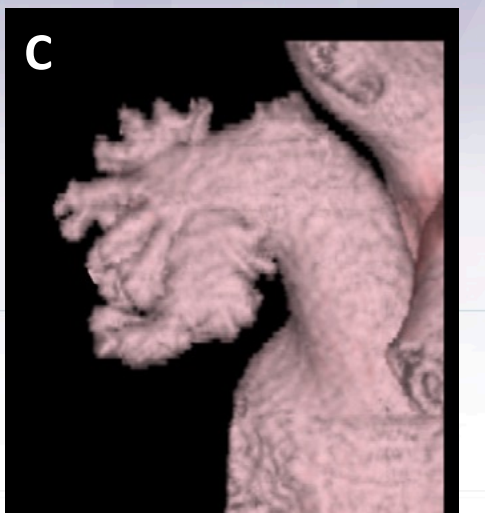
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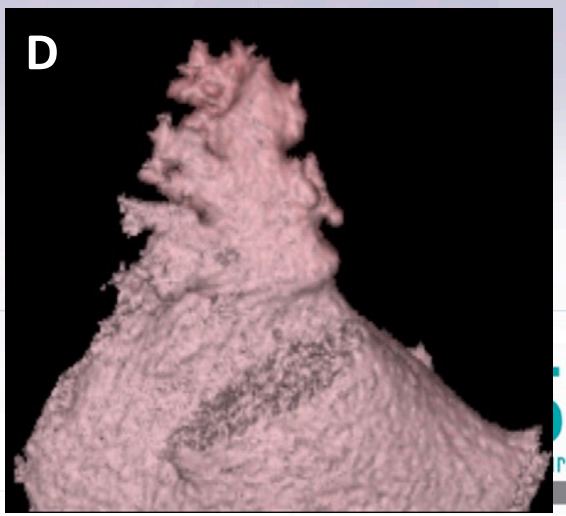
Classification of the LAA morphologies with 3D reconstructed CT

A. Chicken wing (multilobed with an obvious bend)
B. Windsock (single lobed without a bend)
C. Cauliflower (multilobed without an obvious bend or dominant lobe)
D. Cactus (multilobed without an obvious bend but with a dominant lobe)

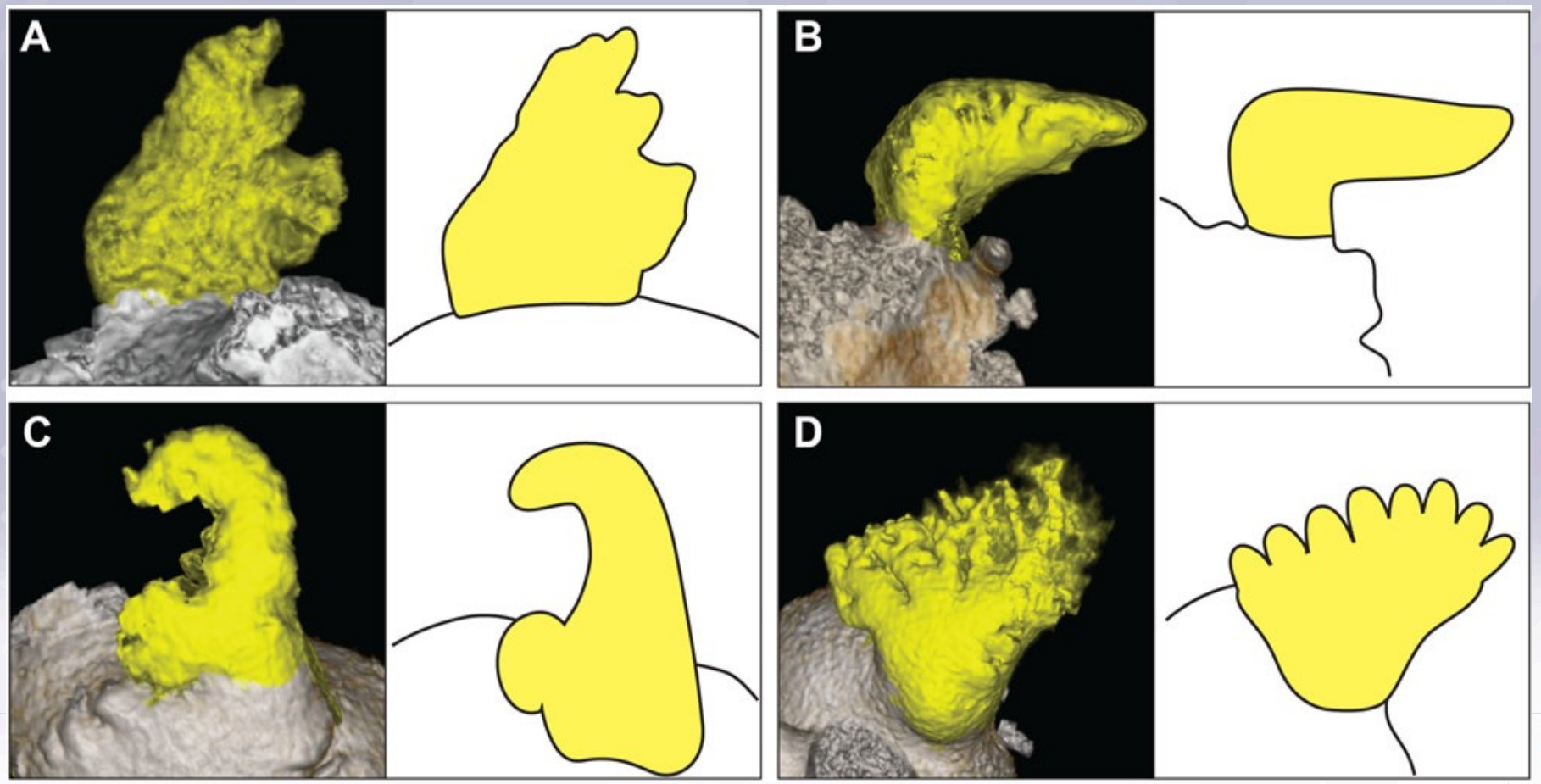








Classification of the LAA morphologies with 3D reconstructed CT

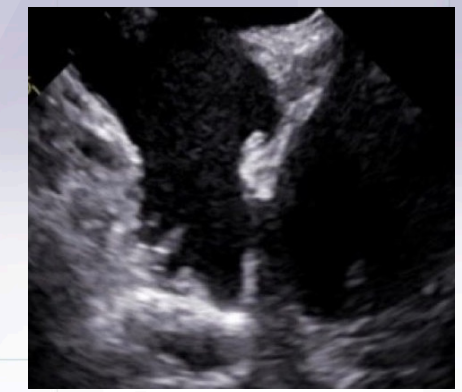


(A) cactus; (B) Chicken wing; (C) Wind sock; (D) Cauliflower.

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LAA Morphology in Relation to Thromboembolism

- The prevalence of ischemic stroke among different LAA morphologies was lower in chicken wing compared with another morphologies.
- Cauliflower LAA morphology was an independent predictor of stroke (OR 3.4, P=0.017).
- Association between nonchicken wing morphology and covert cerebral infarcts on brain MRI
- Extensive LAA trabeculations is associated with ischemic stroke

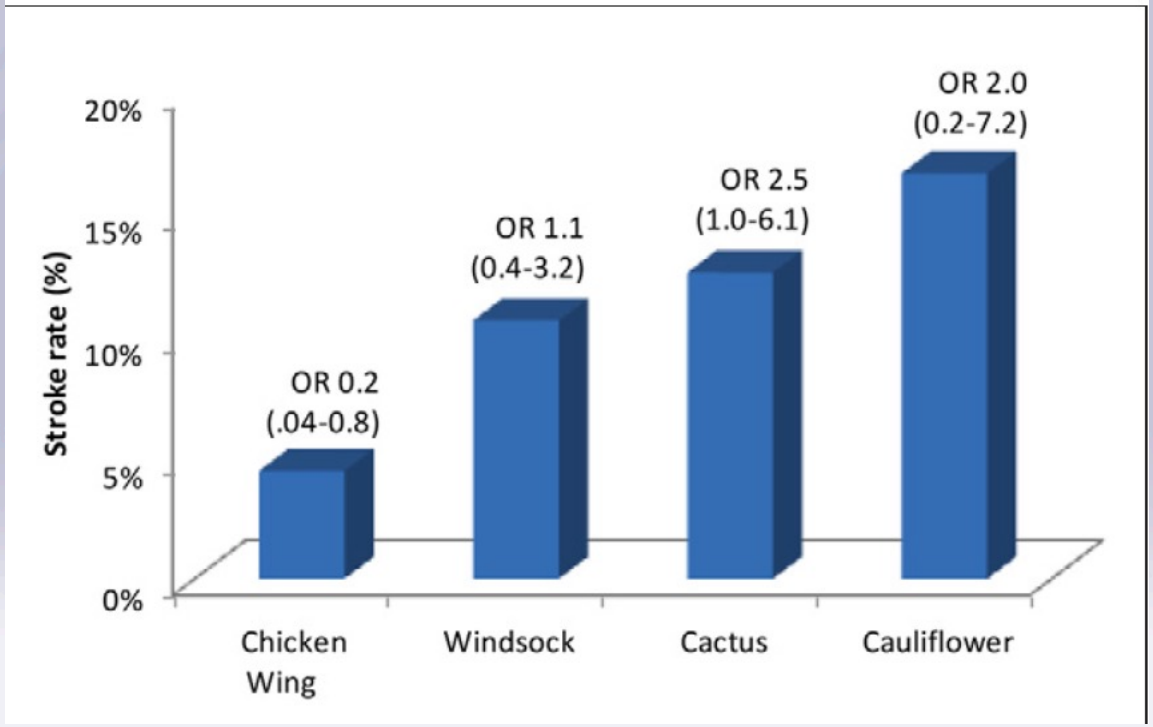


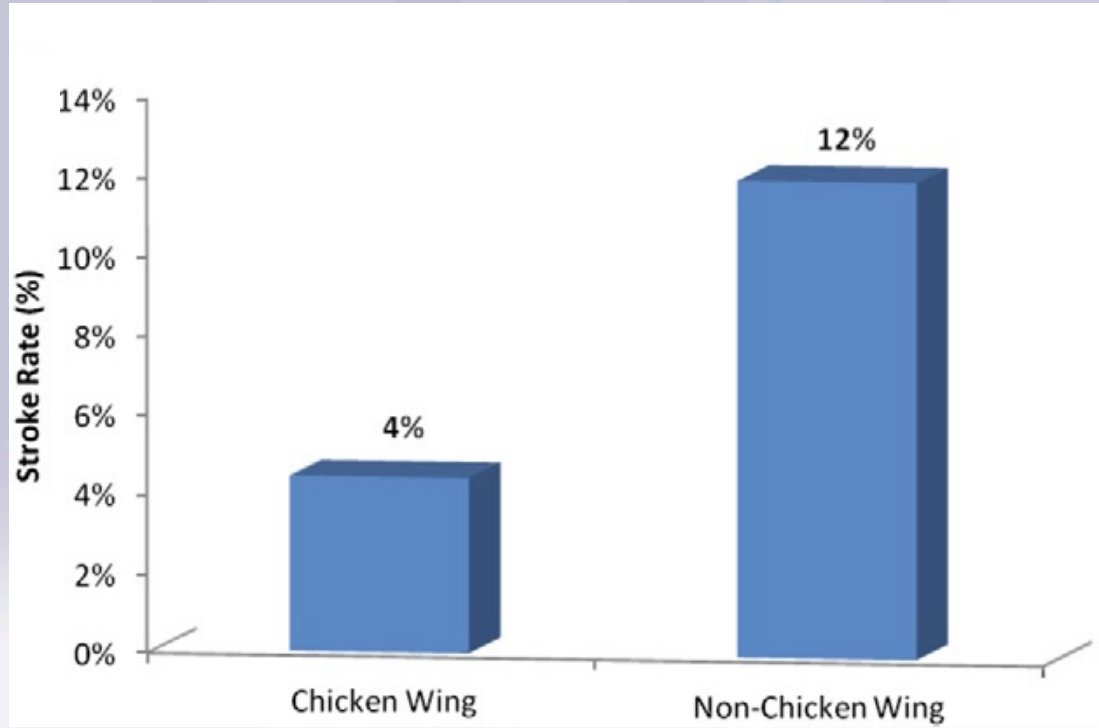
Yaghi s, et al. Stroke, 2015
Lee JM, et al. Cardiovasc Electrophysiol, 2015.

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LAA Morphology Correlate with the Risk of Stroke in Patients with AF

N= 932, stroke in 78 (8%)

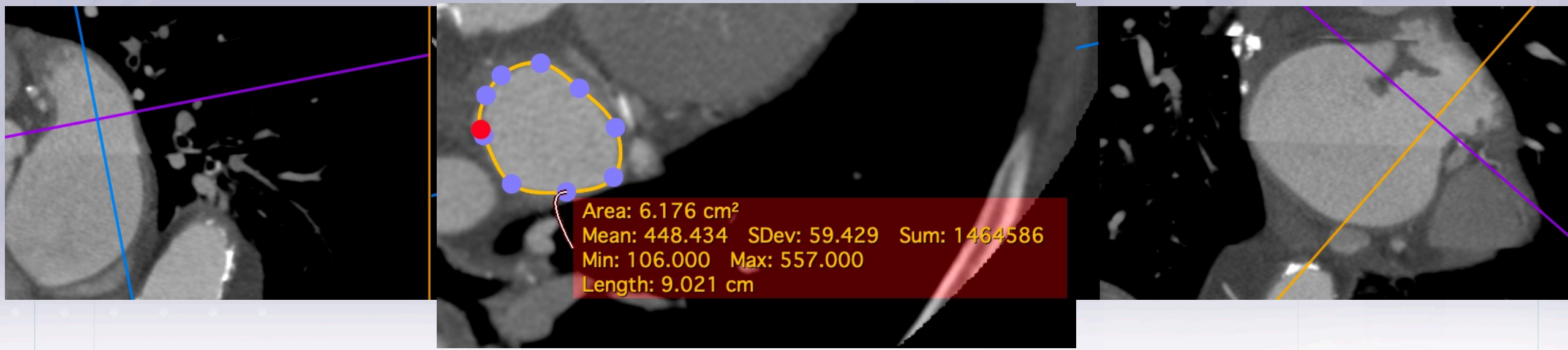




Di Biase et al. JACC Vol. 60, No. 6, 2012

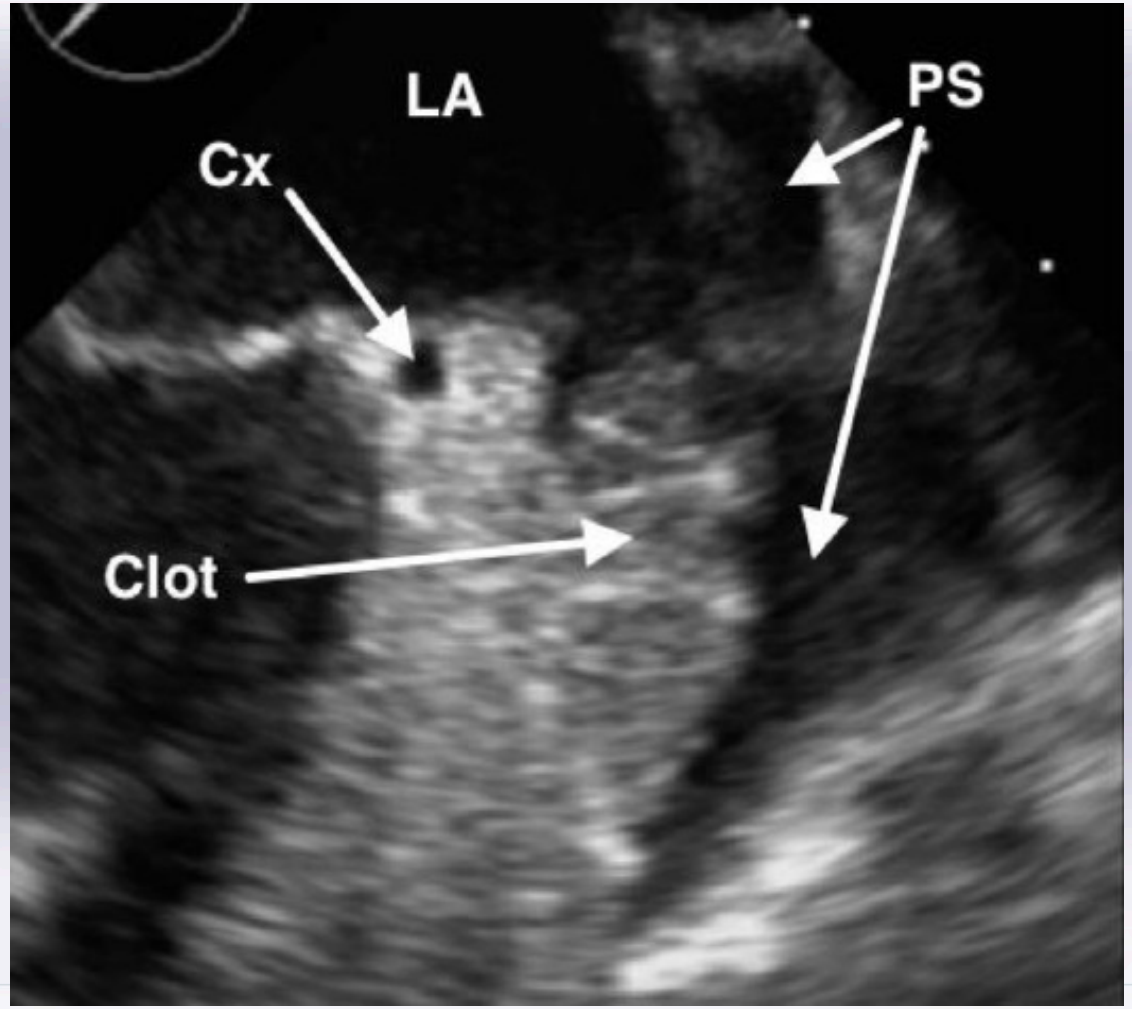
LAA orifice area in Relation to Thromboembolism

- Patients with stroke were found to have a larger LAA orifice area (4.5±1.5 vs
- 3.0±1.1 cm2, P<0.001).



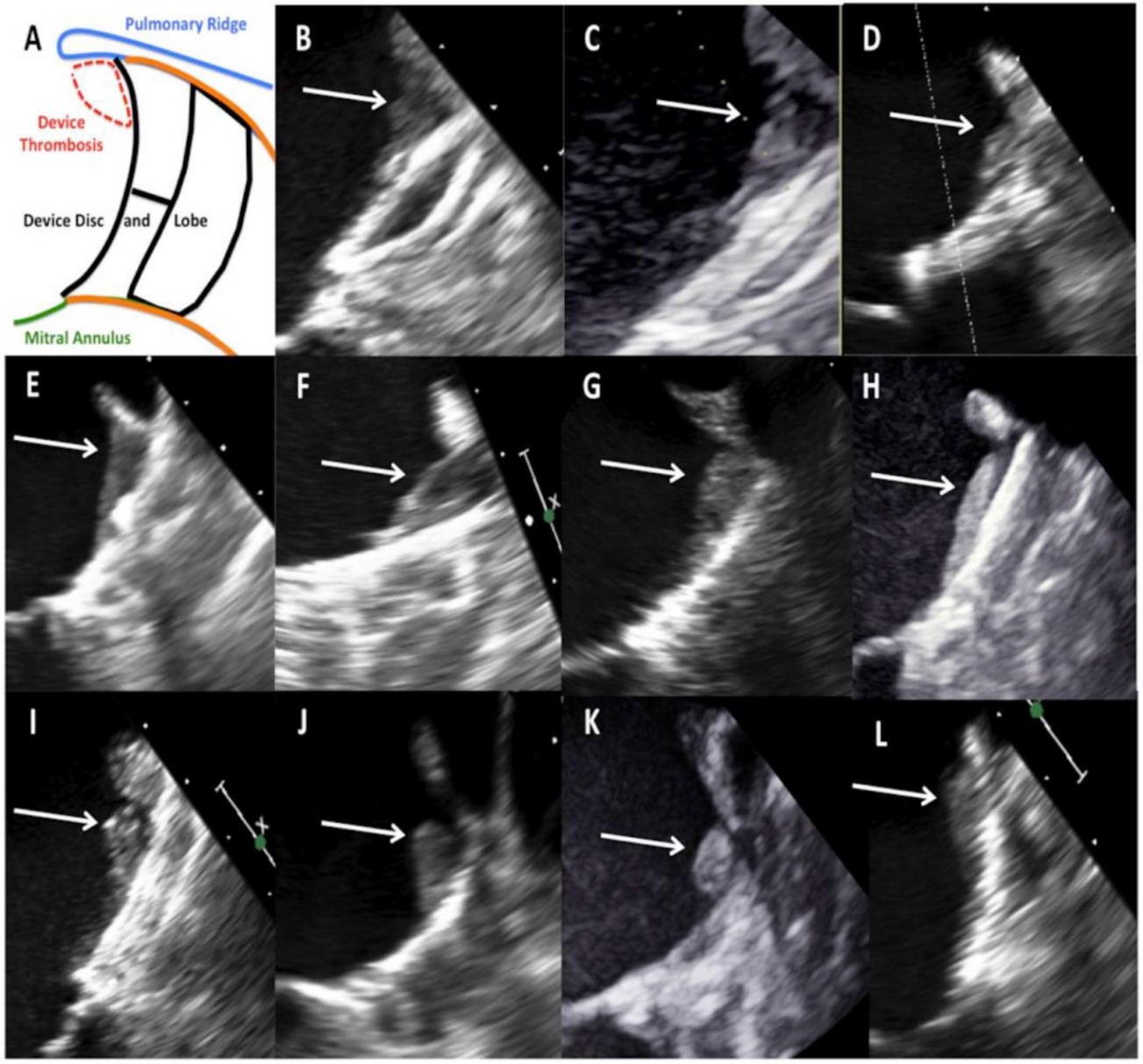
Lee JM, et al. Am J Cardiol. 2014

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LA
PS
Cx
Clot

Impact of Left Lateral Ridge Coverage after Left Atrial Appendage Occlusion

Freixa X, et al. EuroIntervention 2020



B-K → Covered LLR

L → Uncovered LLR

Demographics

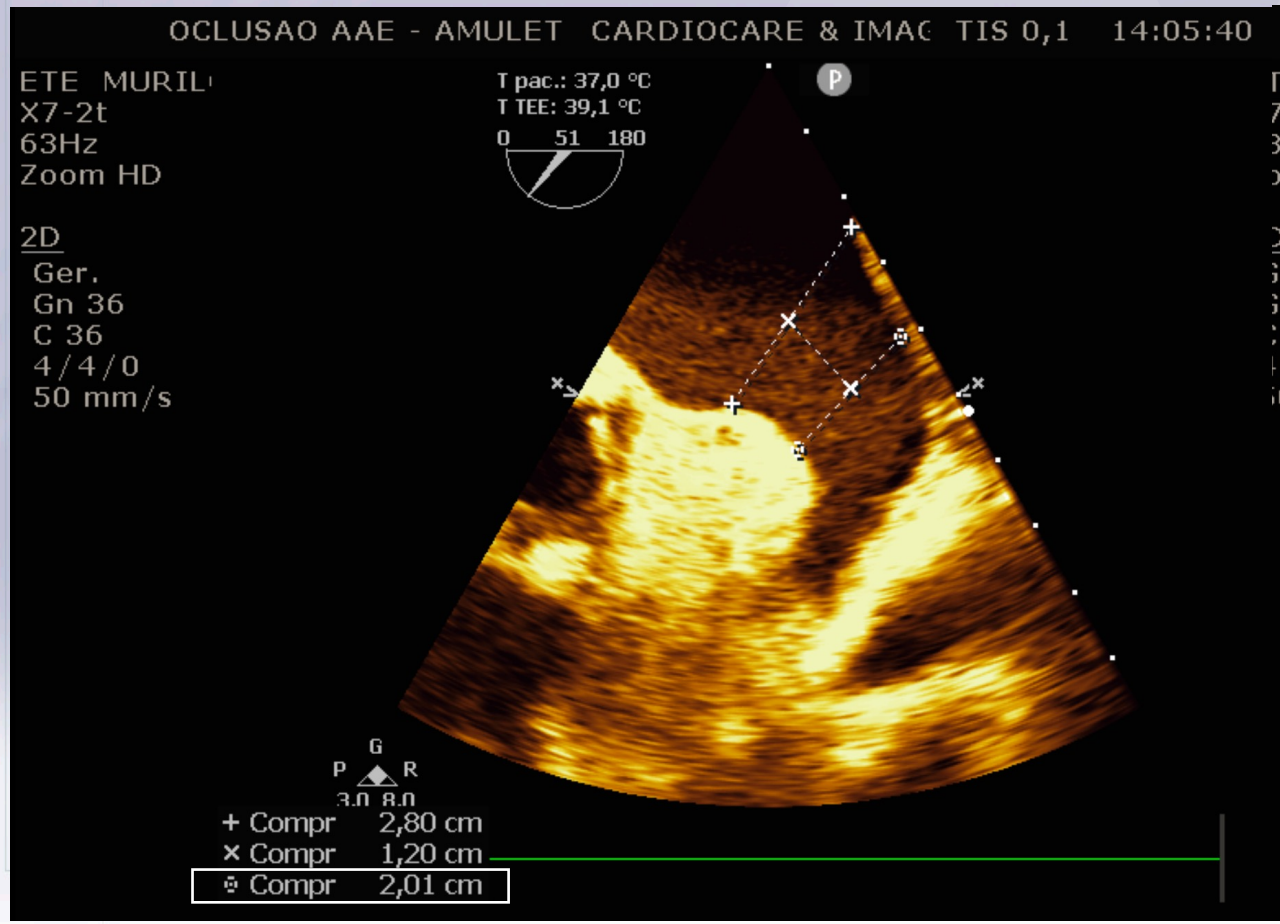
- 86 yo male, crhonic AF
- Stroke in July
- Hemorrhagic stroke in August in use of NOAC
- COVID119 in November 2020

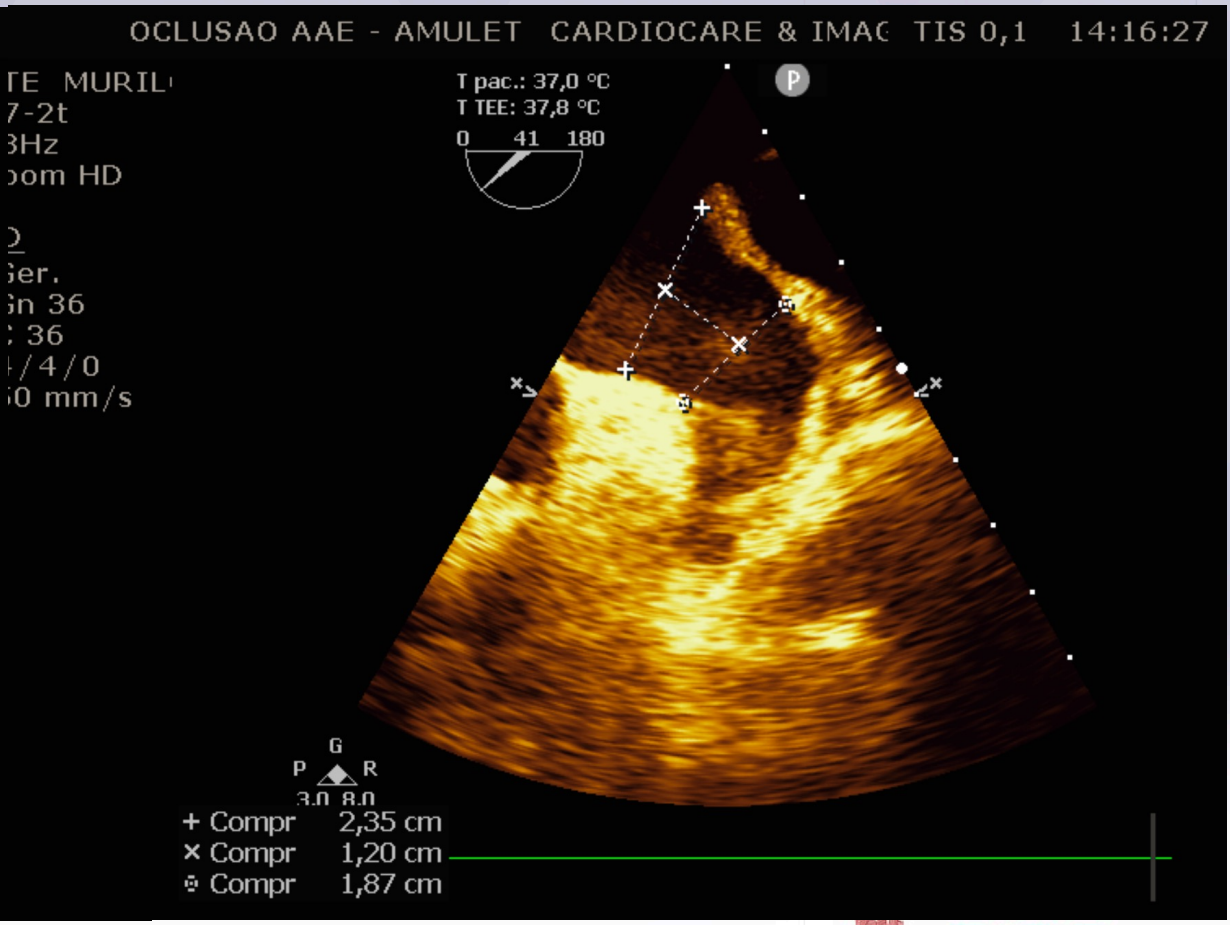
In January/21 hospitalized for gastrointestinal bleeding

Comorbidities:

- HTN/ HFpEF / DM2 / HYPOTHYROIDISM
- CHA_2DS_2-VASc = 6

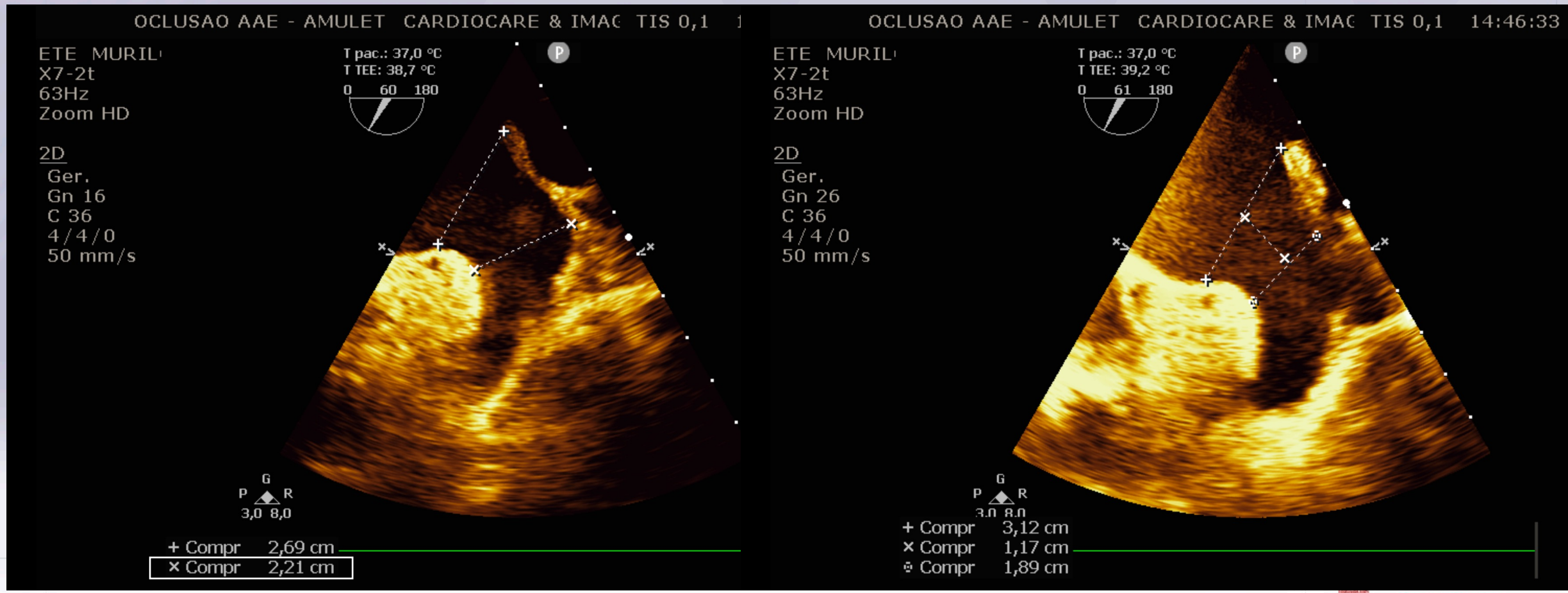
Basal TEE



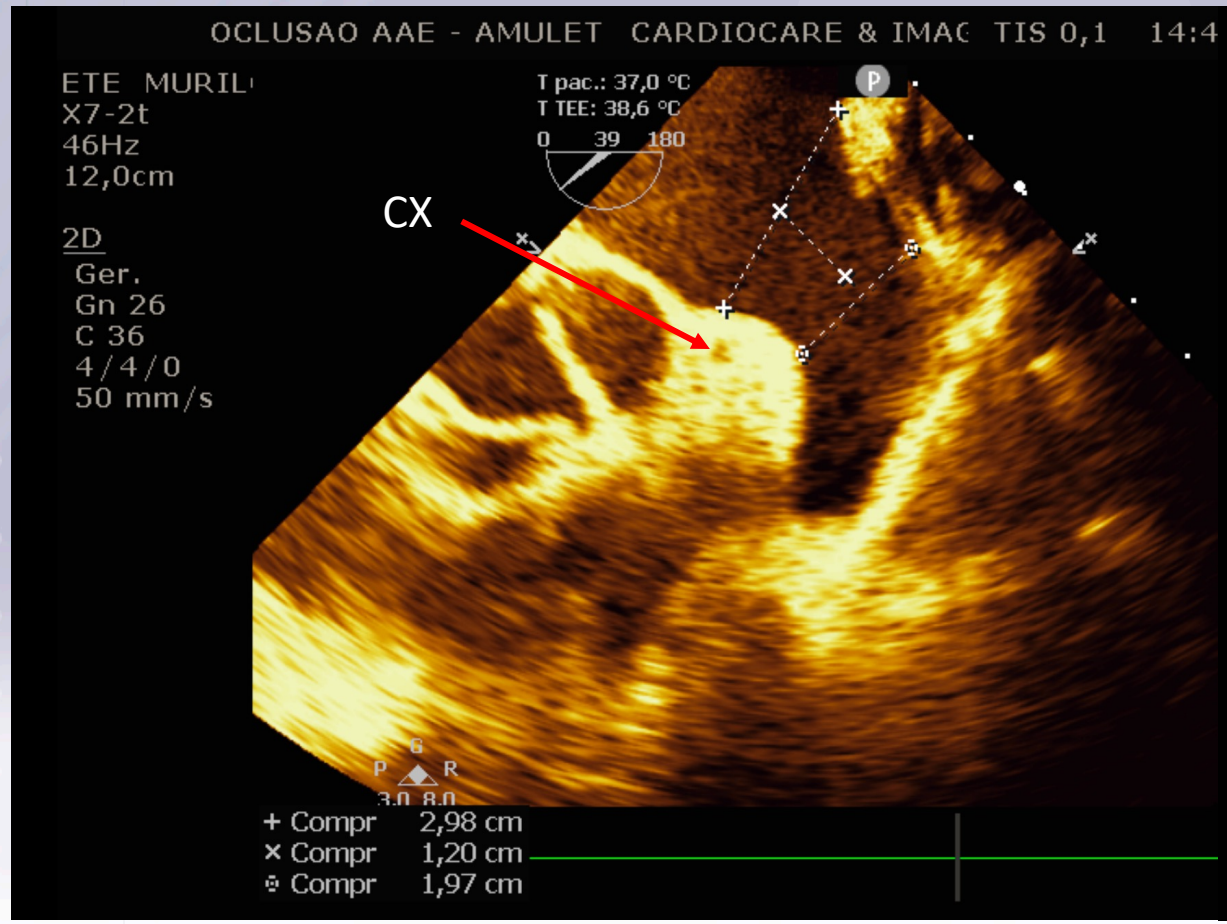


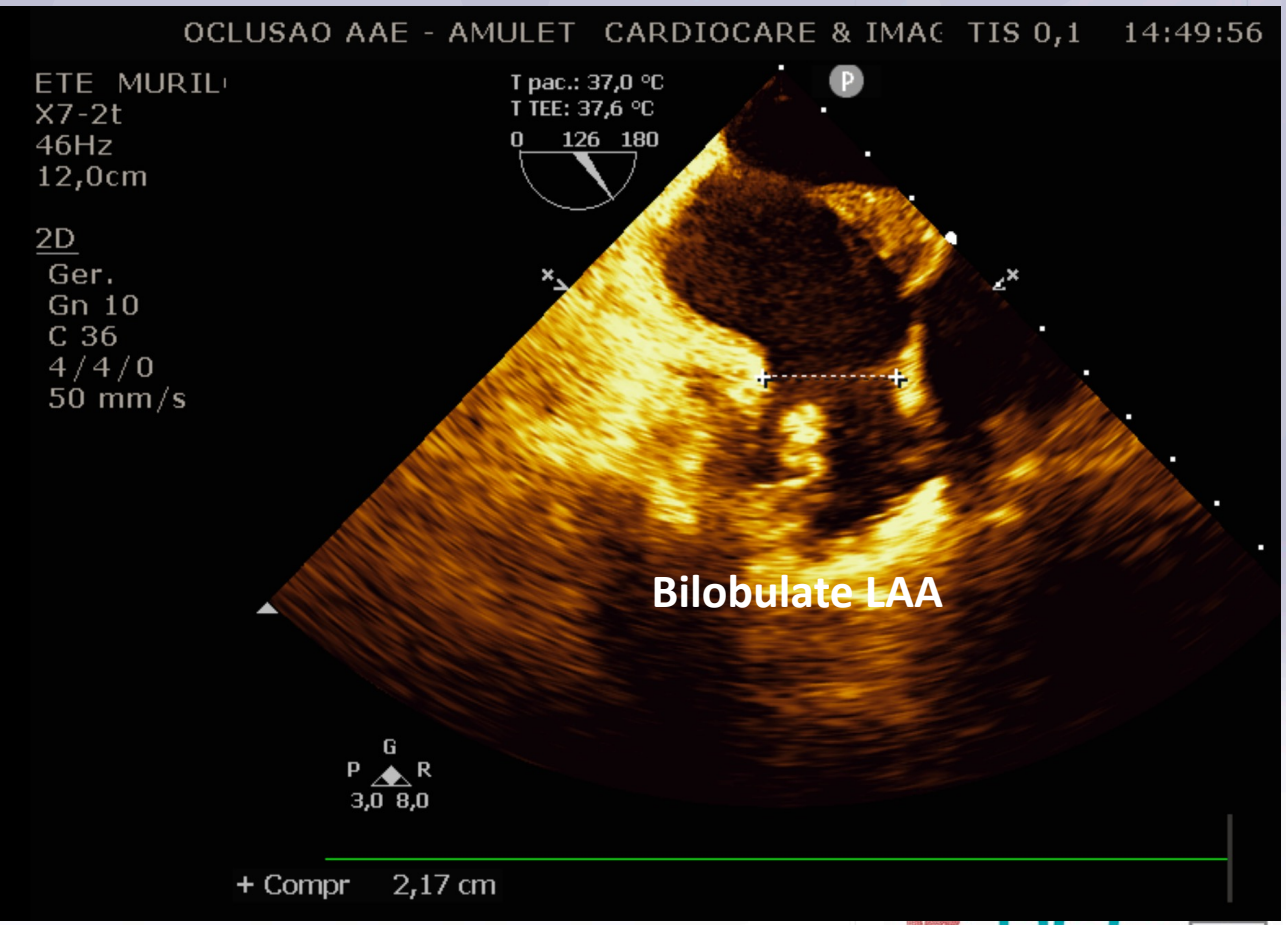
Absence of thrombus, favorable measures for LAAE

Basal TEE

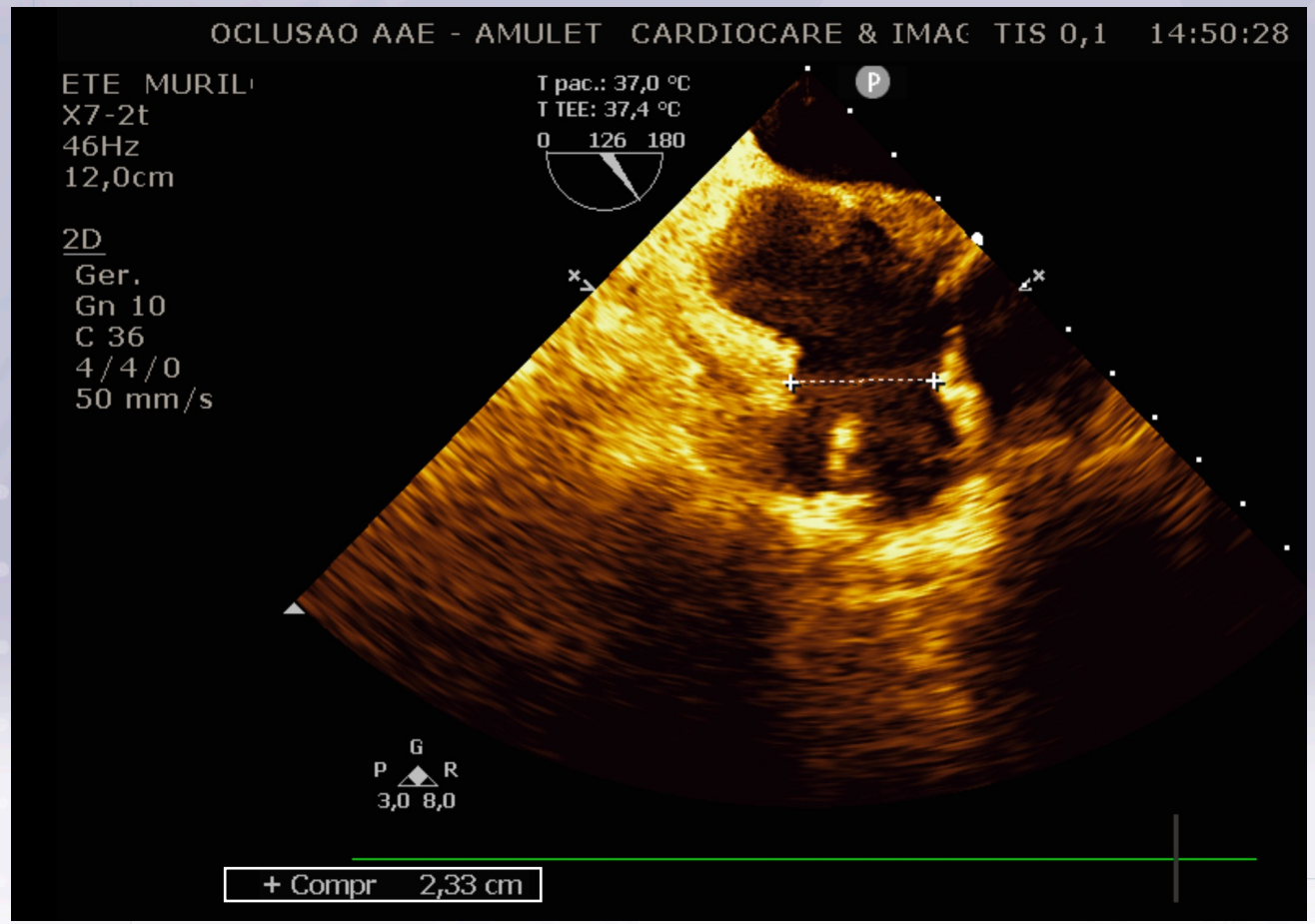

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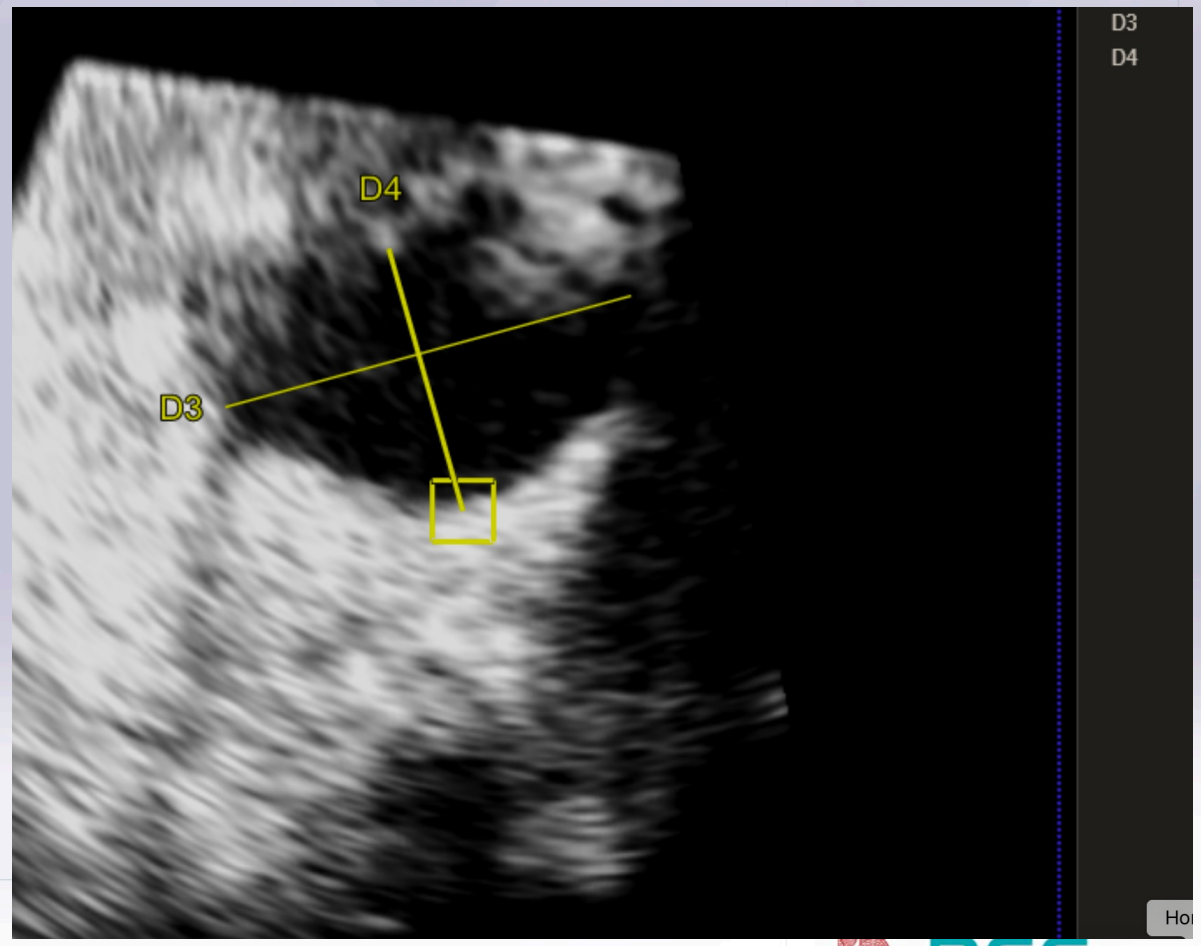
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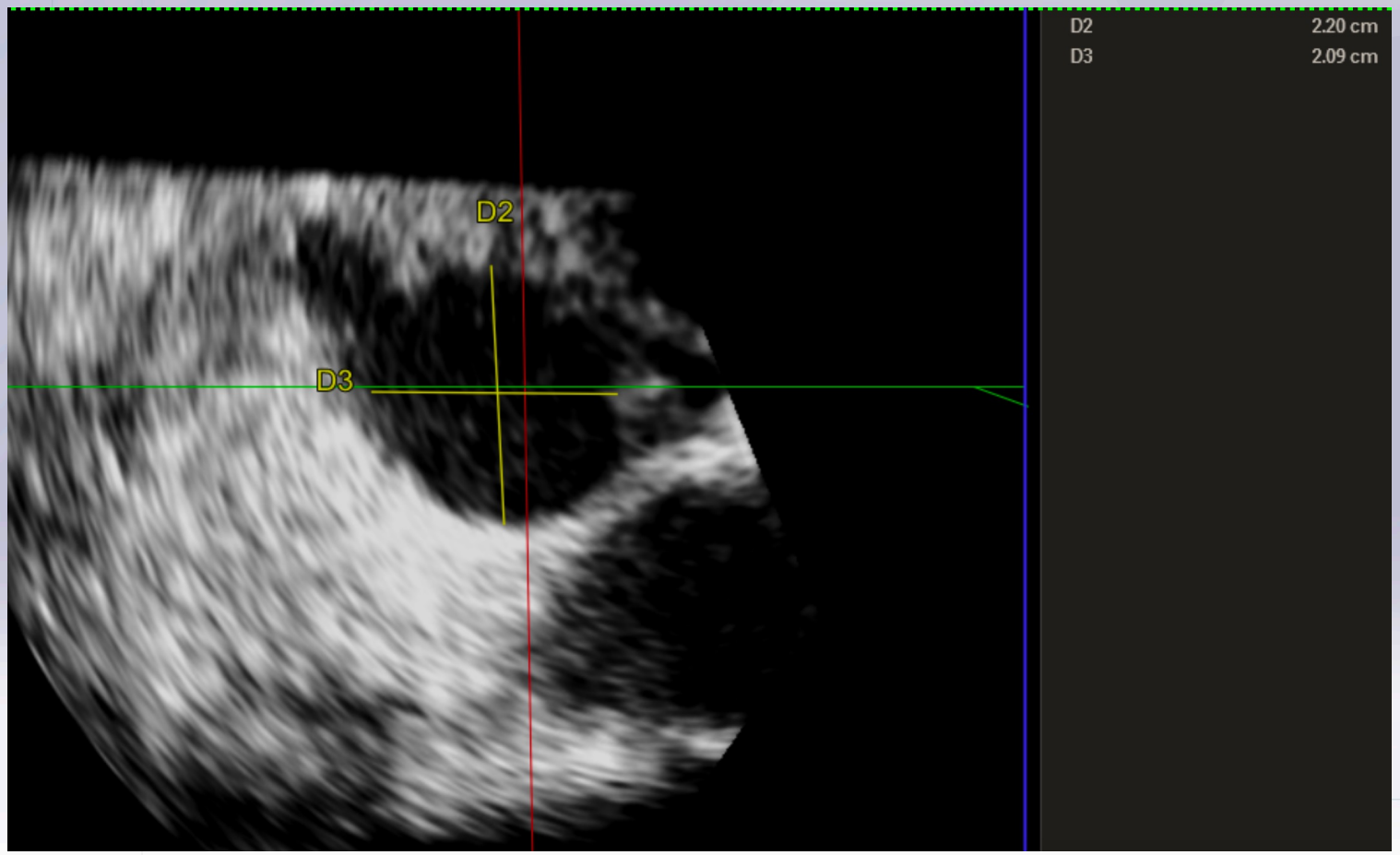

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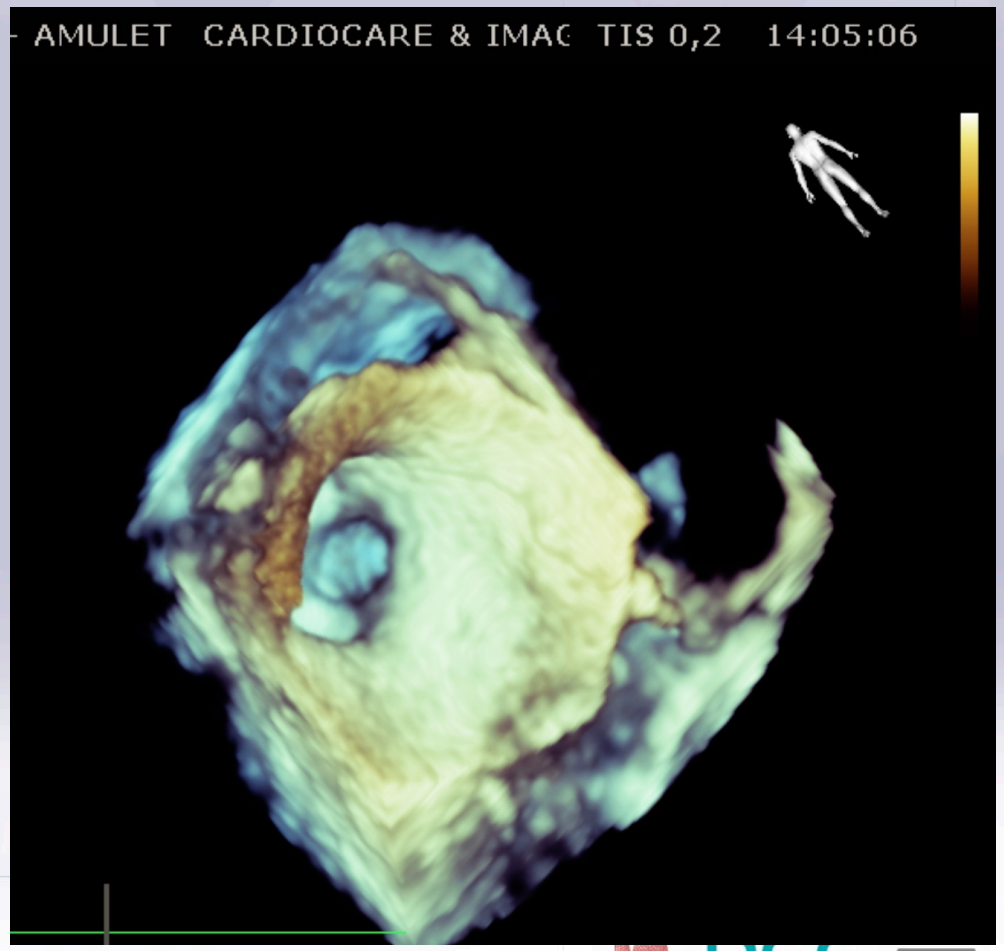
Basal TEE


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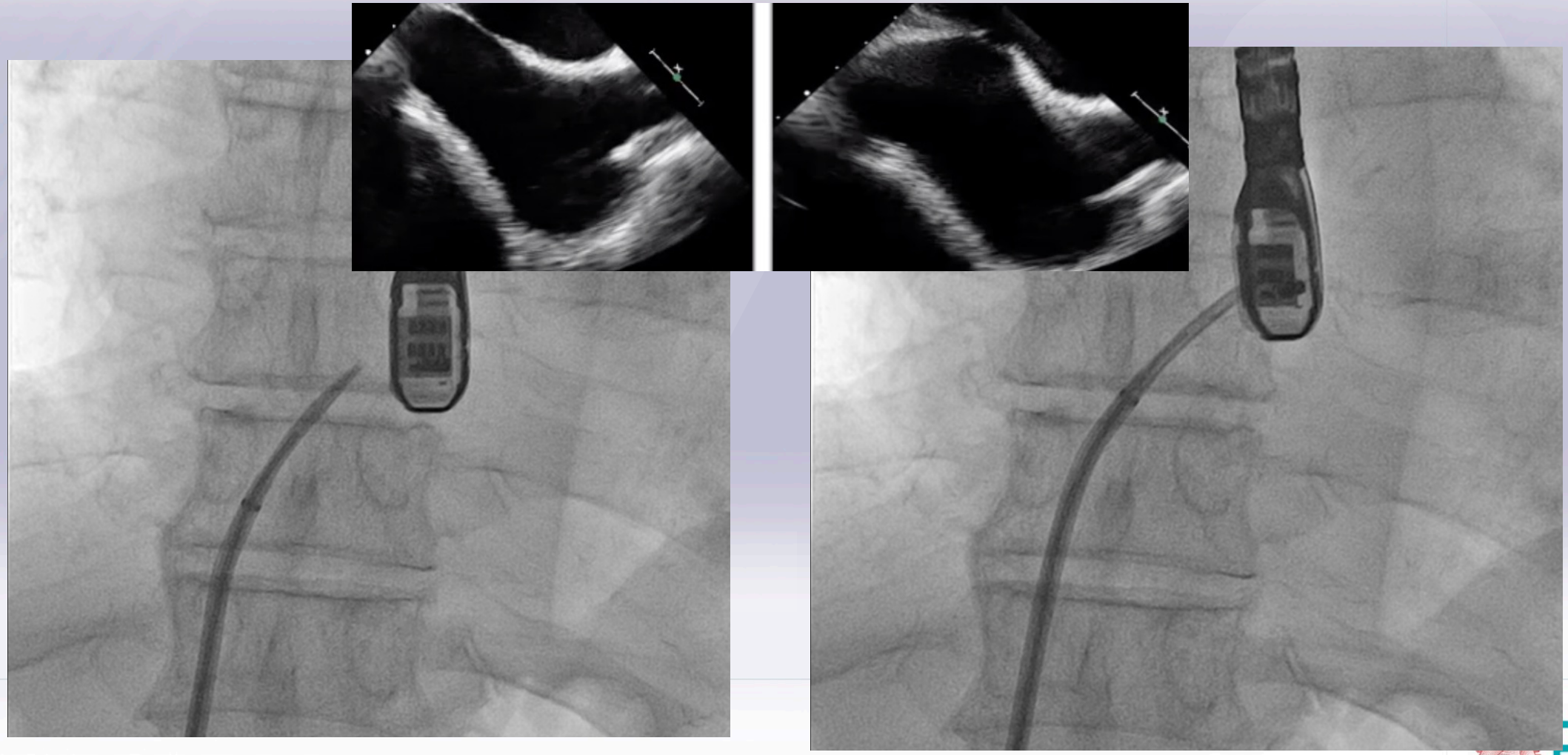
3D TEE



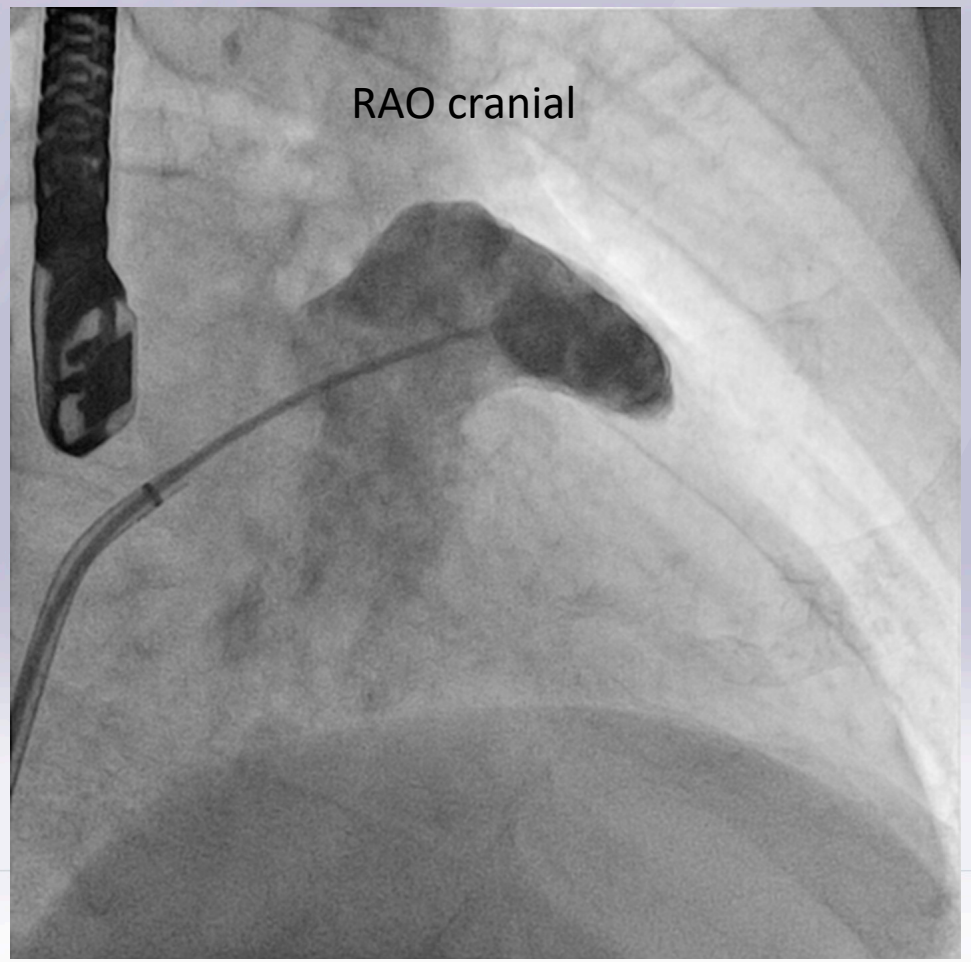


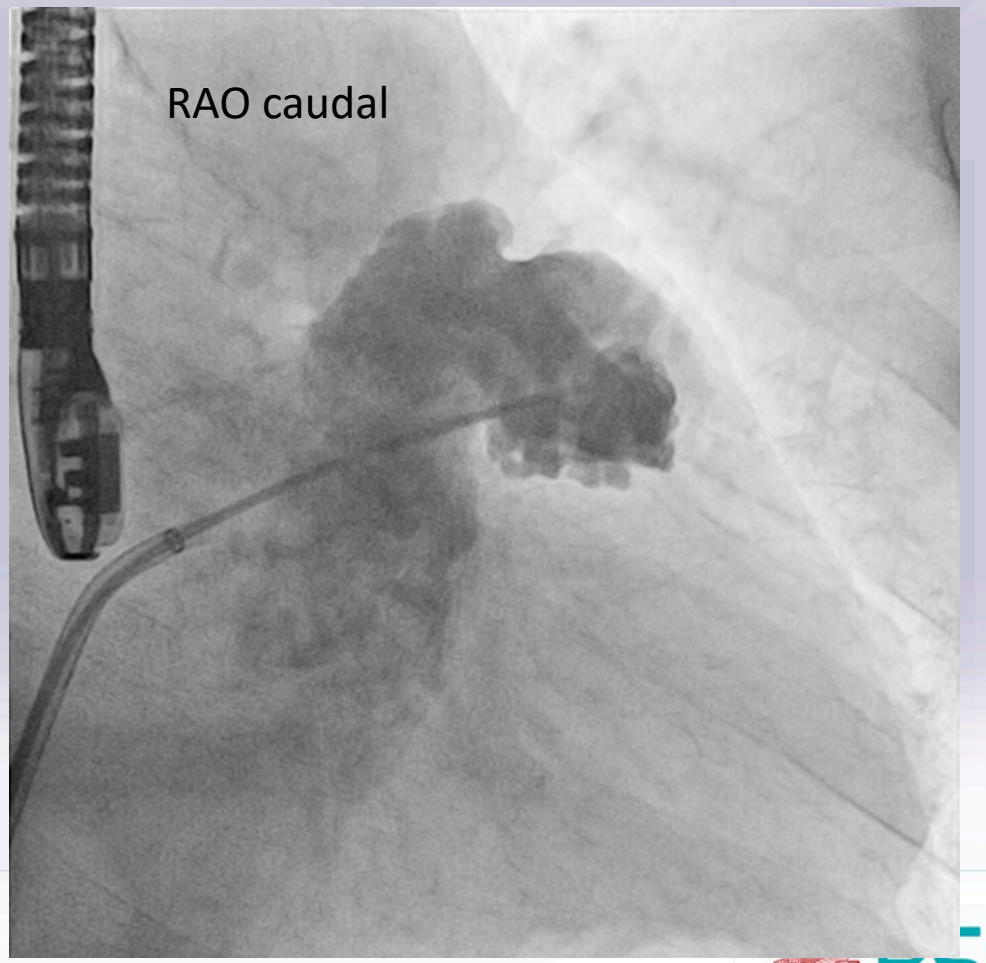
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Transeptal puncture– Posterior and inferior



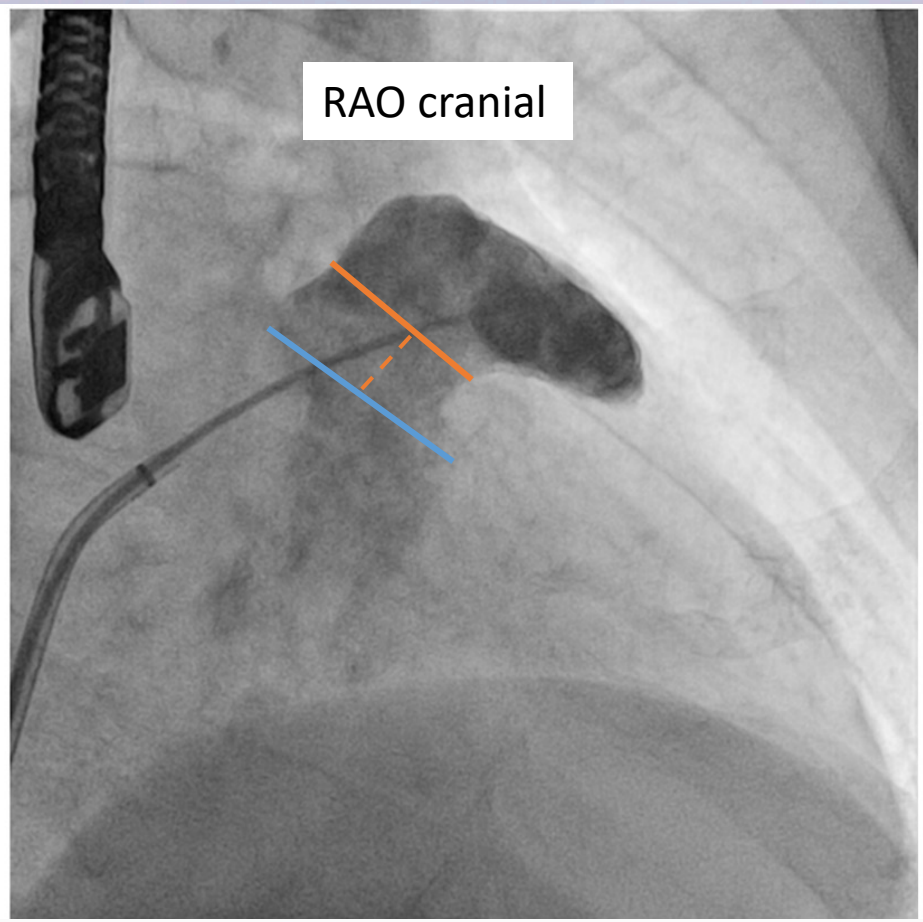
Pigtail inside LAA

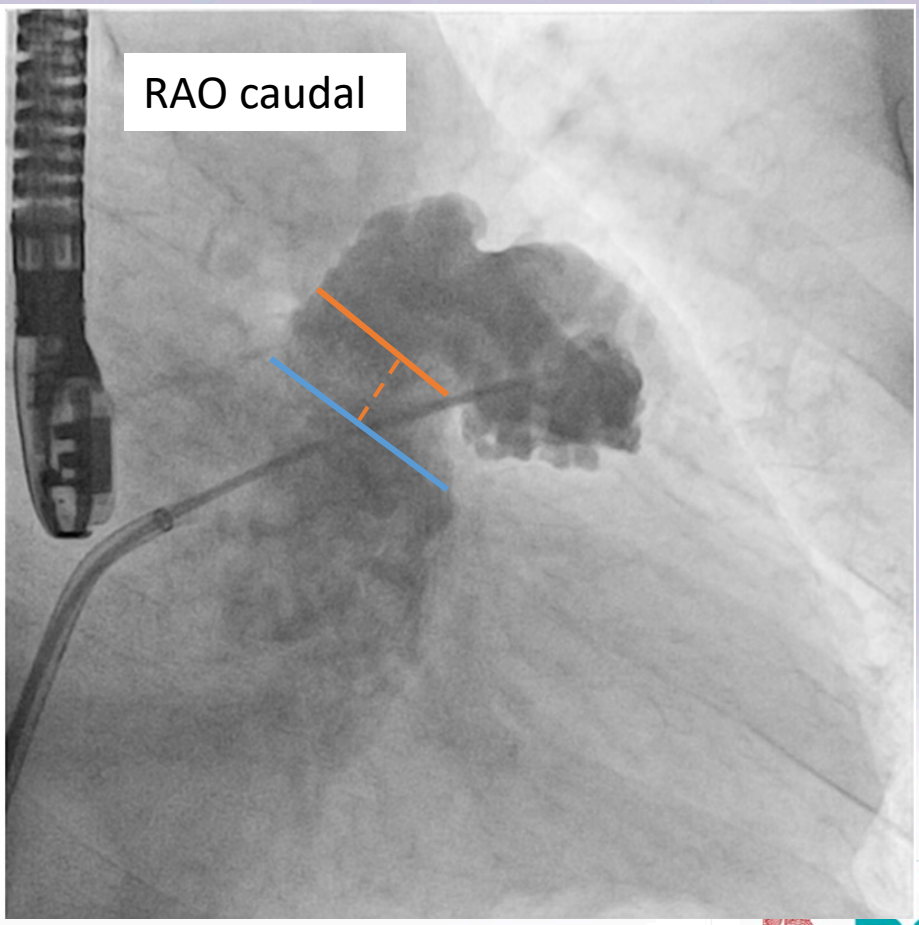




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Measurements

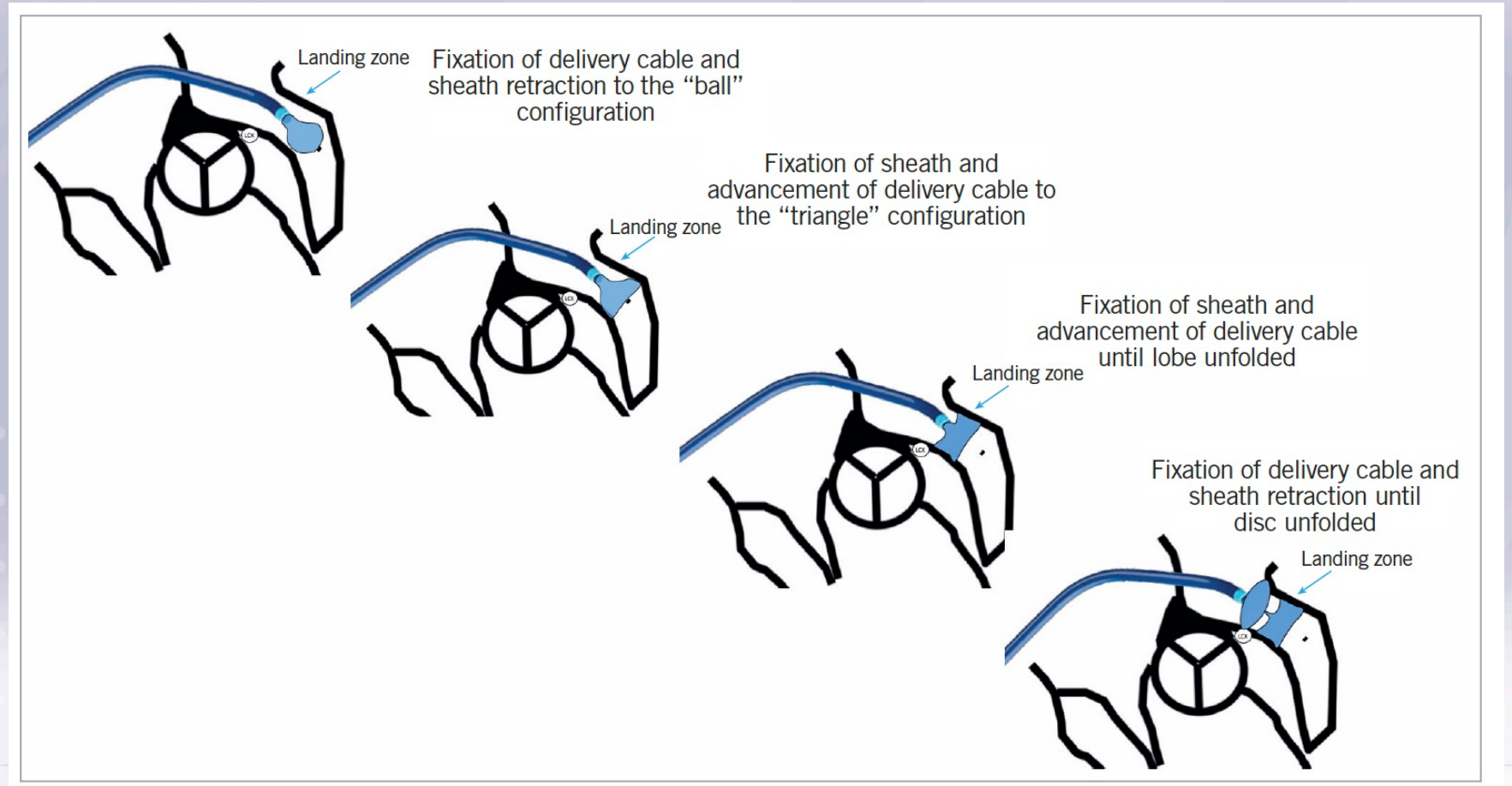




~23 mm

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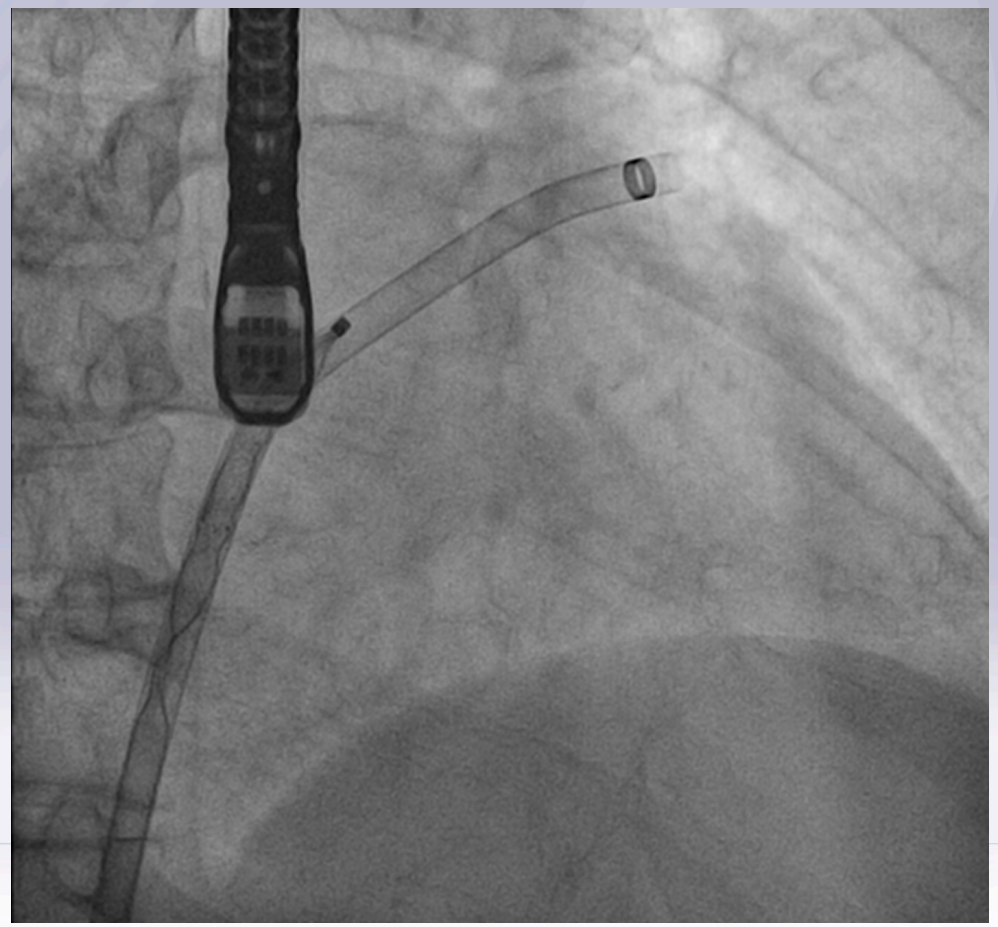
Implant Steps

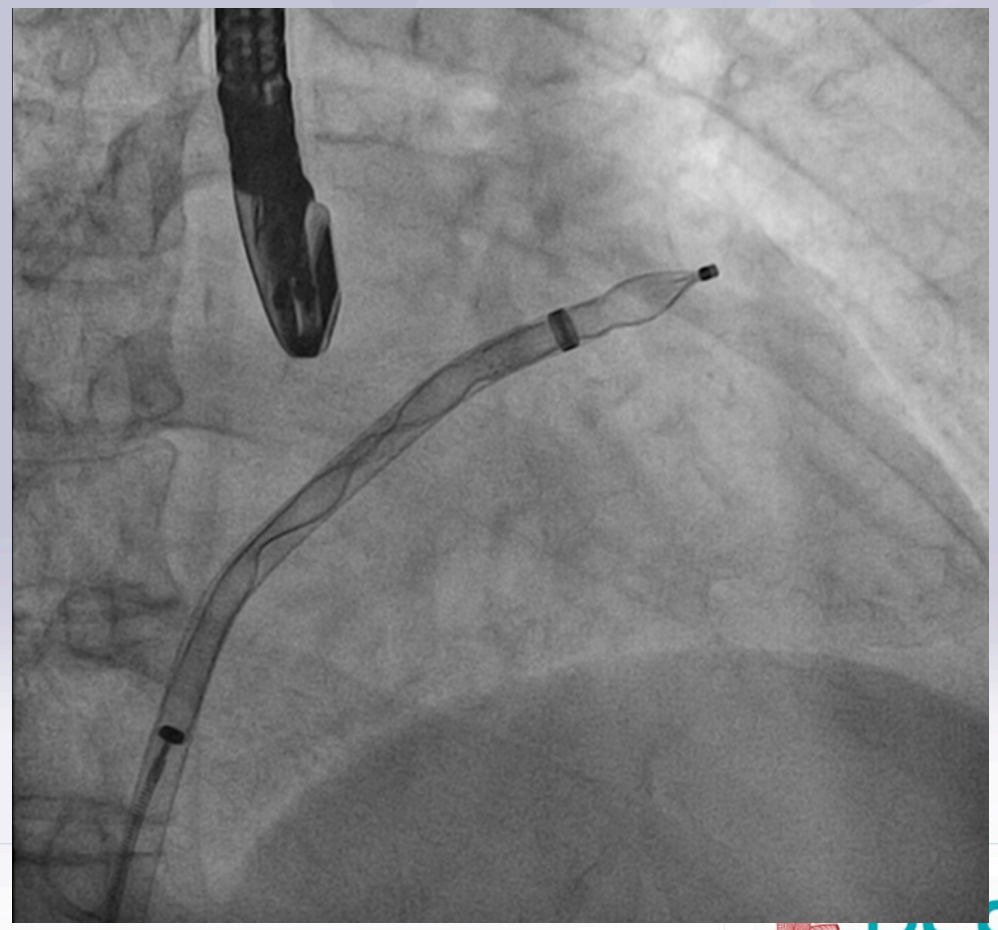


EHRA/EAPCI consensus statement on LAA occlusion update - 2020

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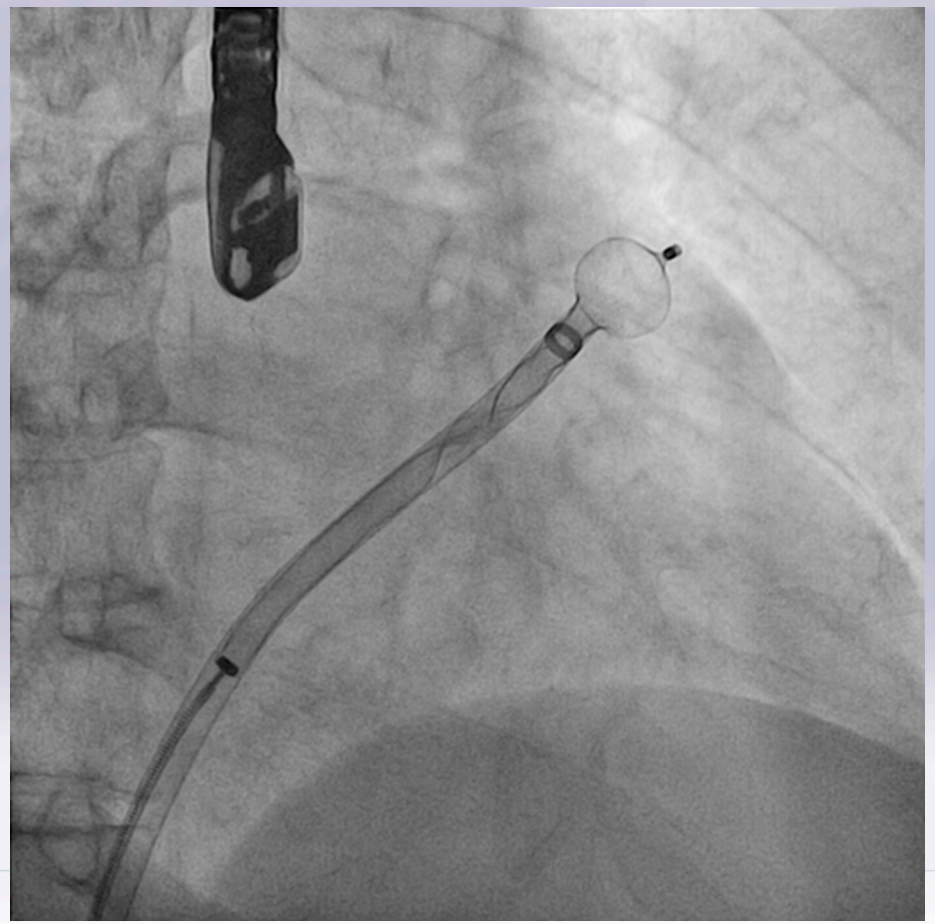
14F sheath and e Amulet #28

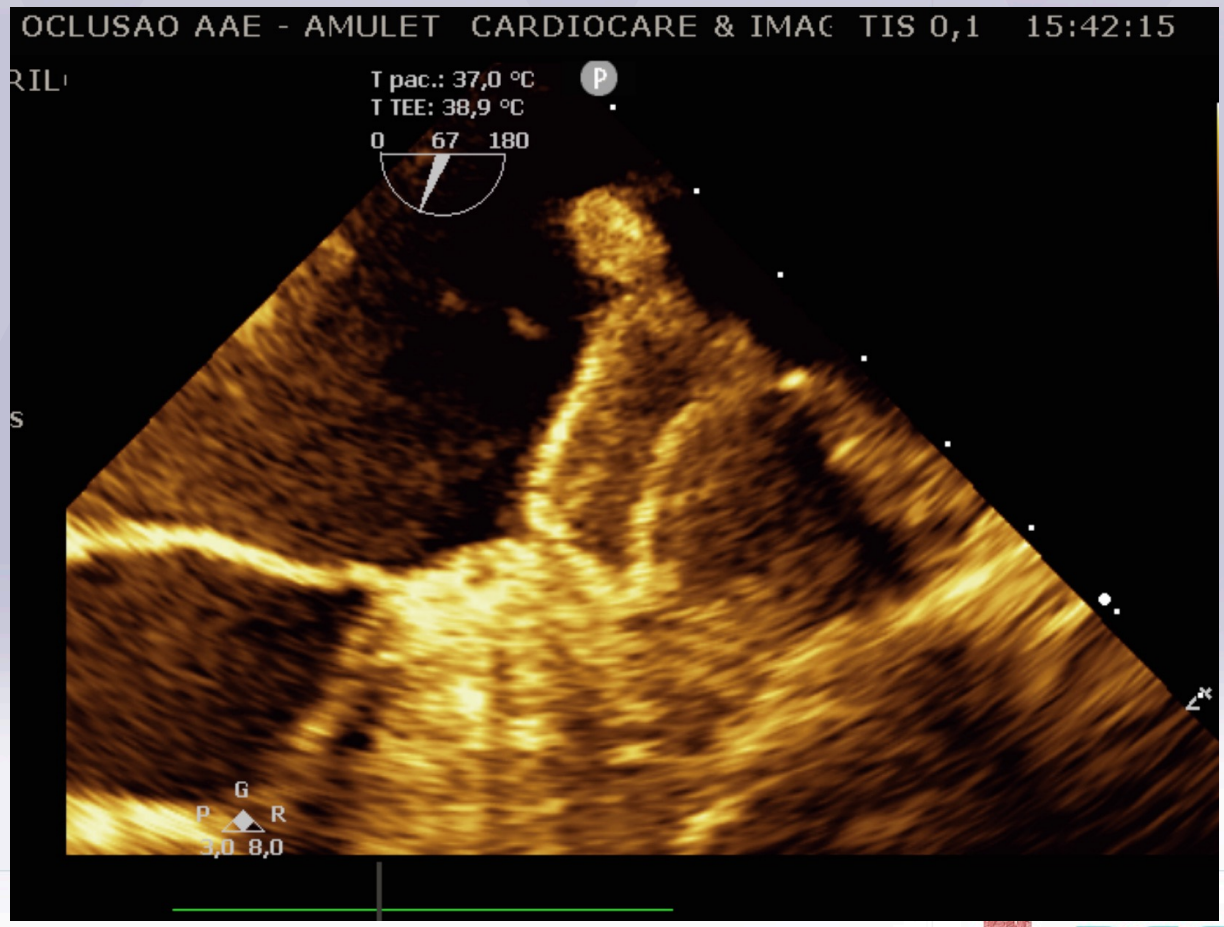




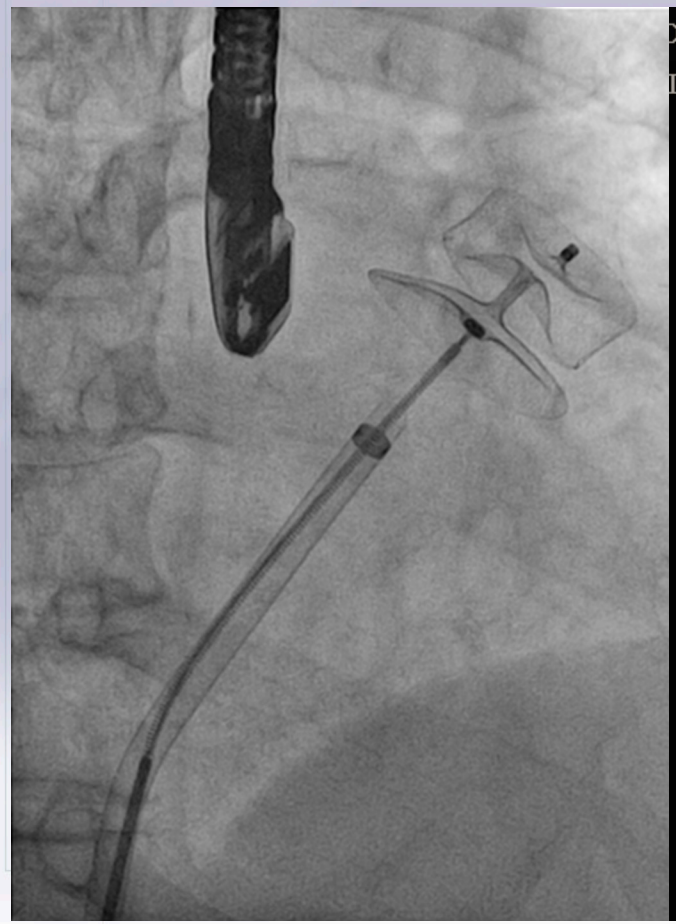
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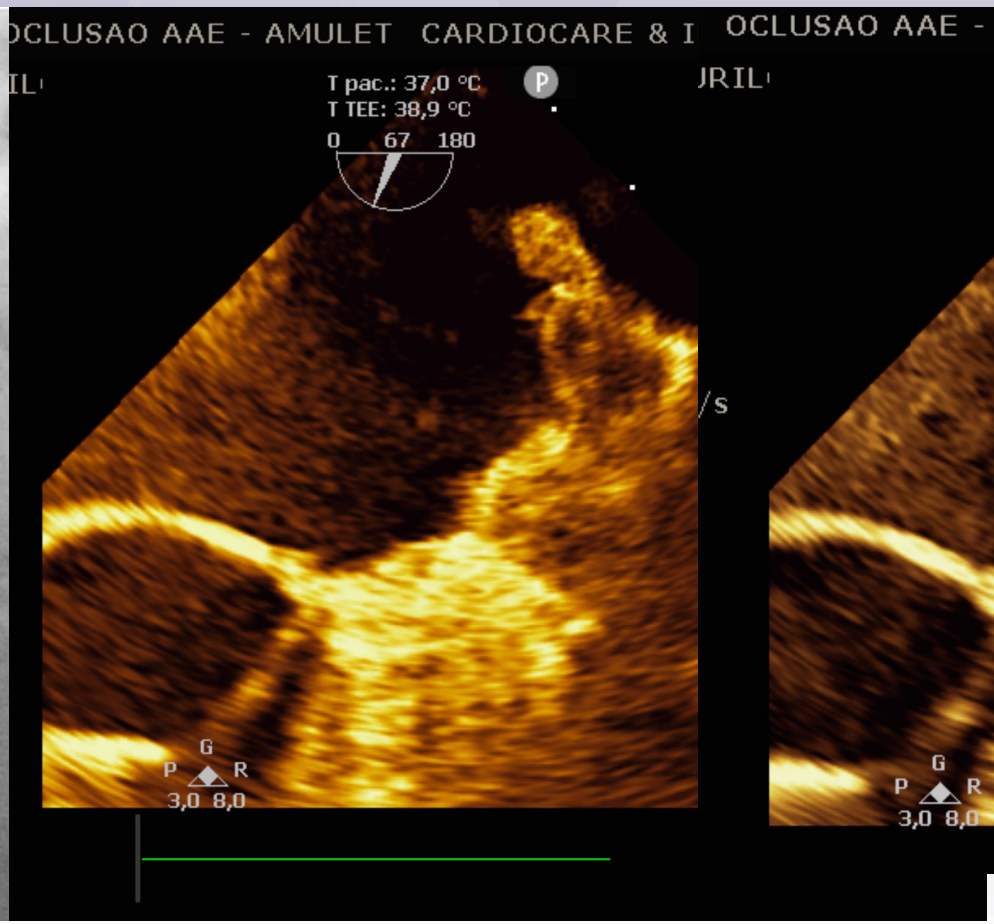
Lobe unfolded

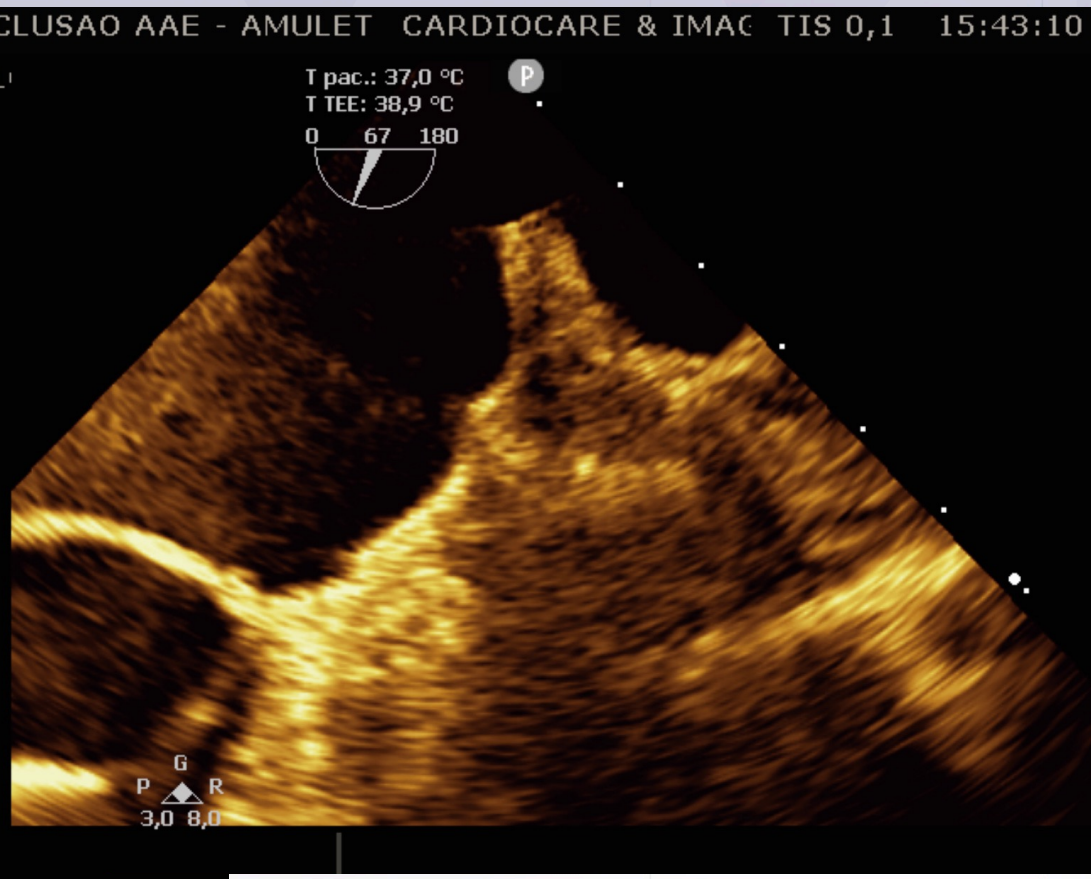




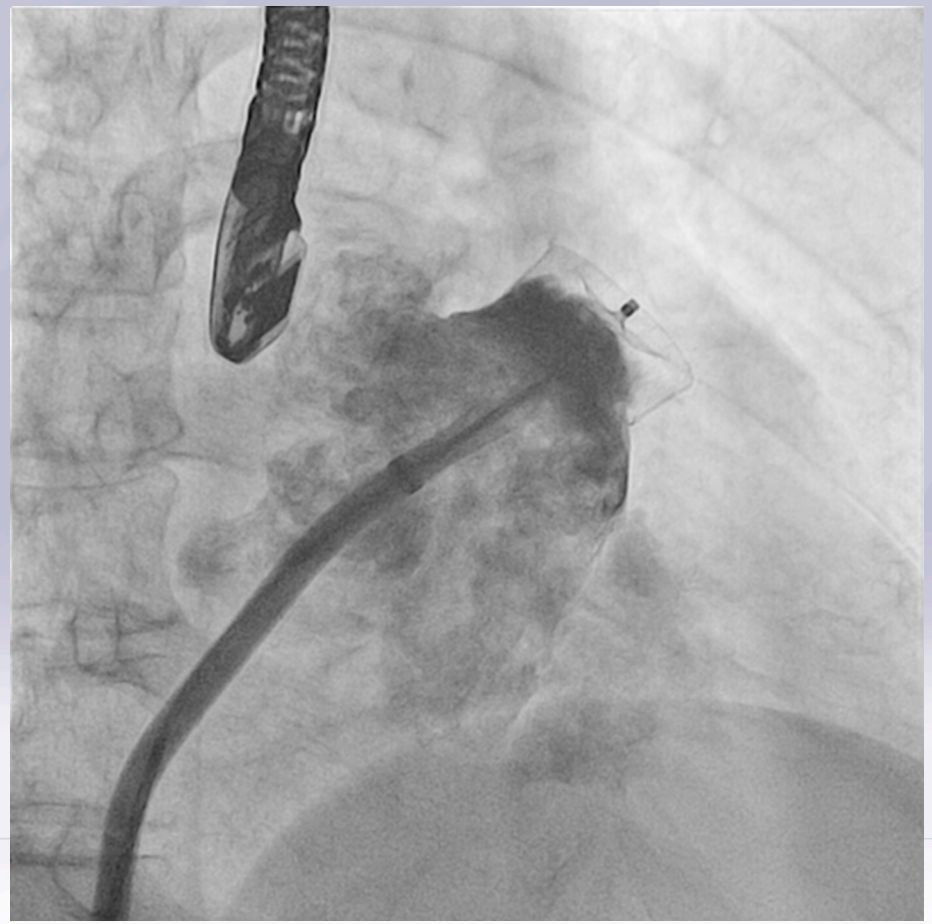
Disk unfolded

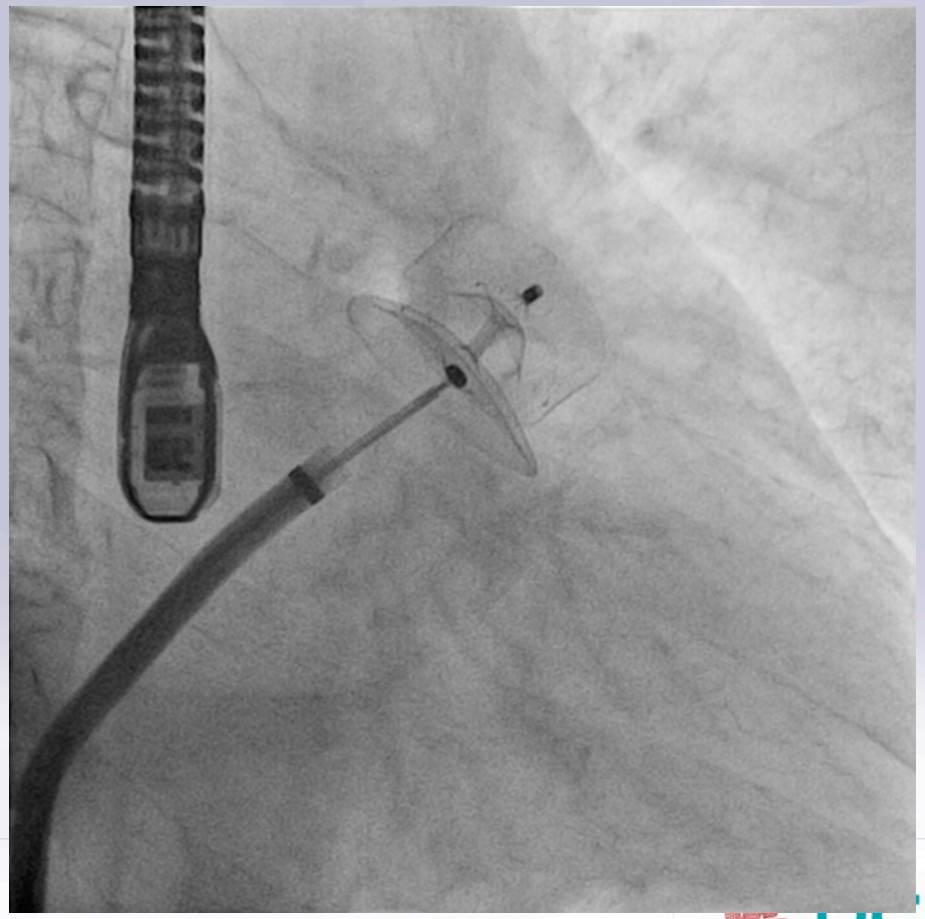






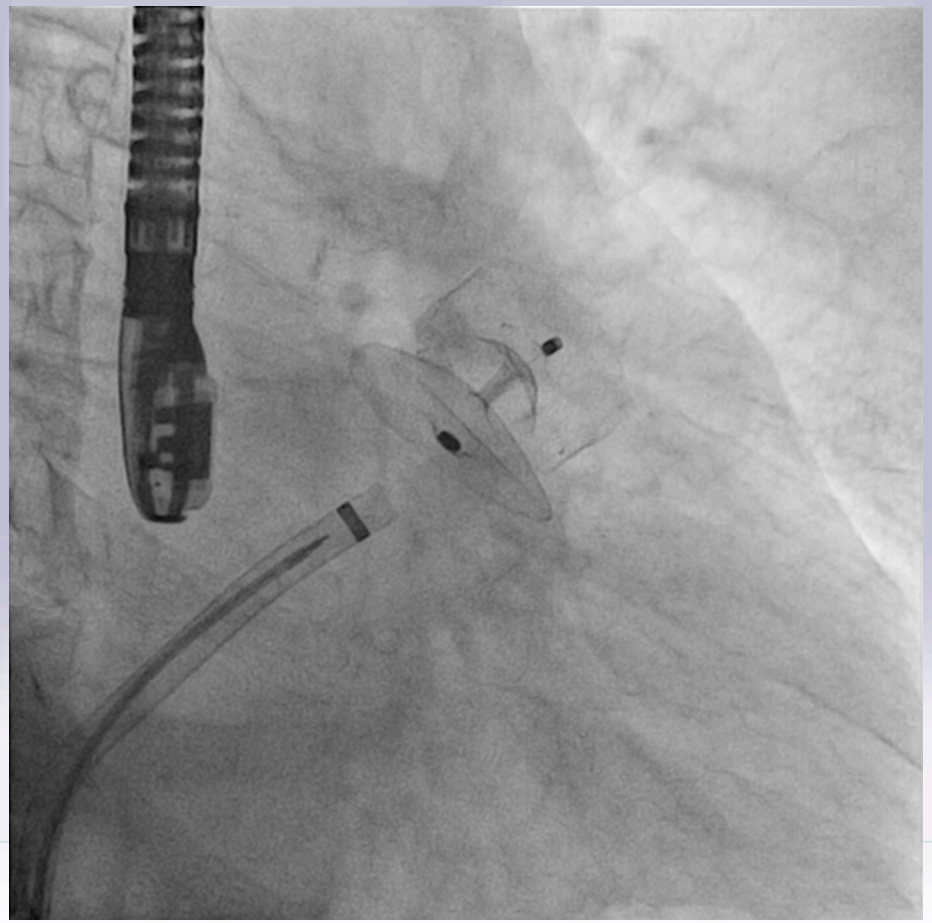
Control Angiography



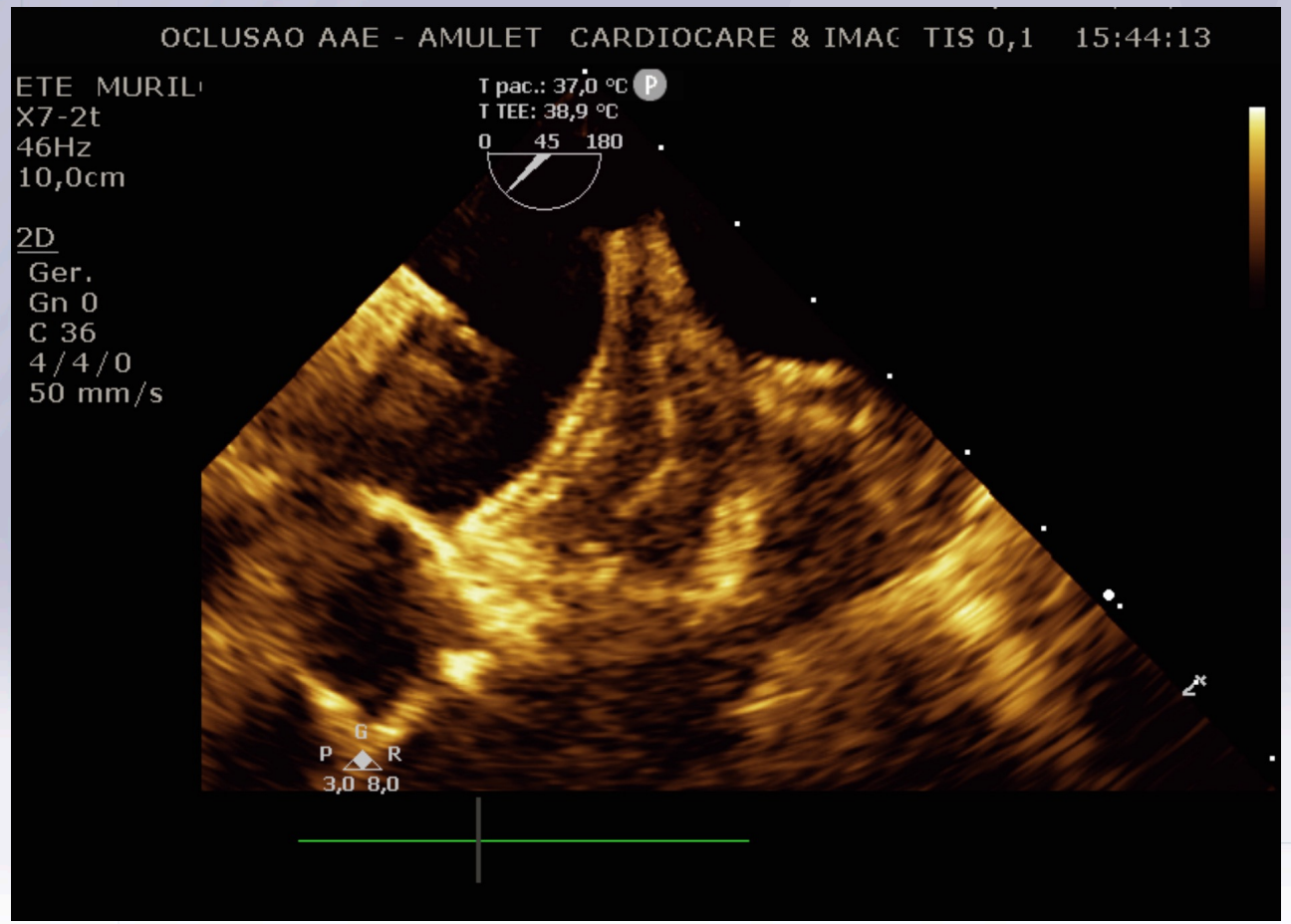


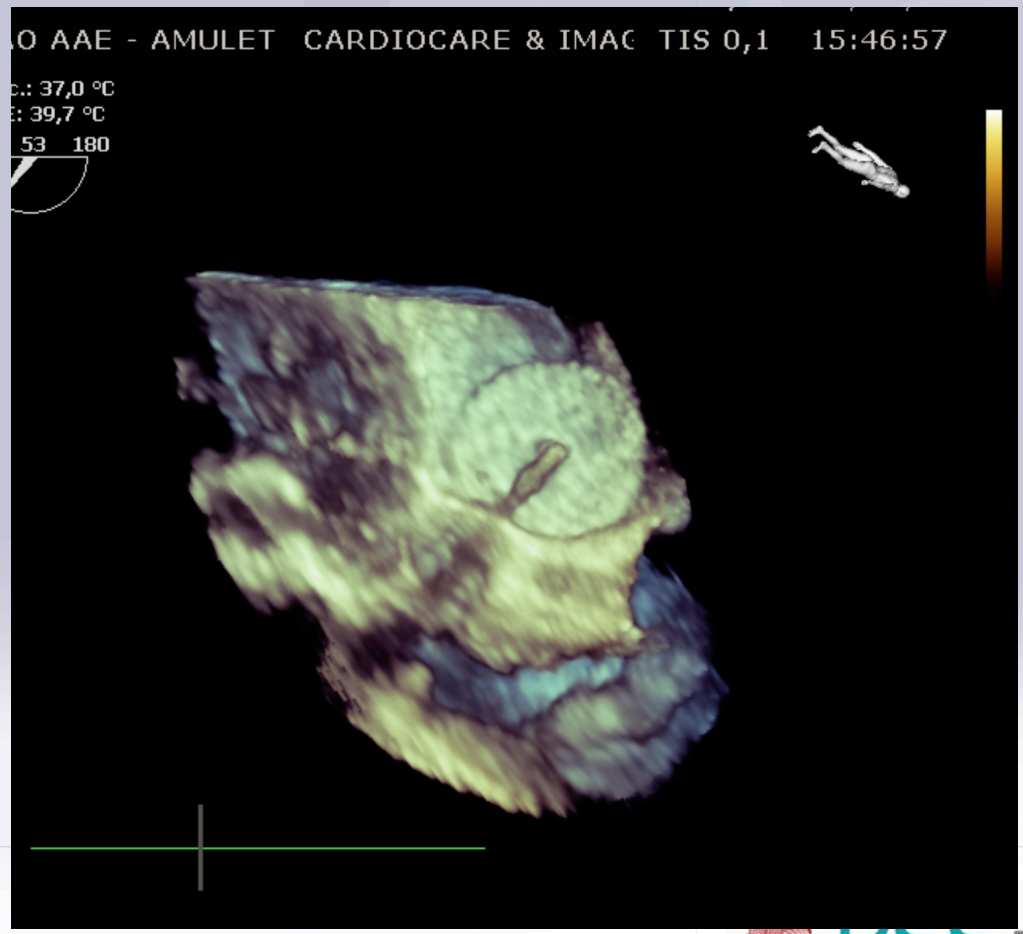
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TEE final

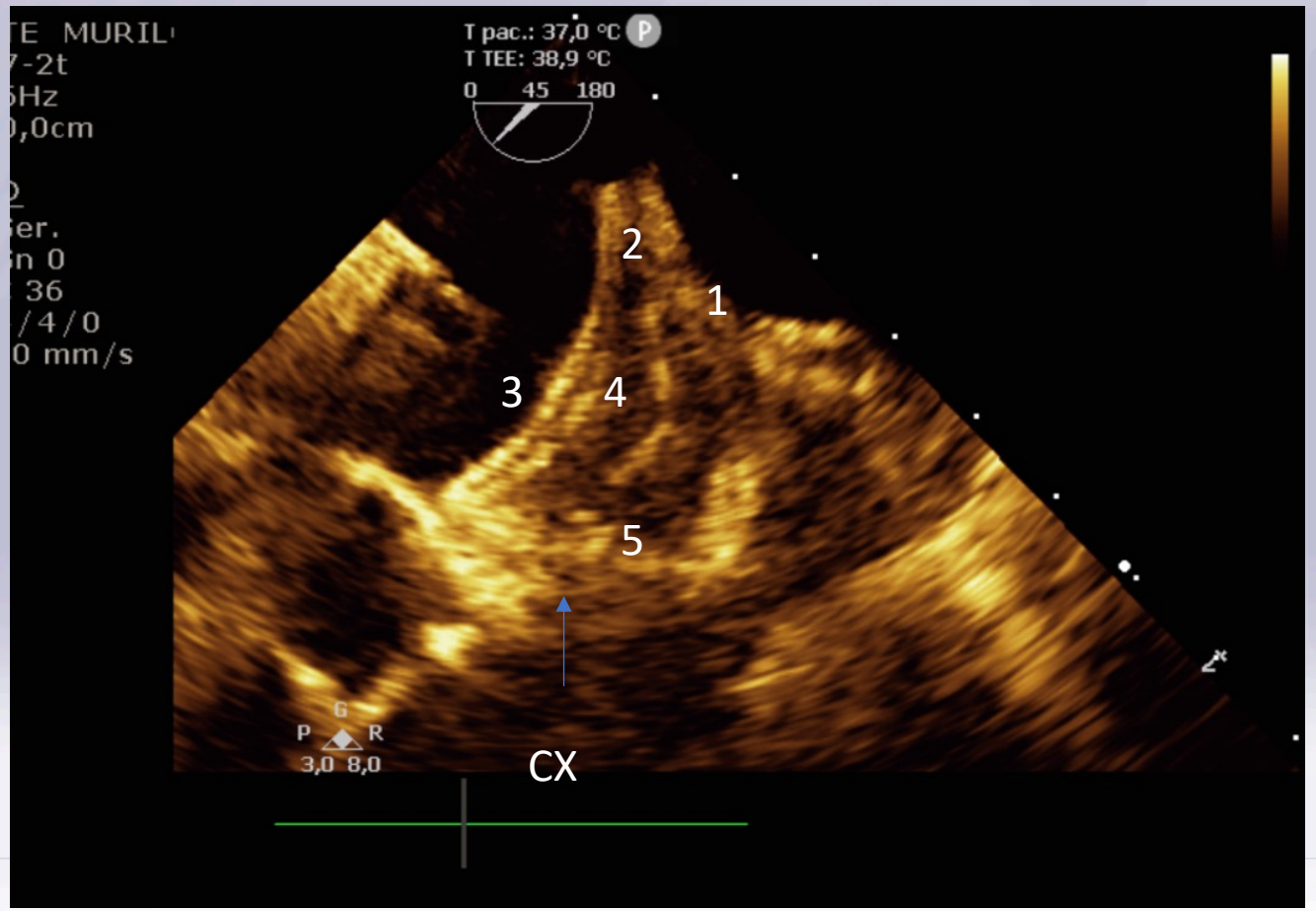


Controle ETE



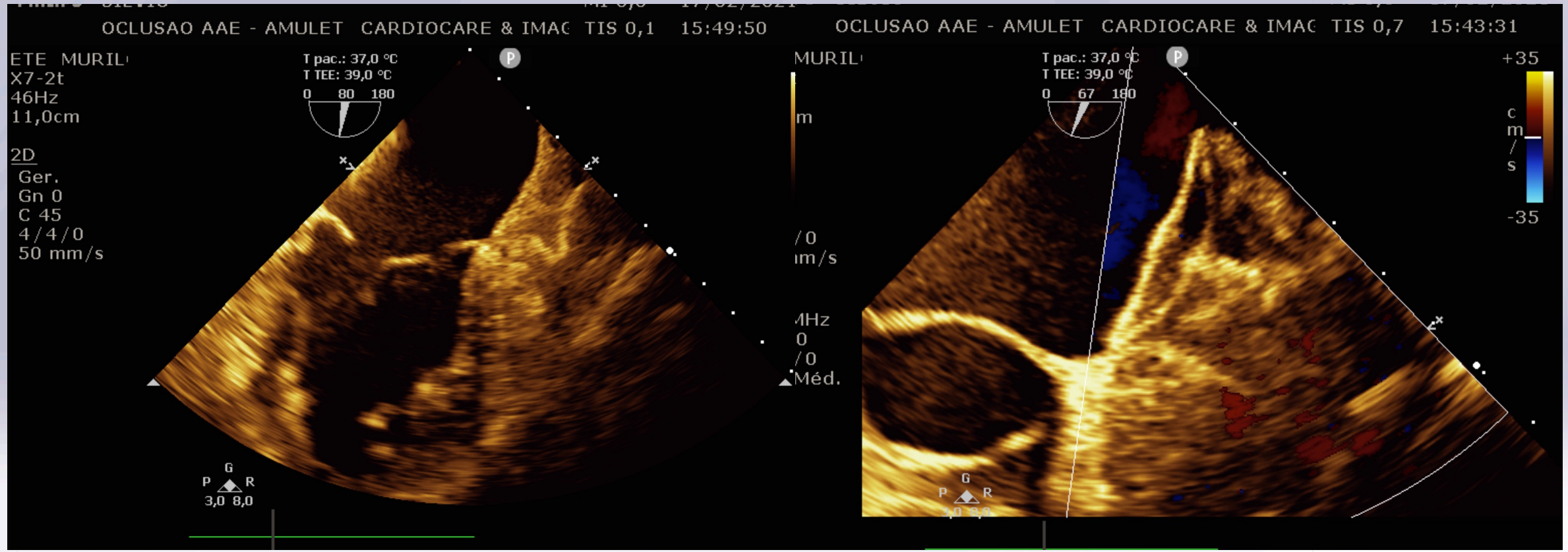


CLOSE



1. Tire-shaped lobe compression
2. Lobe orientation perpendicular to the LAA neck
3. Concave-shaped disk,
4. Separation between the lobe and the disk
5. Lobe should be ≥2/3 within the circumflex artery

Final ETE


OCLUSAO AAE - AMULET CARDIOCARE & IMAC TIS 0,1 15:49:50
ETE MURIL
X7-2t
46Hz
11,0cm
2D
Ger.
Gn 0
C 45
4/4/0
50 mm/s
T pac.: 37,0 °C
T TEE: 39,0 °C
0 80 180
MURIL
m
/0
m/s
MHz
0
/0
Méd.
G
P R
3,0 8,0
OCLUSAO AAE - AMULET CARDIOCARE & IMAC TIS 0,7 15:43:31
T pac.: 37,0 °C
T TEE: 39,0 °C
0 67 180
+35
cm/s
-35