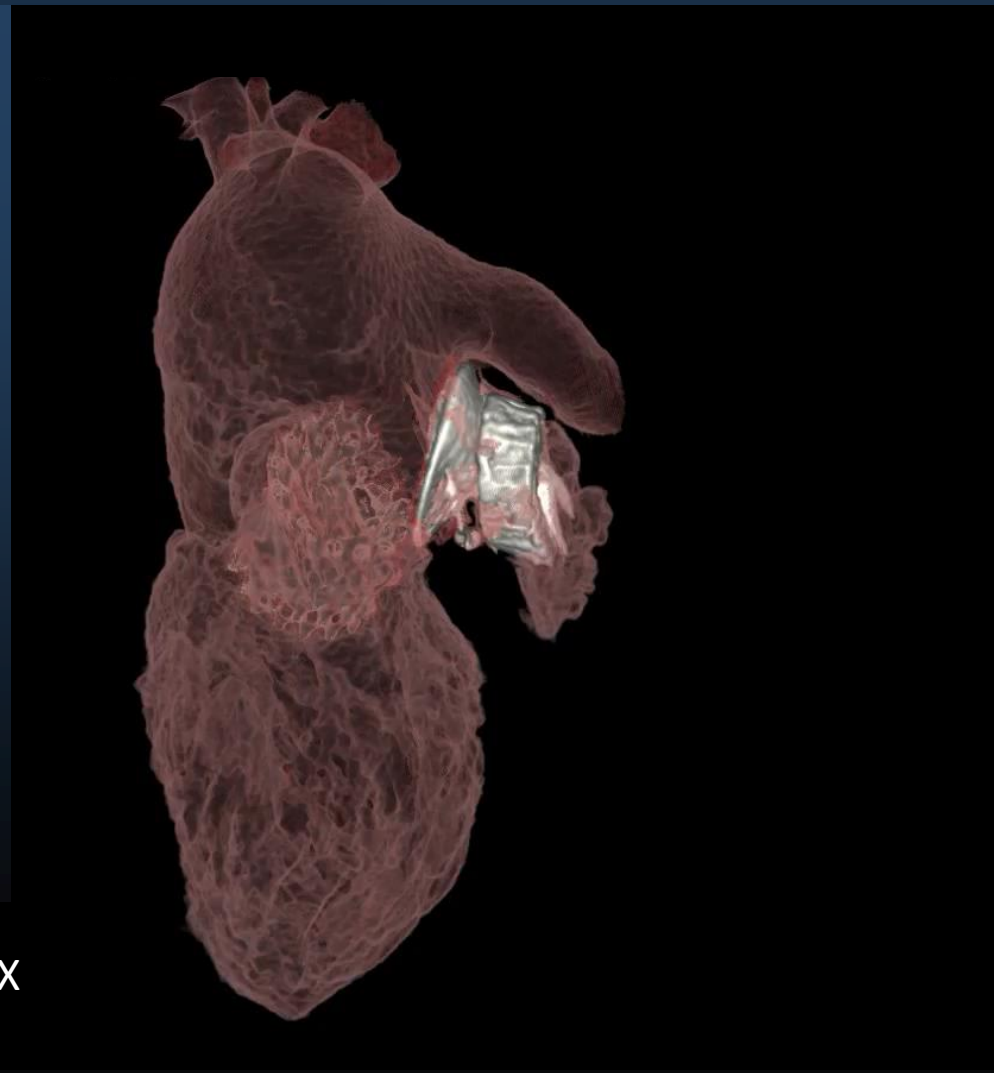
Role of cardiac CT in LAA closure



Dr J-L. SABLAYROLLES, Dr I. TIMOFEEVA, Dr L. MACRON, Dr J. FEIGNOUX

Centre Cardiologique du Nord (CCN). Saint-Denis. France

CTA : >18 years of experience CCN

2000
4 MDCT

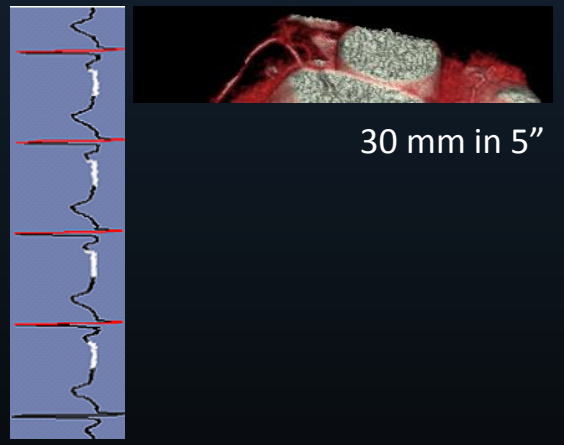
2003
16 MDCT

2004
LS VCT 64

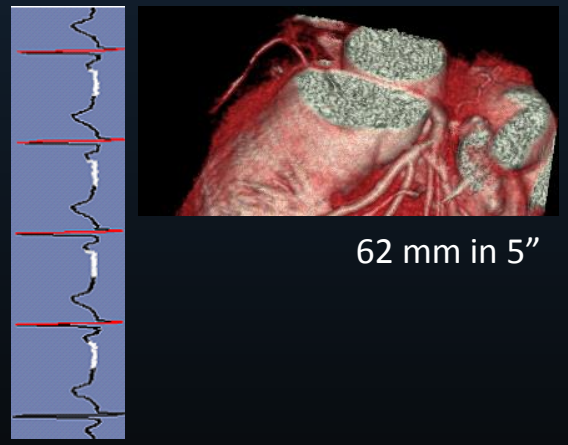
2010
Optima

2013
Discovery
750HD

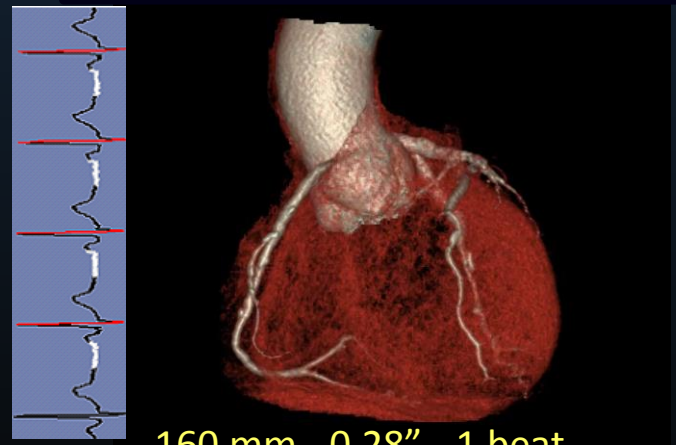
2014
Revolution
256 CT



30 mm in 5”



62 mm in 5”



160 mm - 0,28” - 1 beat

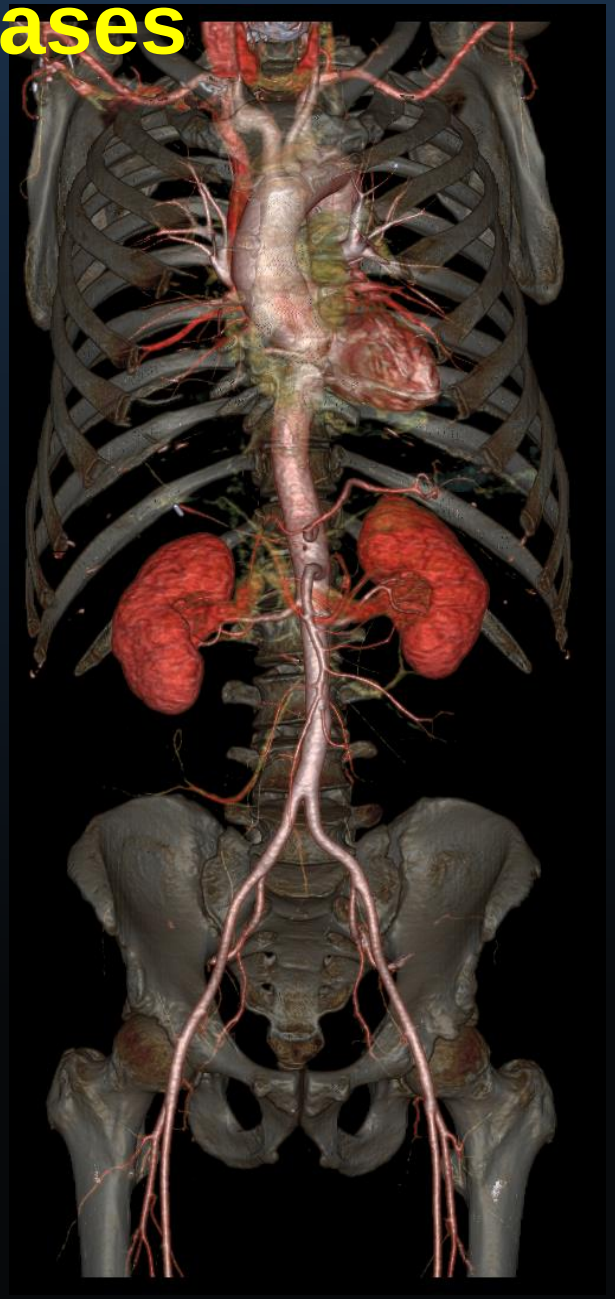
Coverage	10 мм	20 мм	160 мм
Rotation speed	0,5”	0,4”	0,28”
Type	helical	helical	axial
ECG synchro	retro	retro	prospective
ition time	40”	20”	1 heart beat
ess	2,5 мм	0,625 мм	0,625

Centre Cardiologique du Nord (CCN). Saint-Denis. France

CTA is a routine exam in cardiac diseases

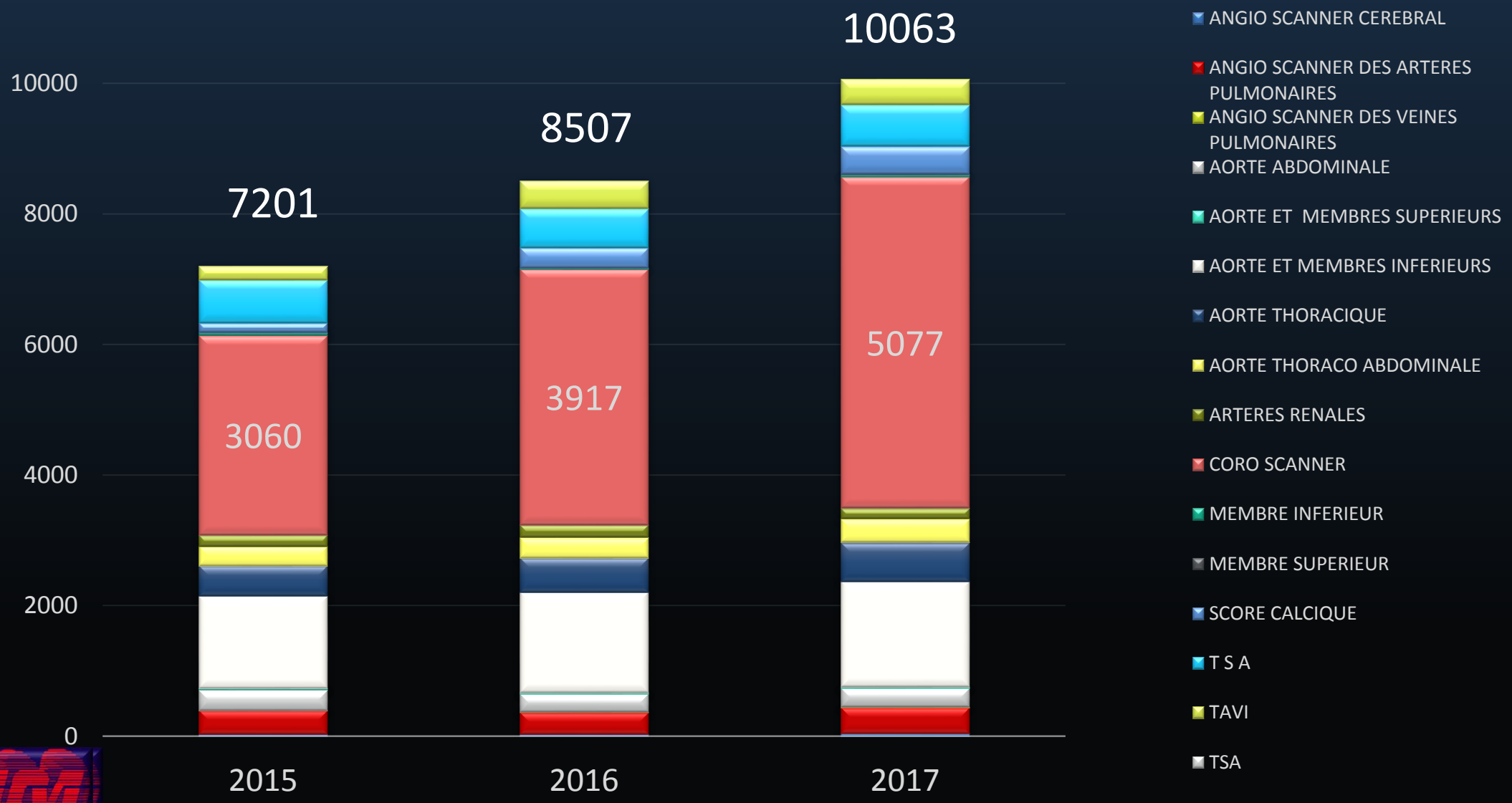
To provide an accurate diagnosis, we need:

- High image quality with robust & reliable technique
- Less radiation dose
- Excellent arterial iodine bolus, safe CM, precise & reliable injector
- Efficient post-processing (AW)
- Clinical Expertise



Centre Cardiologique du Nord (CCN). Saint-Denis. France

Revolution CT: High performance

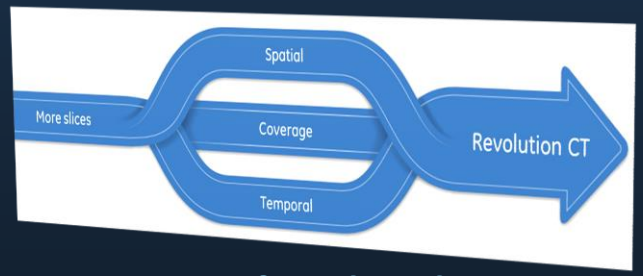


Centre Cardiologique du Nord (CCN). Saint-Denis. France

Clic – Clac acquisition since 2014 with Revolution CT

Acquisition

- 1-Beat acquisition for any patient, any heart rate
- Ultra-fast acquisition (0.28 sec) & real time reconstruction
- Perfect synchronization with injection – Pure arterial phase (smartprep)

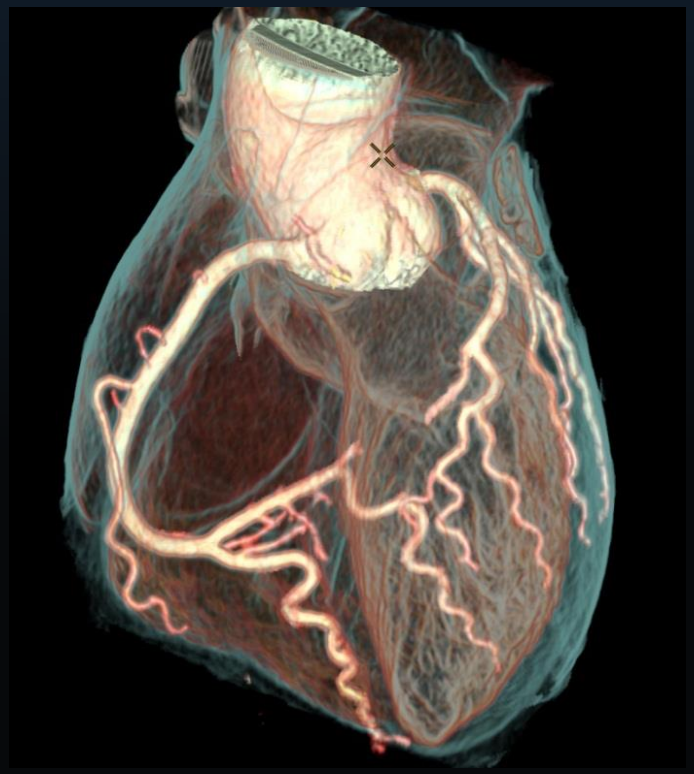


Convergence of technologies

160 mm in 0.28 sec – 1 beat

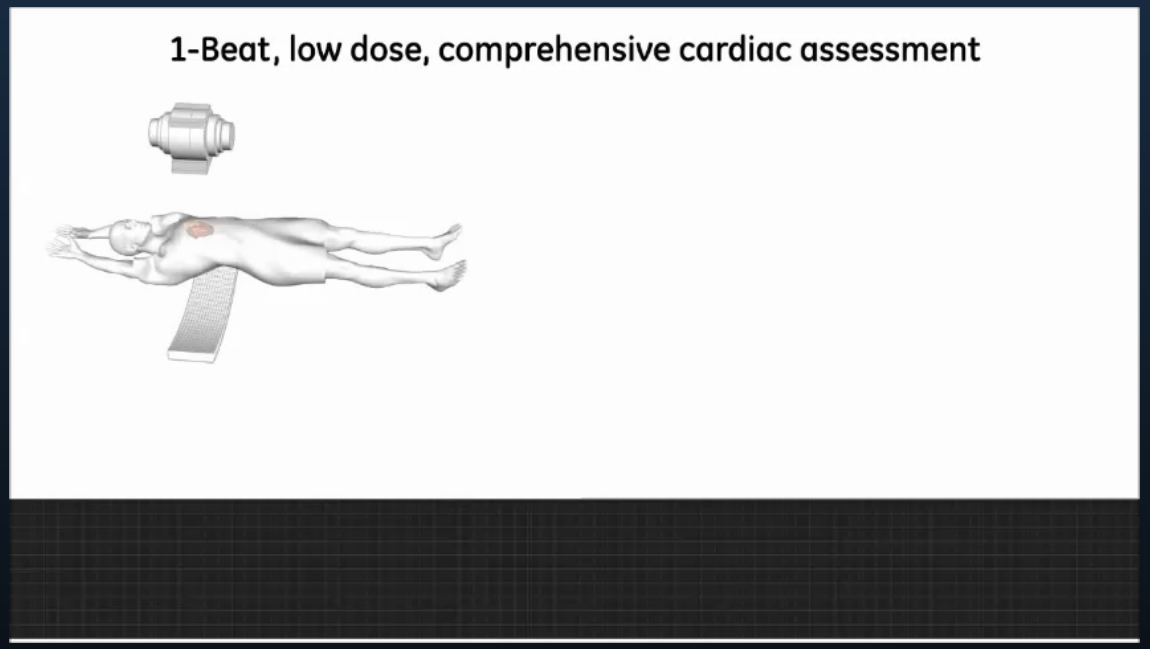
1-Beat Cardiac

- Robust & reliable technique for any patients
- Motion free images
- Autogating to manage arrythmia
- Lower dose & Excellent IQ (ASIR V + HD)
- Huge potential to reduce contrast media



Centre Cardiologique du Nord (CCN). Saint-Denis. France

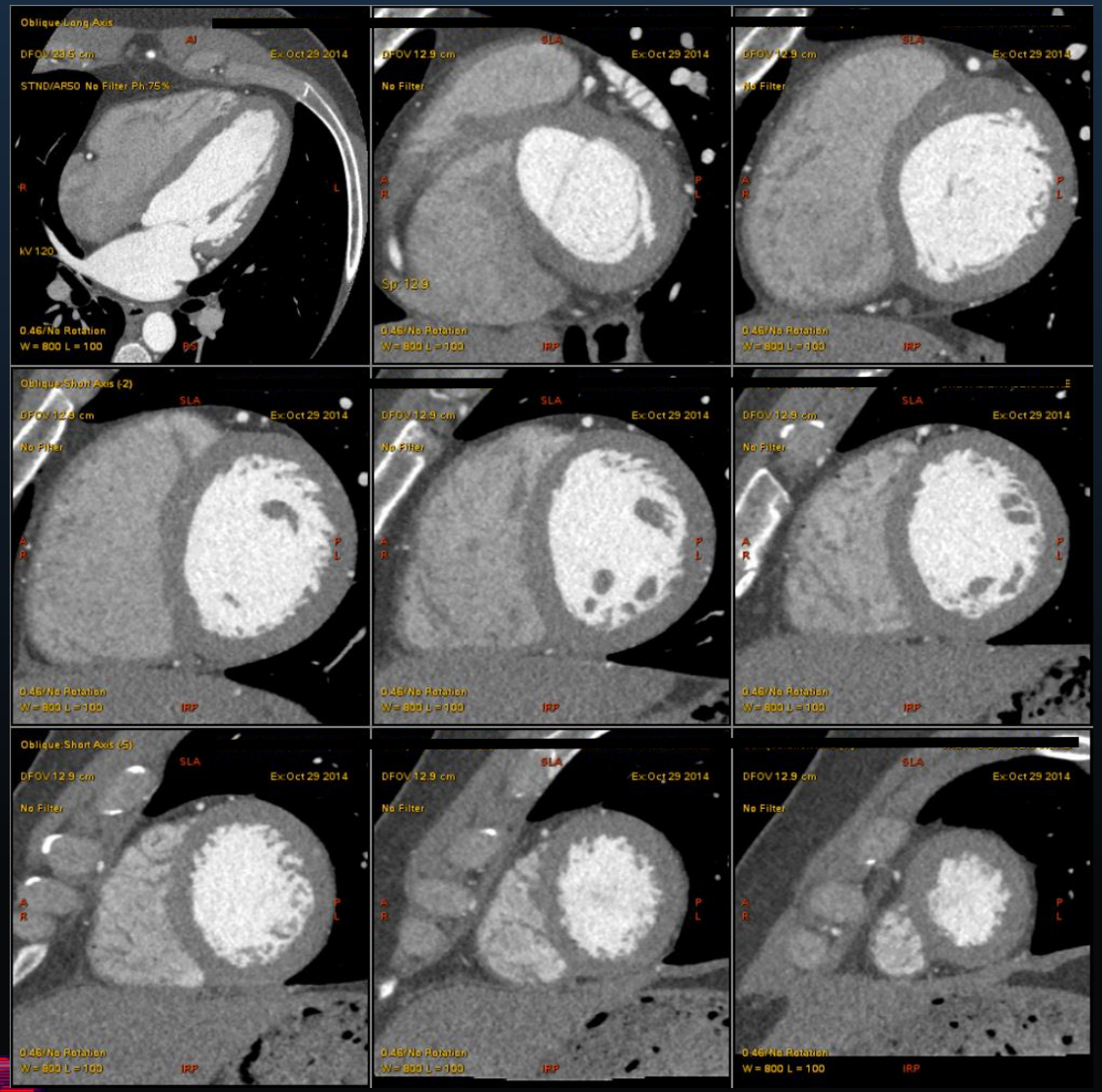
One beat acquisition: clic clac acquisition



- One phase or Multiple phases acquisition for high heart rate (systolic & diastolic) or multiple phases acquisition
- Pure arterial phase: smartprep
- More simple and reproducible
- Snapshot freeze (ex.85 bpm)
- Smartphase: automatical optimal phase

Centr . Saint-Denis. France

Homogeneous myocardium



Centre Cardiologique du Nord (CCN). Saint-Denis. France

In cardiac CTA, CM injection & synchronization injection/acquisition for pure arterial phase is critical

- Adapted volume contrast media & iodine concentration vs vascular territory & patient BMI
- Automatic injector with double chambers (Nemoto) for any application
- Smartprep for any application
- Tri phasic injection:

  CM : 50 cc – 5 ml/sec
  CM (50% dilution): 20 cc – 2.5 ml/sec
  Salin solution: 30 cc – 2.5 ml/sec

Centre Cardiologique du Nord (CCN). Saint-Denis. France

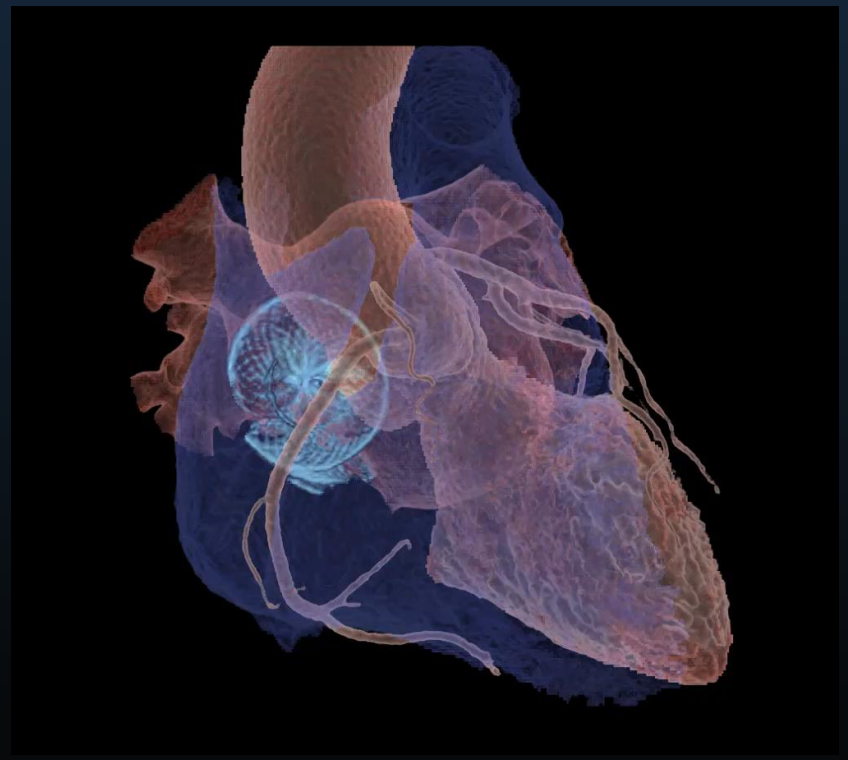
In cardiac imaging, after 4 years' experience of Revolution CT using, thanks to the One Beat acquisition technique

-Cardiac CT became a robust and reliable technique with the best quality and very low irradiation dose.

-Cardiac CT asserts itself as a routine exam of the first intention (first line) for coronary lesion detection.
+++ in emergency

-Cardiac CT expands the range of its indications in cardiology and opens new horizons to study myocardium perfusionthe heart structures as cavities, valves, aortic root and heart valve prosthesis by using new applications.

-Thus, the Cardiac CT is not only gatekeeper to the coronarography, but also a guide and a tool of monitoring before/after surgery and endovascular procedures.

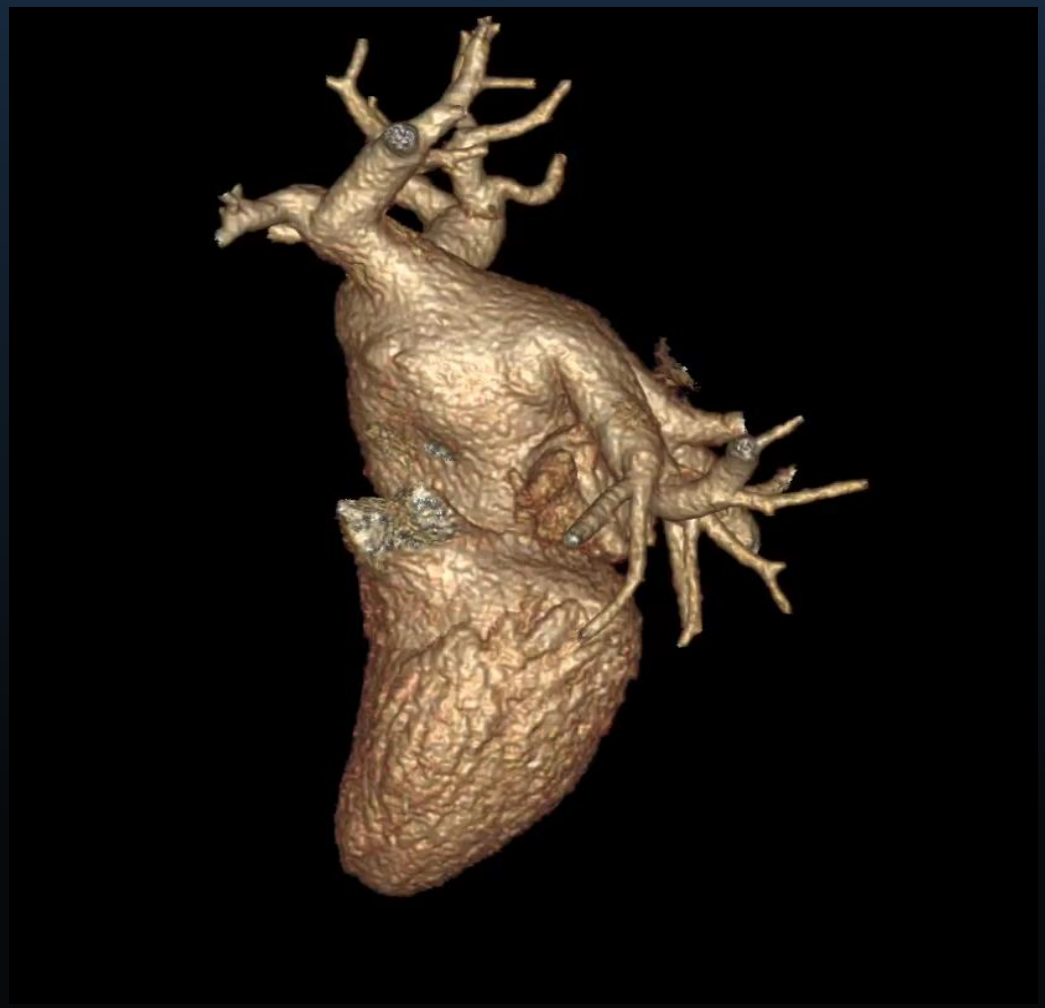


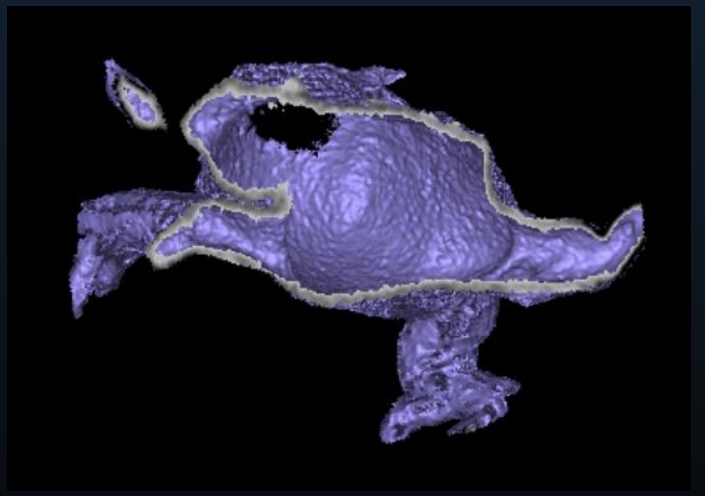
Centre Cardiologique du Nord (CCN). Saint-Denis. France

Real place of CT in AF: pre-procedural planning

Ablation planning

LAA closure planning





Acquisition

High resolution mode
ECG-gated axial one-beat acquisition
100 kV
HR 92 bpm

Injection

Nemoto double chamber injector
Smartprep

Omnipaque 350	Volume, cc	Speed, ml/sec
Contrast media	60	5,0
CM (50% dilution)	14	2,0
Salin solution	20	2,5

Centre Cardiologique du Nord (CCN). Saint-Denis. France

II Late acquisition: Thrombus

Arterial Phase

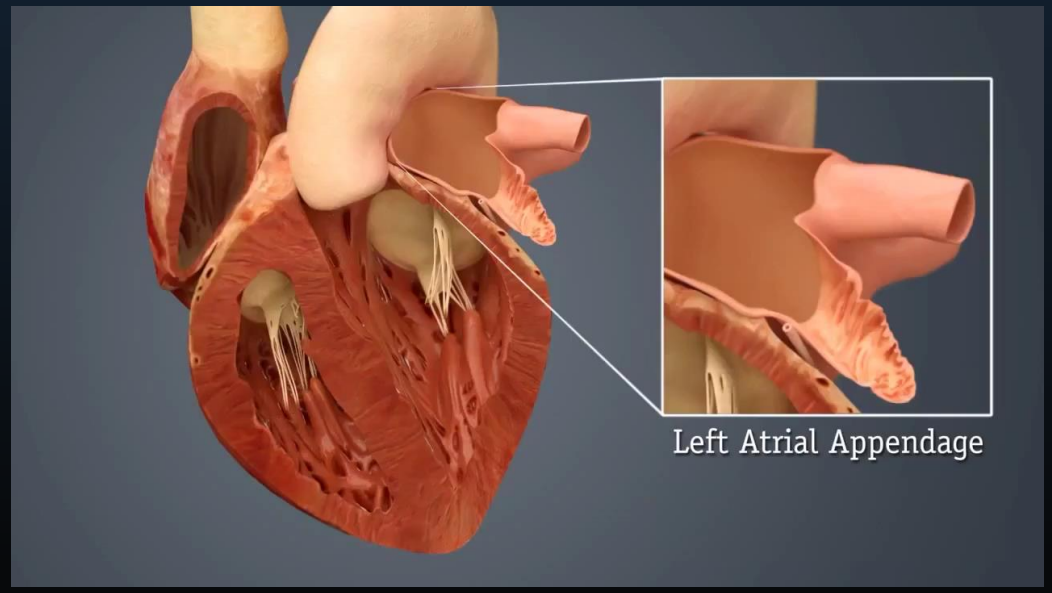
Late Phase

Centre Cardiologique du Nord (CCN). Saint-Denis. France

Indications for LAA occlusion: stroke prevention

High thrombo-embolic risk (CHA2DS2-VASc ≥ 2) + contraindications to OAC

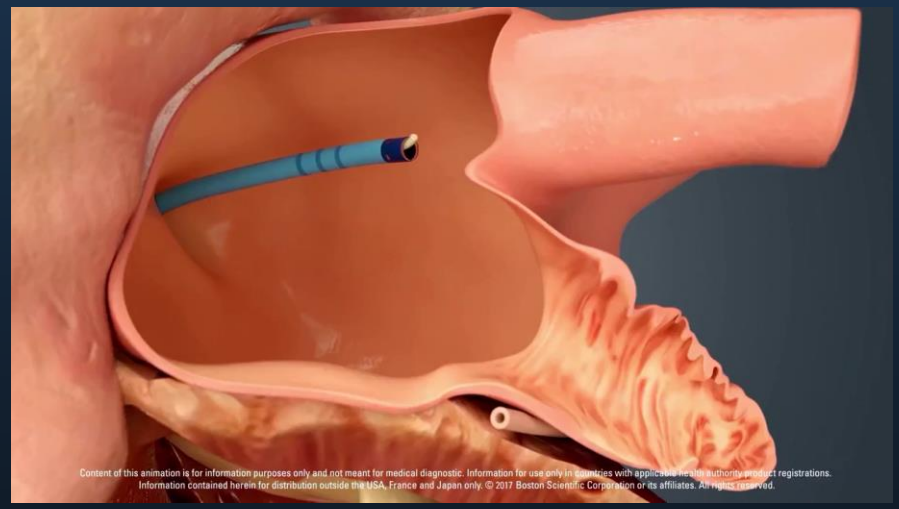
- History of bleeding on OAC therapy
- High bleeding risk
- Contraindications to OAC
- Poor patients compliance



Left atrial appendage occluder implantation in Europe: indications and anticoagulation post-implantation. Results of the European Heart Rhythm Association Survey
Europace (2017) 0, 1–6 EP WIRE doi:10.1093/europace/eux254

Centre Cardiologique du Nord (CCN). Saint-Denis. France

Left atrial appendage (LAA)



Variable size and shape:

- 48% Chicken wing
- 30% Cactus
- 19% Windsock
- 3% Cauliflower

Effective contractions during sinus rhythm

No contractions during AF

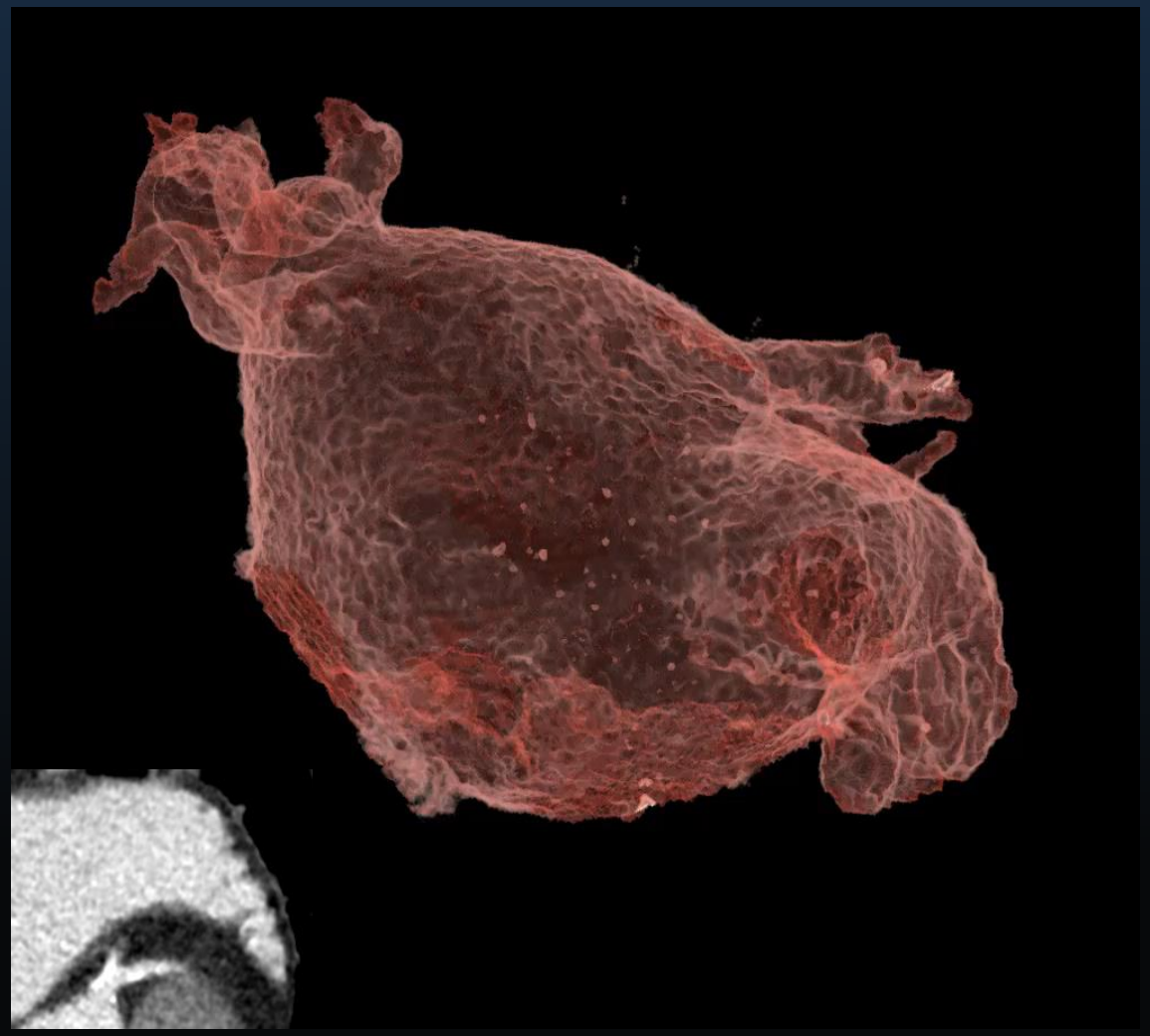
90% of LA thrombi localized in the LAA

Centre Cardiologique du Nord (CCN). Saint-Denis. France

Cardiac CT: pre-procedural planning

Essential: LAA anatomy

- Type
- Sizes
- Orientation
- Thrombus
- Relationship to others structures



Centre Cardiologique du Nord (CCN). Saint-Denis. France

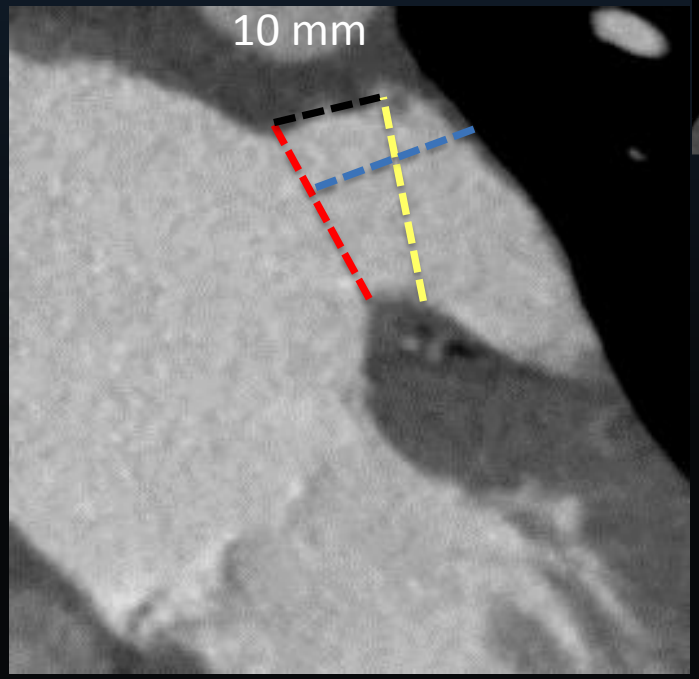
Pre-procedural LAA assessment and sizing

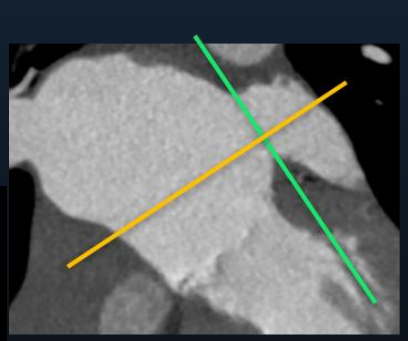
3D & 2D reconstruction

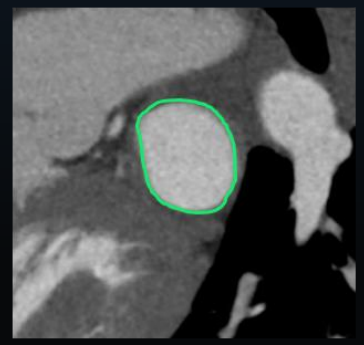
end-diastolic phase

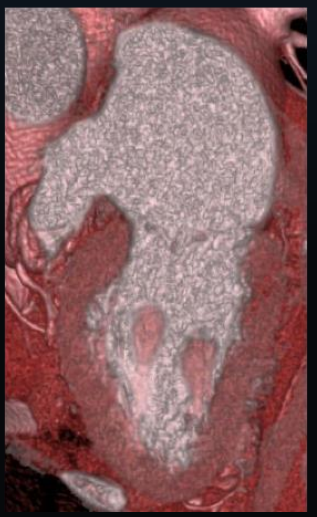
LAA anatomy in 3 planes (sagittal, coronal and axial) locked at 90°

- 4 types of LAA morphology
- LAA ostium
- LAA landing zone
- maximal diameter
- minimal diameter
- perimeter-derived mean diameter



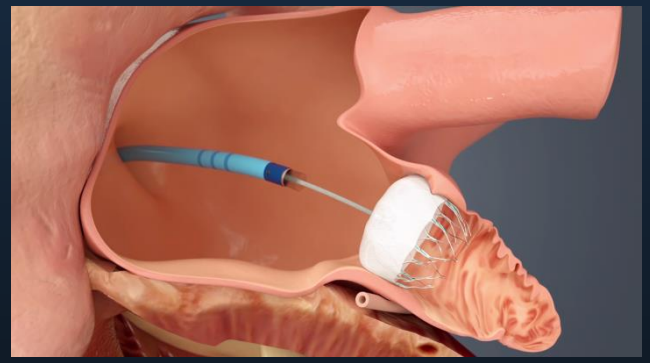






Centre Cardiologique du Nord (CCN). Saint-Denis. France

Types of LAA devices



WATCHMAN

AMPLATZER Amulet

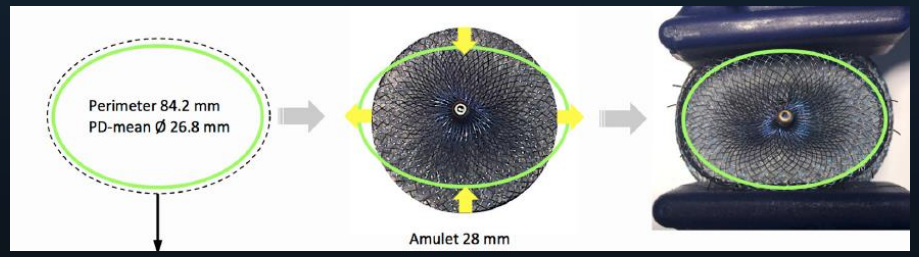
COHEREX WaveCrest

PLAATO

Pre-procedural LAA assessment and sizing

Design of the closure device

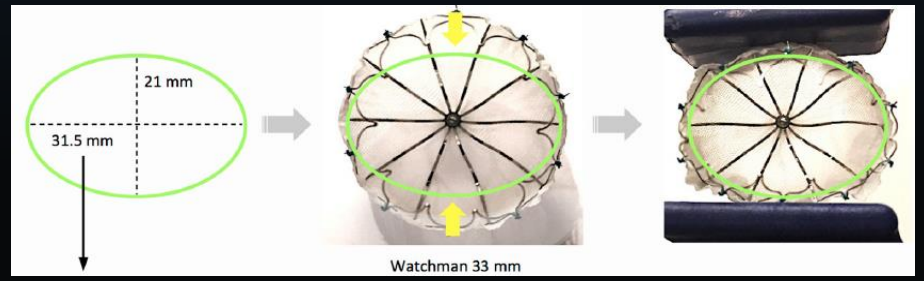
'Closed distal end' device will expand in a perpendicular plane to the short axis



Amulet ™

second generation of Amplatzer Cardiac Plug (ACP)

'Open distal end' device will not expand



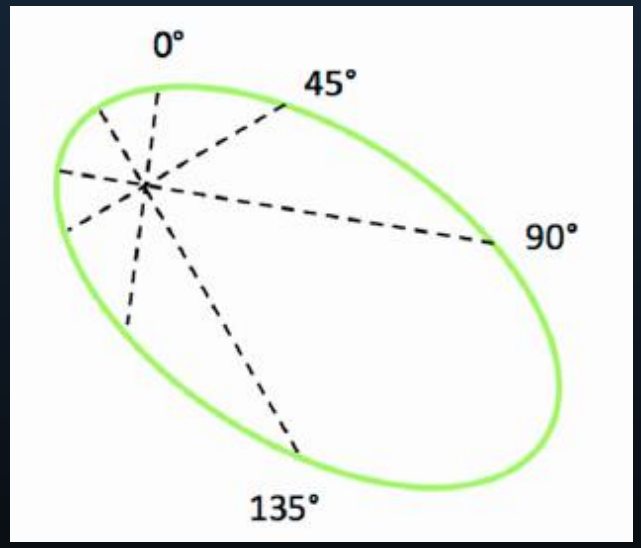
Watchman ™

Centre Cardiologique du Nord (CCN). Saint-Denis. France

Open Heart: first published as 10.1136/openhrt-2017-000627 on 30 June 2017

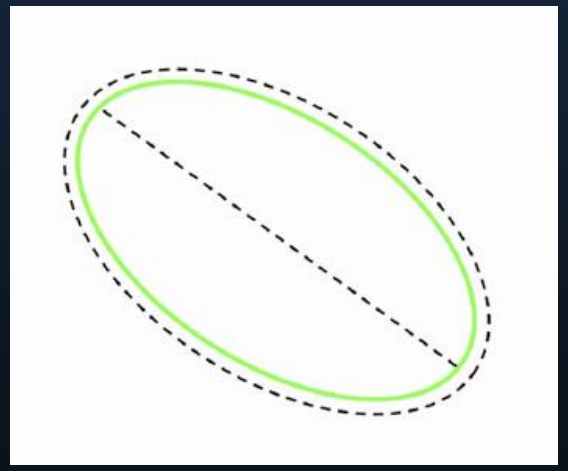
LAA sizing: TEE vs CT

TEE –based sizing



Measured max LAA diameter << Actual max diameter

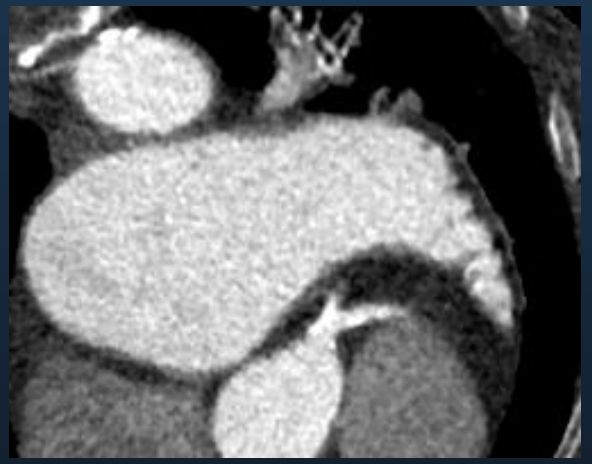
CT –based sizing



Accurate measurement of:

- Perimeter-derived mean diameter
- Maximal diameter

LAA closure: good result

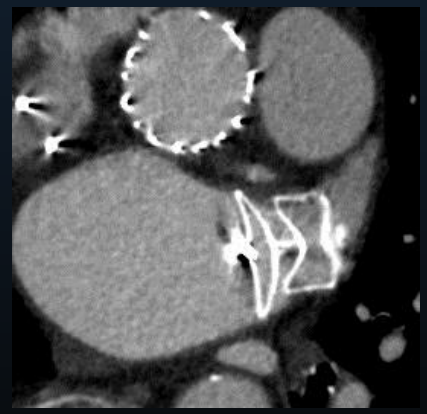


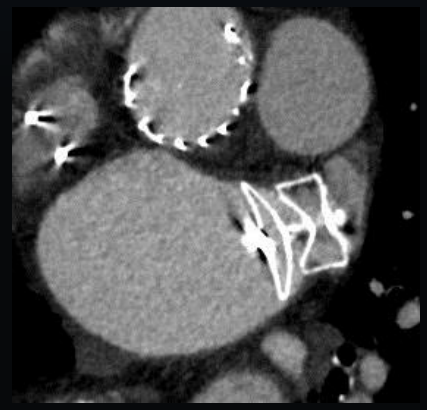
- ✓ No atrial-side device thrombus
- ✓ No residual leak
- ✓ Good device embolization
- ✓ Good device positioning
- ✓ No pericardial effusion

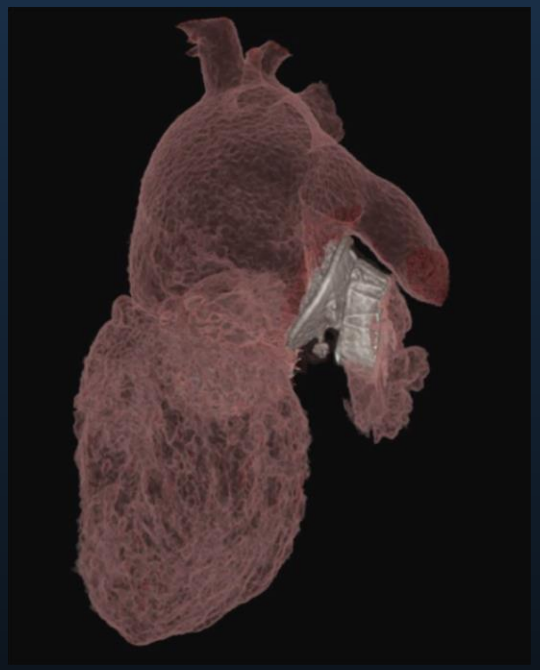
Centre Cardiologique du Nord (CCN). Saint-Denis. France

Unsuccessful LAA closure

- ✓ No atrial-side device thrombus
- x Residual leak
- ✓ Good device embolization ???
- x Poor alignement
- ✓ No pericardial effusion



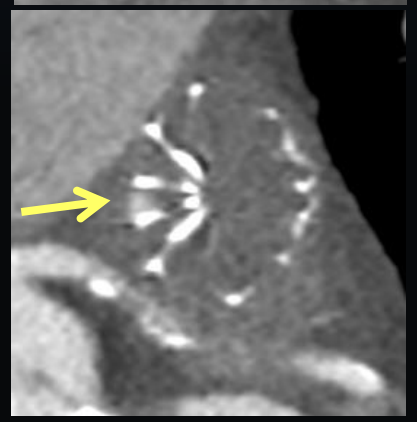




Centre Cardiologique du Nord (CCN). Saint-Denis. France


PM:112
0 L 49RA
VOI
120
6mm/0.62sp
112
1L 82RA

Leakage




BPM:112
R
P
0.42
kV 120
0.6mm/0.62sp

Unsuccessful LAA closure: thrombus

Atrial-side device thrombus on a

WATCHMAN device

- at the fabric insert (white arrow)
- adjacent to the device (black arrow)

Eur Heart J Cardiovasc Imaging. 2015 Nov; 16(11): 1198–1206. PMCID: PMC4609159 PMID: 25851318

Centre Cardiologique du Nord (CCN). Saint-Denis. France

LAA Closure CT pre-procedural planning: take home messages

- **Mature technique**:

  Less radiation dose,
  Available for any patient
  Simple, reliable & accurate

- **Cardiac CT**= guide for endovascular procedure like LLA Closure
  - More accurate than conventional TEE-based sizing
  - optimal choice of device
  - prevent complications