How to Build a Successful Cardiac CT Program

Sujith Kalathiveetil MD, FACC
Director of Imaging, Section of Cardiology
Duly Health and Care

duly
HEALTH AND CARE

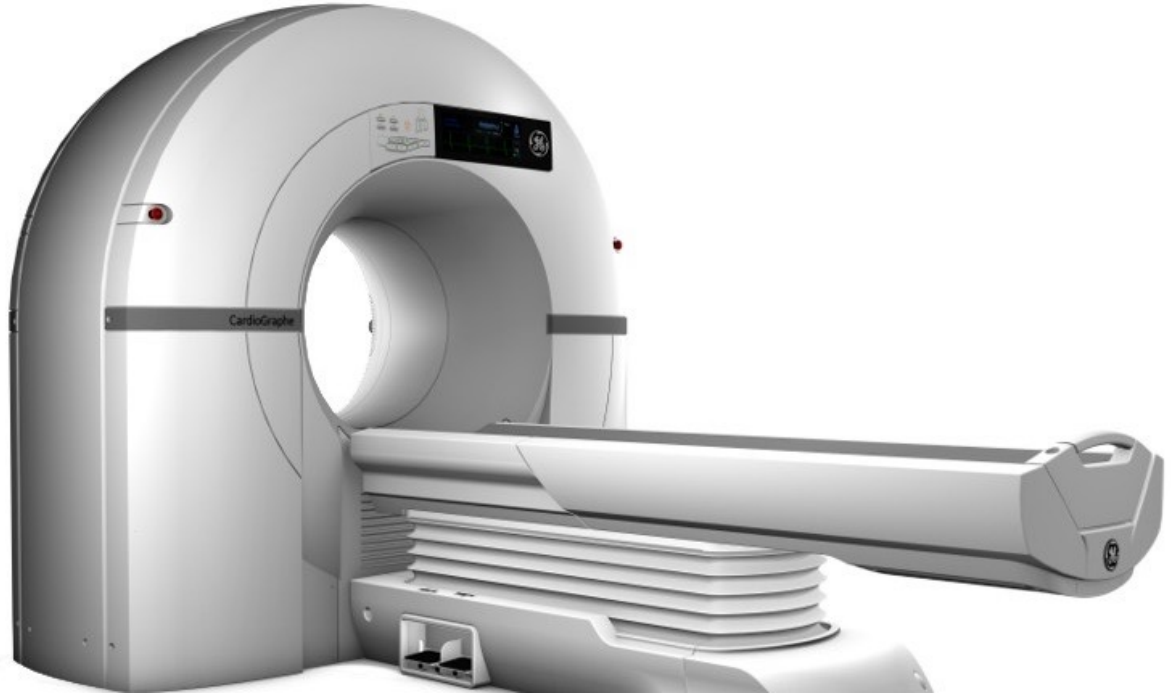
Duly Health and Care

- Private multispecialty practice of ~1000 physicians; 45 cardiologists
- Range of services across primary and specialty care, serving over two-thirds of Chicagoland suburbs
- Duly core philosophy: provide high quality care that is outpatient based and cost-effective (sizeable Medicare Advantage population)

duly HEALTH AND CARE

Introduction

- Cardiac CT is a vital tool in the contemporary management of heart disease
- CT scanners are generally expensive; historically owned by hospitals
- CardioGraphe™ scanner allowed us to bring cost-efficient, high quality, cardiac CT into our outpatient-focused independent practice



duly
HEALTH AND CARE

Introduction

- Two keys for building our cardiac CT program
  1. CT first strategy for evaluating chest pain
  2. CT first strategy managing structural heart disease

duly HEALTH AND CARE

Chest Pain

- Chest pain is a unique problem for an outpatient-based practice
  - Triage nurses reflexively sent all patients with chest pain to local ERs where they were typically admitted for inpatient evaluation
  - Many of these patients did not have life-threatening chest pain; hospital admission unnecessary

duly HEALTH AND CARE

Chest Pain

- Duly created a **Cardiac Evaluation Center (CEC)** for patients with non-life-threatening cardiac symptoms (including chest pain) to provide:
  - Rapid evaluation
  - Onsite testing
- By providing expedited outpatient evaluation, our goals were to:
  - Reduce healthcare costs and
  - Provide greater patient satisfaction

duly HEALTH AND CARE

JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY
© 2021 BY THE AMERICAN HEART ASSOCIATION, INC.,
AND THE AMERICAN COLLEGE OF CARDIOLOGY FOUNDATION.
PUBLISHED BY ELSEVIER

VOL. 78, NO. 22, 2021

CLINICAL PRACTICE GUIDELINE: FULL TEXT

2021 AHA/ACC/ASE/CHEST/SAEM/SCCT/SCMR Guideline for the Evaluation and Diagnosis of Chest Pain

A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines

Writing Committee Members*

Martha Gulati, MD, MS, FACC, FAHA, *Chair*†
Phillip D. Levy, MD, MPH, FACC, FAHA, *Vice Chair*†
Debabrata Mukherjee, MD, MS, FACC, FAHA, *Vice Chair*†

Ezra Amsterdam, MD, FACC†
Deepak L. Bhatt, MD, MPH, FACC, FAHA†
Kim K. Birtcher, MS, PharmD, AACC‡
Ron Blankstein, MD, FACC, MSCCT§
Jack Boyd, MD†
Renee P. Bullock-Palmer, MD, FACC, FAHA, FASE, FSCCT†
Theresa Conejo, RN, BSN, FAHA‖
Deborah B. Diercks, MD, MSc, FACC¶
Federico Gentile, MD, FACC#
John P. Greenwood, MBChB, PhD, FSCMR, FACC**
Erik P. Hess, MD, MSc†
Steven M. Hollenberg, MD, FACC, FAHA, FCCP††
Wael A. Jaber, MD, FACC, FASE‡‡
Hani Jneid, MD, FACC, FAHA§§
José A. Joglar, MD, FAHA, FACC‡
David A. Morrow, MD, MPH, FACC, FAHA†
Robert E. O'Connor, MD, MPH, FAHA†
Michael A. Ross, MD, FACC†
Leslee J. Shaw, PhD, FACC, FAHA, MSCCT†

*Writing committee members are required to recuse themselves from voting on sections to which their specific relationships with industry may apply; see Appendix 1 for detailed information.
†ACC/AHA Representative.
‡ACC/AHA Joint Committee on Clinical Practice Guidelines Liaison.
§Society of Cardiovascular Computed Tomography Representative.
‖Lay Patient Representative.
¶Society for Academic Emergency Medicine Representative.
#Former ACC/AHA Joint Committee member; current member during the writing effort.
**Society for Cardiovascular Magnetic Resonance Representative.
††American College of Chest Physicians Representative.
‡‡American Society of Echocardiography Representative.
§§Task Force on Performance Measures, Liaison.

duly HEALTH AND CARE

Cardiac Evaluation Center (CEC)

- Coronary CTA (CCTA) is the only test with a **class I recommendation and level A evidence** for the diagnosis and management of stable chest pain in patients without a history of prior obstructive CAD
- 2021 ACC/AHA chest pain guidelines made it clear acquiring a cardiac CT scanner was vital for our practice
- Duly purchased a CardioGraphe™ CT scanner and opened the CEC in January 2022

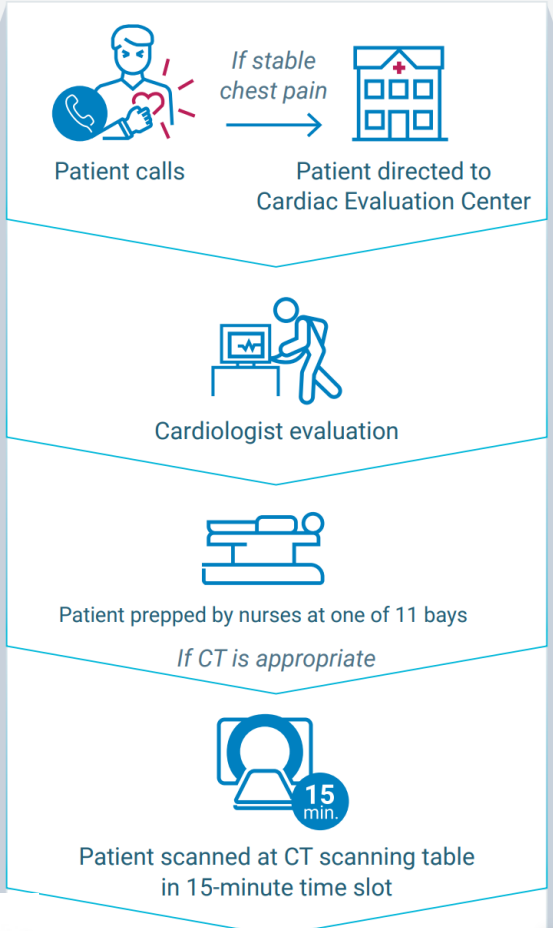
duly HEALTH AND CARE

Cardiac Evaluation Center (CEC)

- The CardioGraphe™ CT scanner was chosen for a variety of reasons:
  - Small form factor is space-efficient (great for ambulatory setting)
  - Smaller field-of-view (FOV) reduces radiation dose and limits visualization of noncardiac anatomy (dedicated cardiac CT)
  - Cost-efficient as compared to larger detector scanners
  - Provides excellent image quality

duly
HEALTH AND CARE

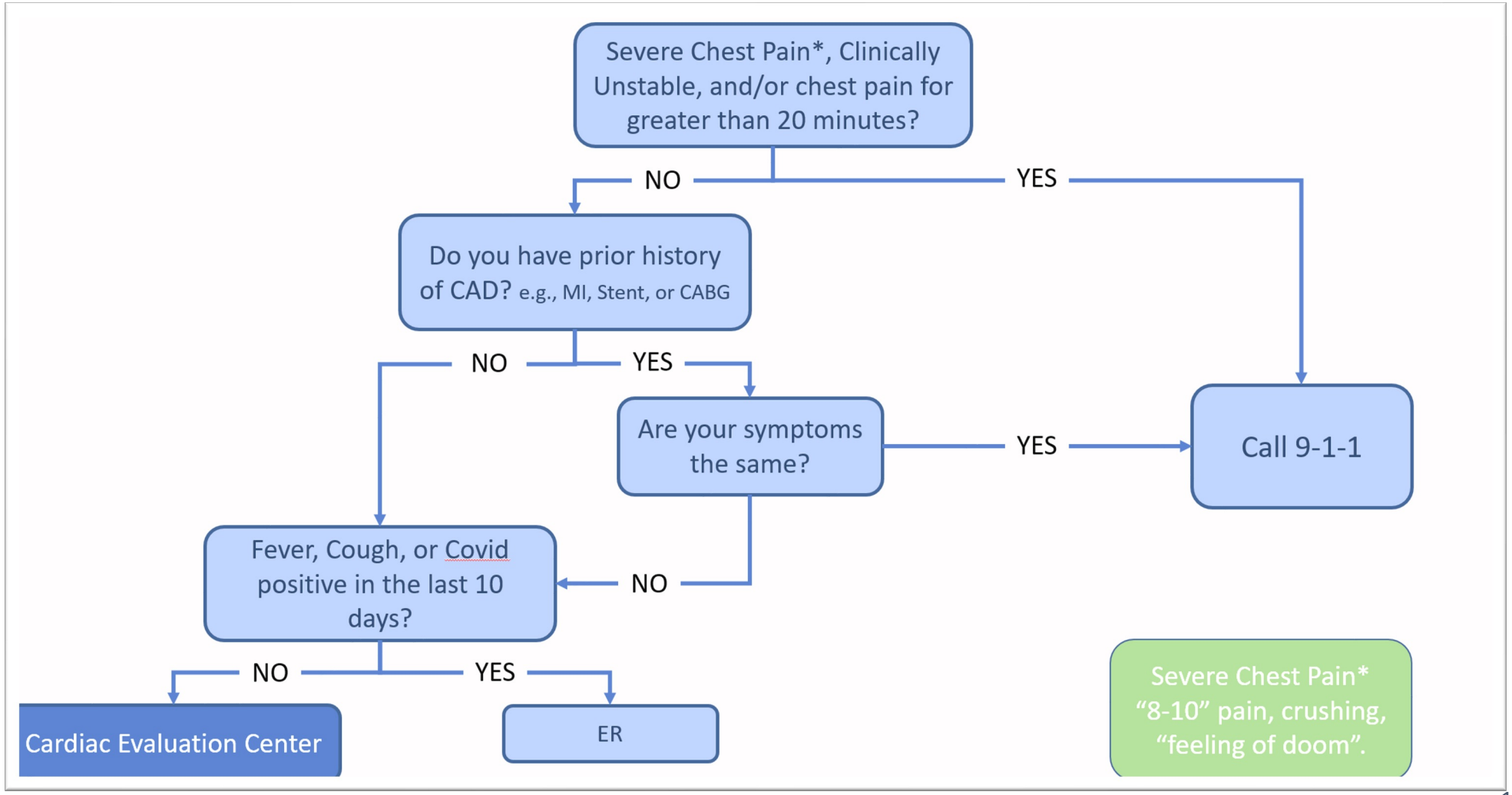
Cardiac Evaluation Center (CEC)



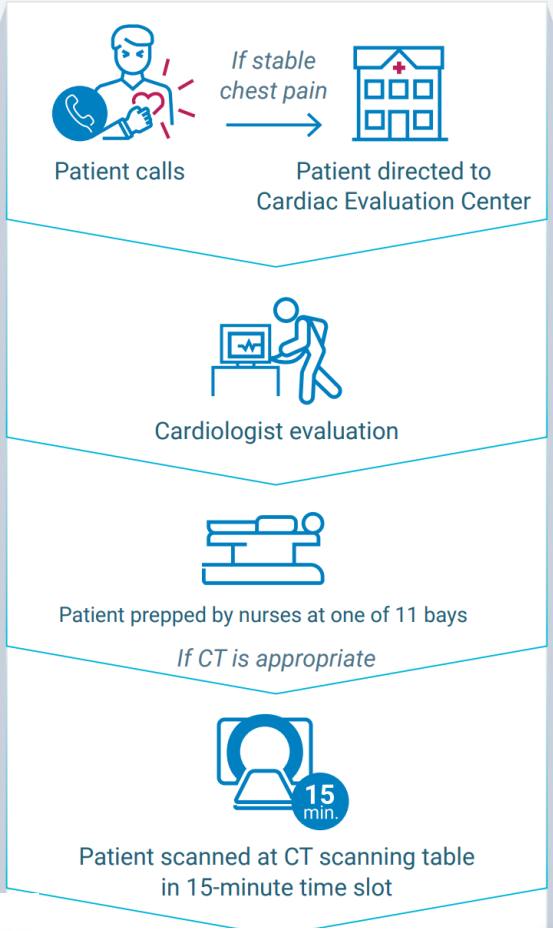
- **STEP 1:** Patient calls/presents to PCP/cardiologist/urgent care with chest pain. The patient is referred to CEC.
  Triage RN at the CEC screens patient to make sure inpatient evaluation is not indicated.
- **STEP 2:** The patient is seen at CEC within one working day *(usually same day)*.
  EKG and labs (troponin, BMP, CBC) are checked immediately, and the patient is placed on telemetry.
  They are then evaluated by a cardiologist or APP.

duly HEALTH AND CARE

Duly chest pain guideline for CEC



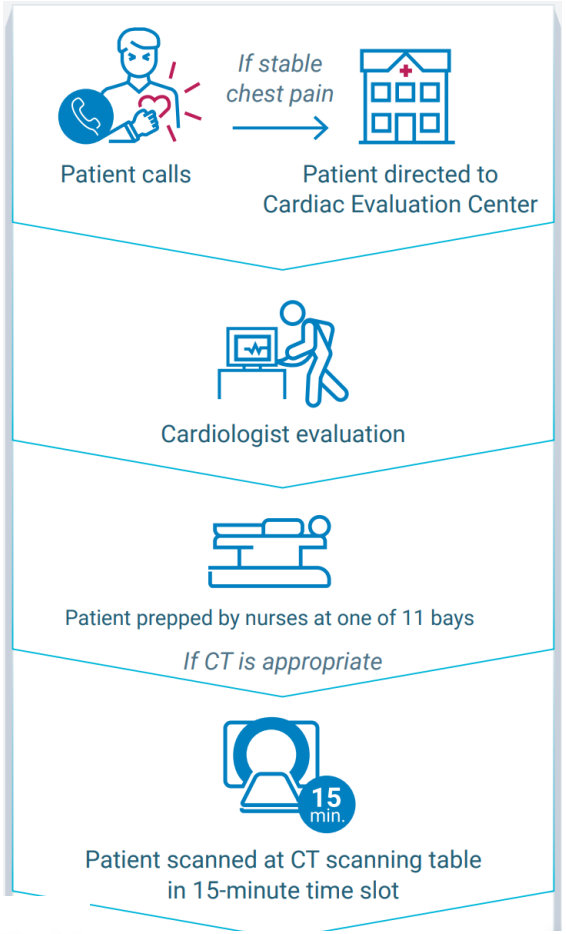
Cardiac Evaluation Center (CEC)



- **STEP 3:** If the patient is identified to be an appropriate candidate, CCTA is performed *(typically same day)*.
  - Rate control is achieved with metoprolol, diltiazem and ivabradine
  - If HR on presentation is high *(90-120 bpm)*, the patient returns the next day after being pre-medicated with oral metoprolol

duly HEALTH AND CARE

Cardiac Evaluation Center (CEC)



- **Step 4:** All walk-in CCTAs are read prior to the patient being discharged. Goal is discharge within 2.5 hours of presentation.
  - Duly is part of the **HeartFlow Unlimited** program. **All CCTAs at our CEC have FFR-CT performed**.
  - All walk-in patients are flagged as high priority, with **1-hour FFR-CT turnaround time**.
  - Patients with obstructive CAD are started on GDMT and arranged for prompt outpatient cardiac catheterization *(<72 hours)*
  - Patients with nonobstructive CAD are started on GDMT and follow-up in the office within two weeks

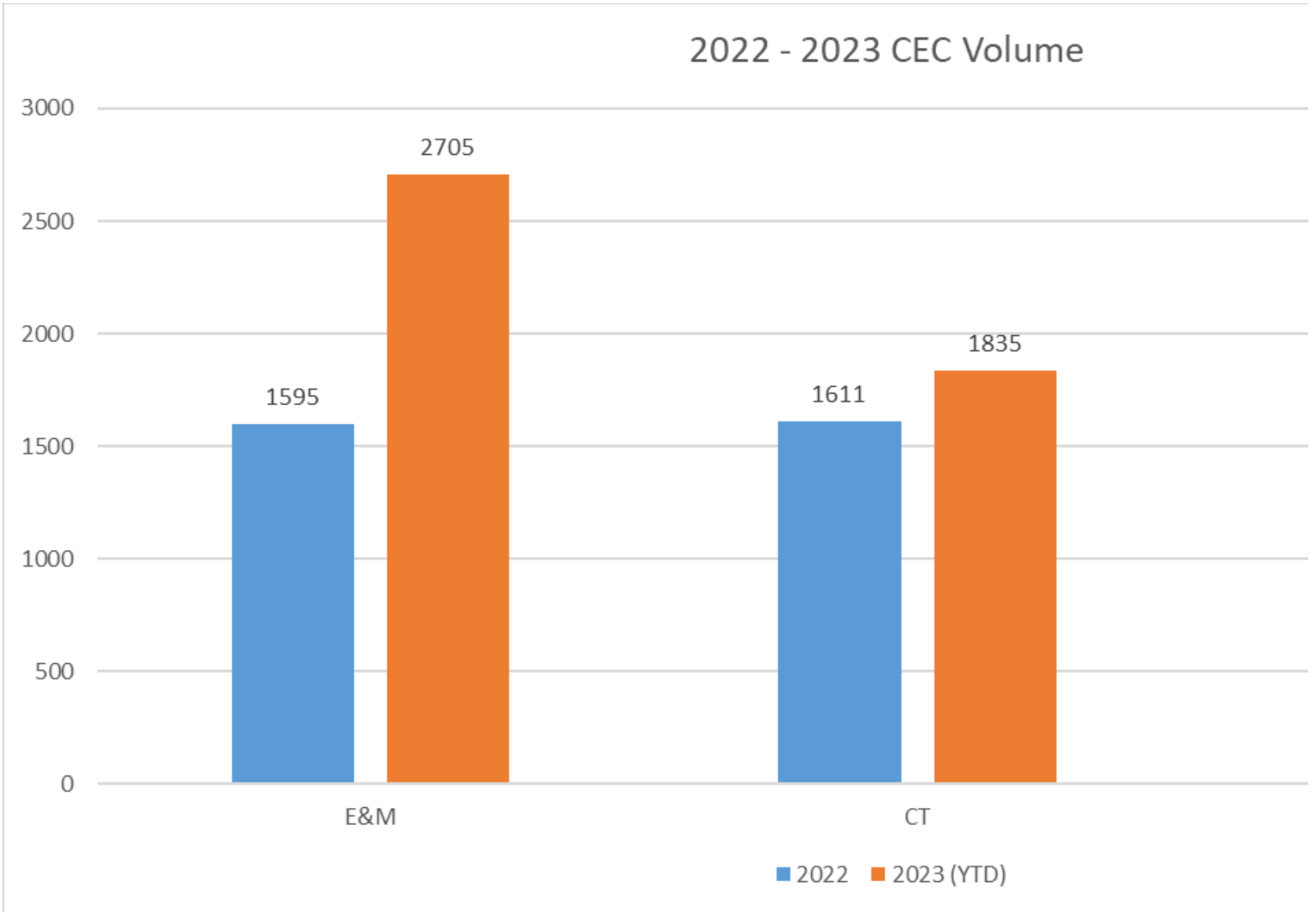
duly HEALTH AND CARE

Cardiac Evaluation Center (CEC)

- Open Monday – Friday, 8 AM-5 PM
- 12 elective outpatient CTs are scheduled daily
  - 75% CCTAs and 25% structural heart CTs
- 5 CTA additional slots reserved for daily “walk-in” CCTAs
  - 2-3 walk-in CTAs are typical
- 14-24 patients seen daily at CEC; 4300 patients were seen from 2022-2023
- 3446 CTs were performed from 2022-2023; 2410 were CCTAs
- Received the HeartFlow CT Quality award every quarter since opening (9 quarters consecutively); highest FFR-CT approval rate in our geography

duly HEALTH AND CARE

Cardiac Evaluation Center Volumes



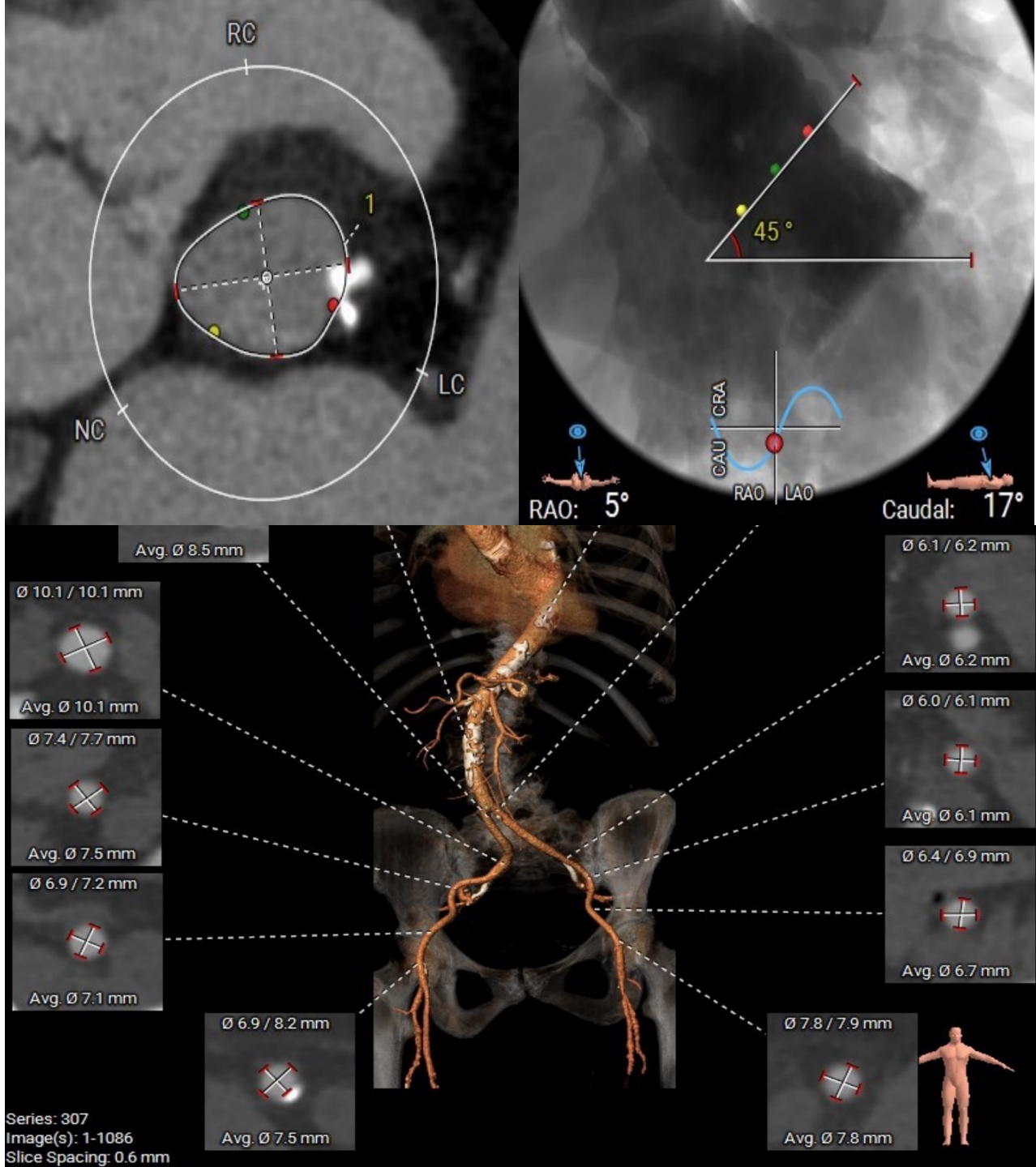
Structural Heart Disease

- CT has become integral in the management of structural heart disease
  - Evaluation of valvular heart disease
  - Left atrial appendage occlusion
  - Pulmonary vein isolation
  - Aortic aneurysm surveillance

duly HEALTH AND CARE

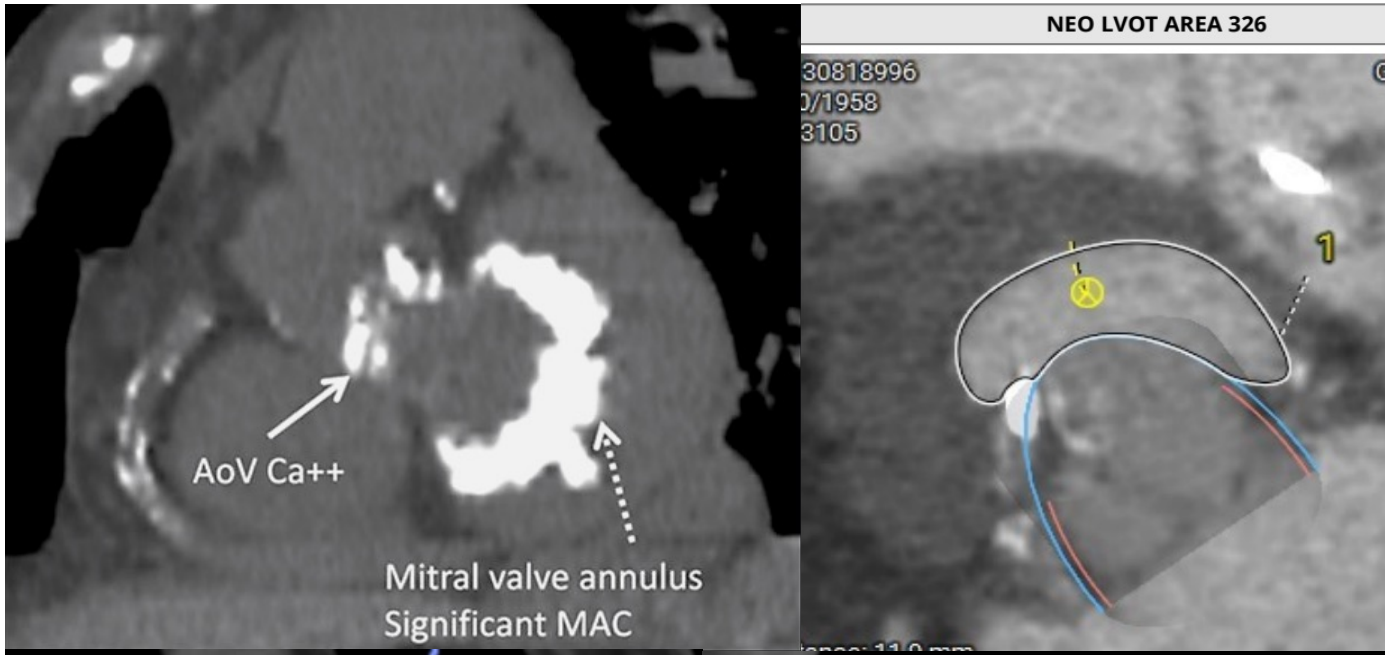
Valvular Heart Disease

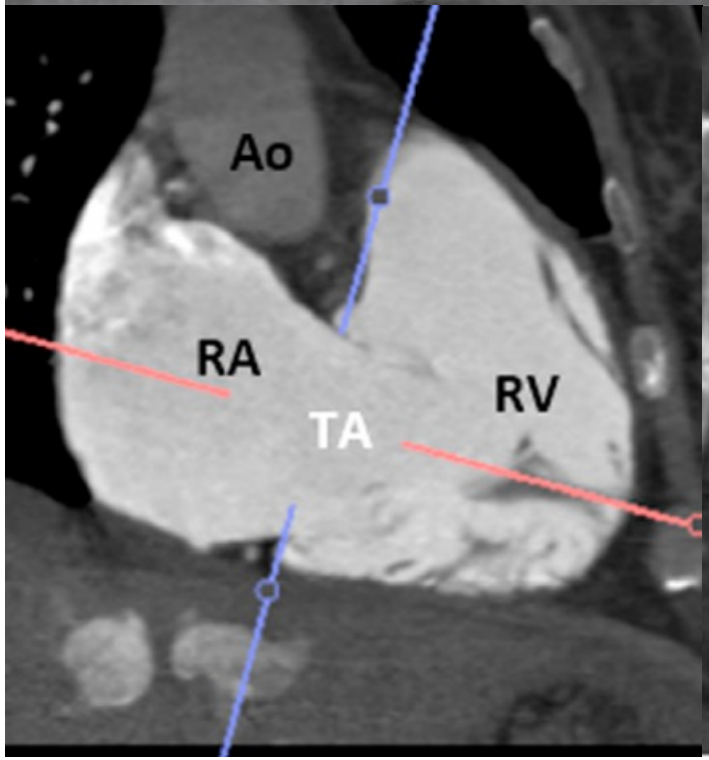
- Aortic valve
  - CT used for assessing aortic valve morphology and stenosis severity (calcium scoring and planimetry for low gradient AS)
  - Valve sizing and vascular access for TAVI planning
  - Evaluating prosthetic aortic valve function (4DCT for leaflet mobility, thrombosis and pannus formation)

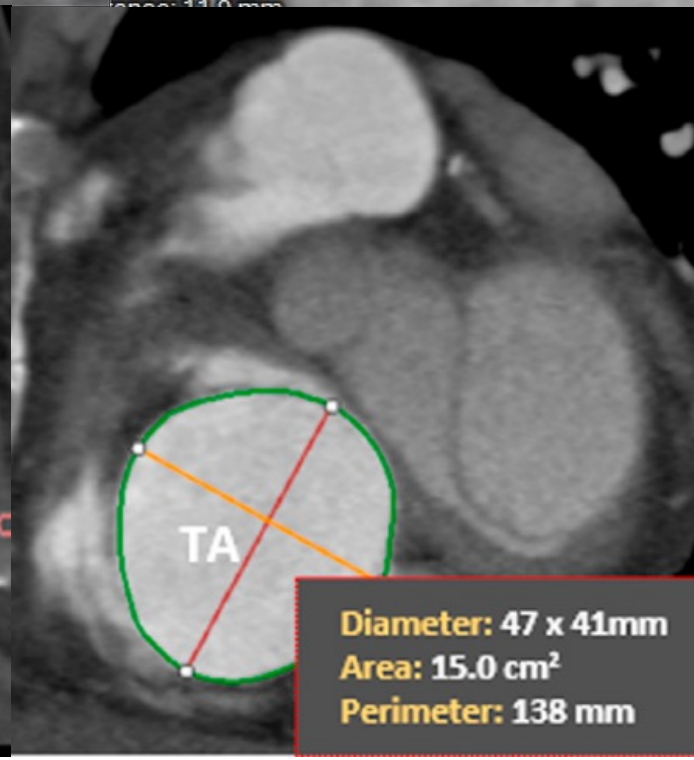


Valvular Heart Disease

- Mitral valve
  - Assessing mitral annular calcification prior to surgery
  - Planning valve-in-valve mitral valve implantation
- Tricuspid valve
  - First FDA approved transcatheter tricuspid valve for severe TR
  - CT is integral for planning tricuspid valve implantation







duly
HEALTH AND CARE

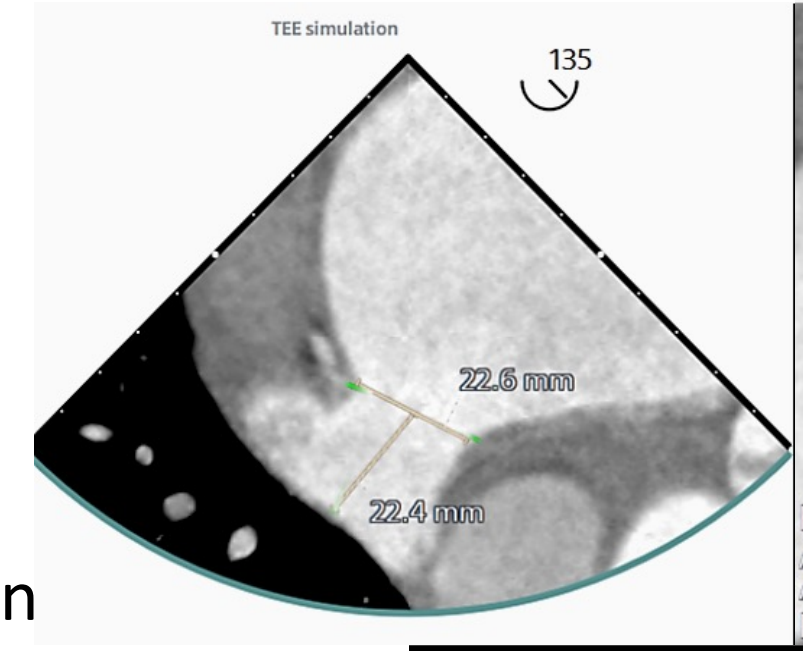
Valvular Heart Disease

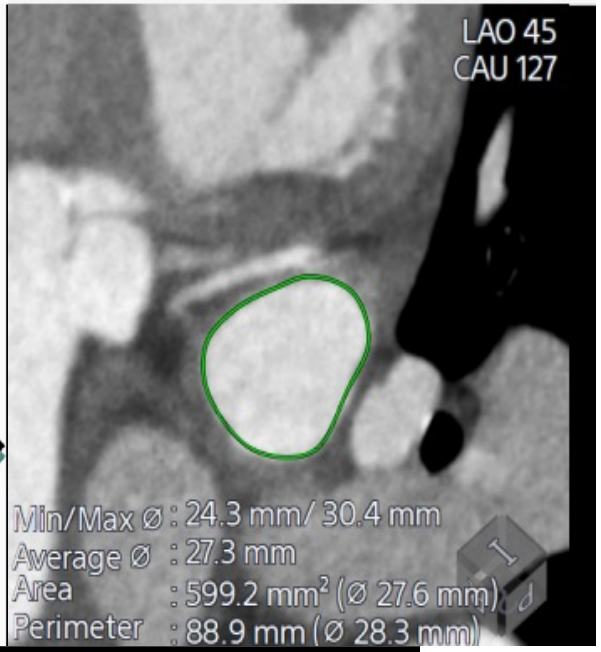
- We follow a CT first strategy for **aortic valve disease**
- If a patient is referred to our structural heart team for possible symptomatic **low gradient aortic stenosis**, we use CT as a our first line test to confirm AS severity (over dobutamine echo and catheterization)
- If a patient has a **prosthetic aortic valve with elevated gradients**, we use CT as our first-line test over TEE, to assess for leaflet thrombosis and structural valve deterioration

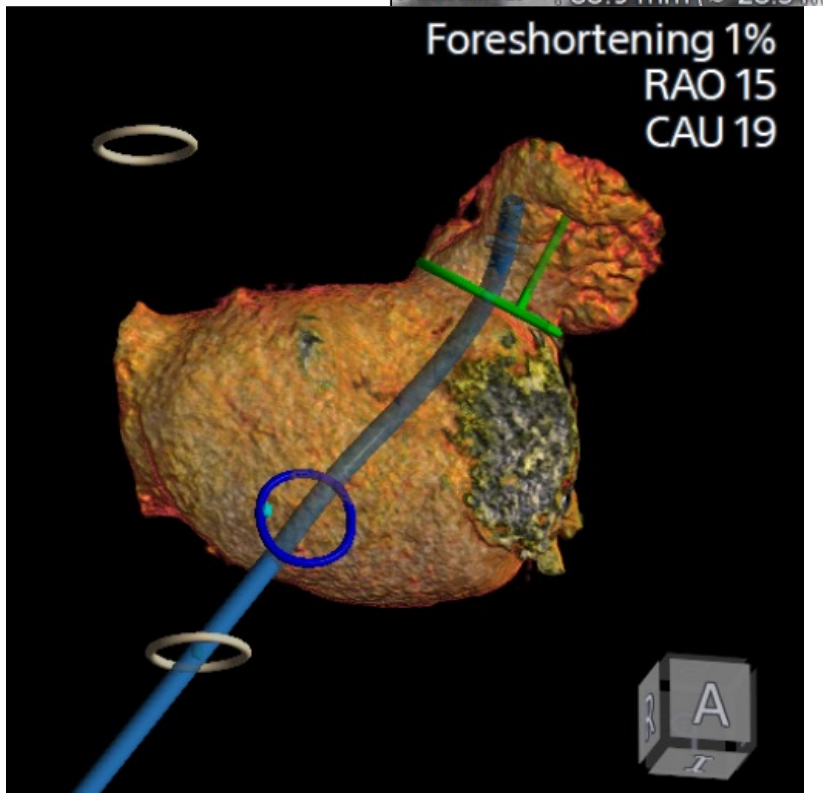
duly HEALTH AND CARE

Appendage Occlusion

- Left atrial appendage occlusion (LAAO) is recommended in the 2023 ACC/AHA AF guidelines for patients with AF who cannot tolerate long-term anticoagulation
- CT offers many advantages over TEE planning of LAAO
  - Non-invasive
  - Faster
  - Associated with shorter implant times and greater procedural success



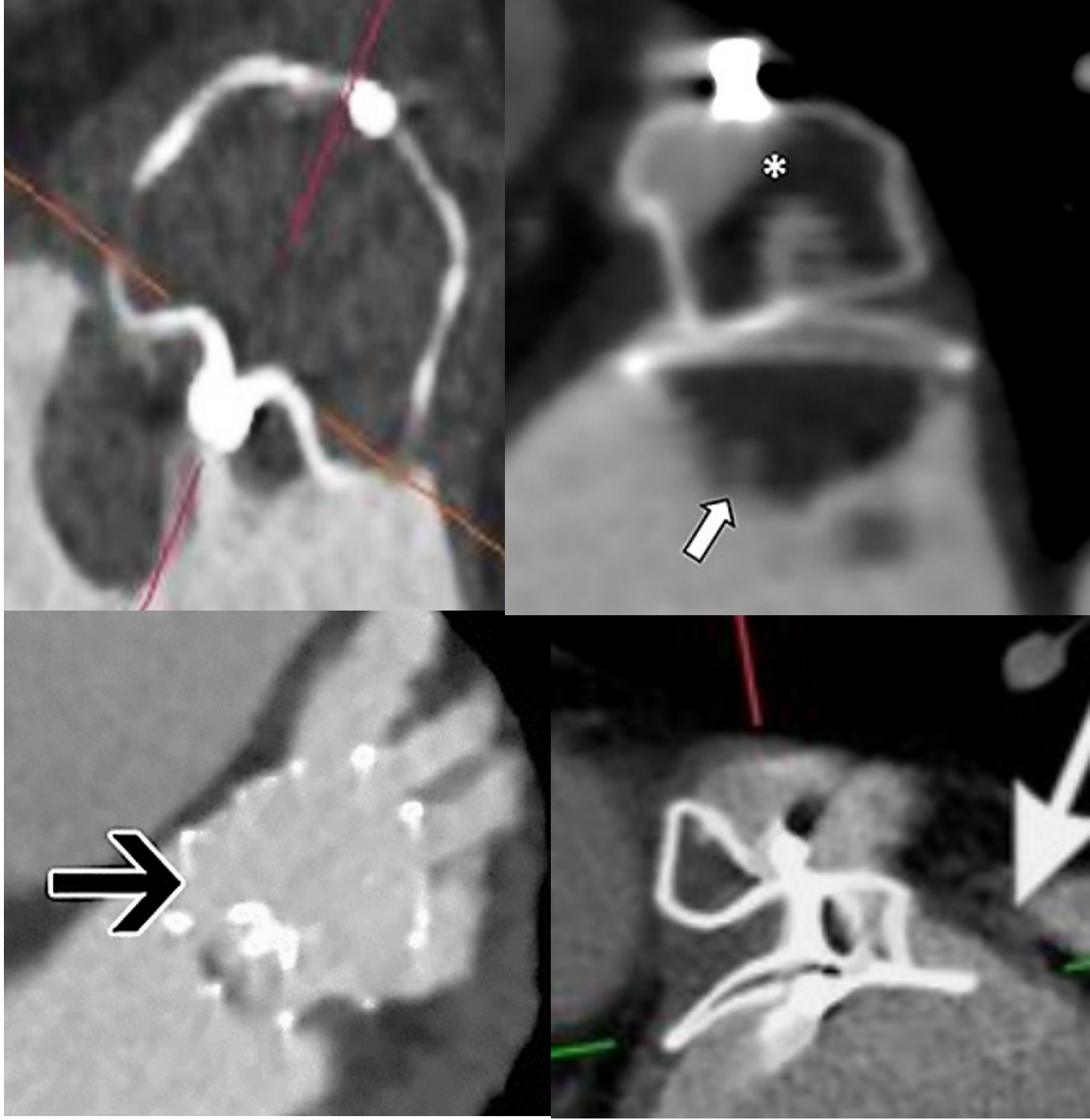




Joglar JA, Chung MK, Armbruster AL et al. 2023 ACC/AHA/ACCP/HRS Guideline for the Diagnosis and Management of Atrial Fibrillation: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. Circulation. 2024 Jan 2;149(1):e1-e156.

Appendage Occlusion

- CT can also be used for post-implant assessment of left atrial appendage occluders to satisfy requirements of NCDR registry
- More sensitive than TEE at detecting complications such as device-related thrombus and peri-device leak



Appendage Occlusion

- We use a CT-first strategy for left atrial appendage occlusion
  - Unless a patient has a GFR<30 or a severe iodine contrast allergy, we use CT preferentially for **planning LAAO** (95% CT; 5% TEE)
  - Prefer CT for **surveillance of LAAO patients post-implant** at 6 weeks and 1 year
  - If there is concern of a **device-related complication** (stroke) > 1 year implant, CT is our first line test over TEE

duly HEALTH AND CARE

Pulmonary vein isolation

- Our electrophysiologists have incorporated CT early into their **workflow for atrial fibrillation;** typically order CT at initial consultation
- Nearly every patient who undergoes PV isolation ablation will have a CT done for mapping; but same study gives much additional information
    - Rule out **appendage thrombus** prior to ablation (delayed imaging)
    - Assess septum for **safety of transseptal puncture**
    - Assess for **coronary artery disease** (safety of IC antiarrhythmics)
    - Assess appendage anatomy for future or concomitant **LAAO**

duly HEALTH AND CARE

Aortic aneurysm surveillance

- Our practice has made CT preferred test for yearly surveillance of thoracic aortic aneurysms that are not confined to the aortic root
- CT offers greater accuracy over echocardiography
- Assess aortic valve morphology (bicuspid aortic valves)
- Also allows detection of preclinical coronary artery disease

duly
HEALTH AND CARE

Conclusion

1. CardioGraphe™ scanner has brought cost-efficient, high quality, cardiac CT into our outpatient-focused independent practice
2. Two major keys to growing our cardiac CT program:
    1. CT first strategy for evaluating chest pain (2021 ACC/AHA chest pain guidelines)
    2. CT first strategy for structural heart disease (aortic stenosis; prosthetic aortic valves, left atrial appendage occlusion and AF management; thoracic aortic aneurysms)

duly HEALTH AND CARE

Thank you for your attention

duly
HEALTH AND CARE