CORONARY CT ANGIOGRAPHY ENABLES THERAPEUTIC DECISION FOR THE TREATMENT OF CORONARY ARTERY DISEASE

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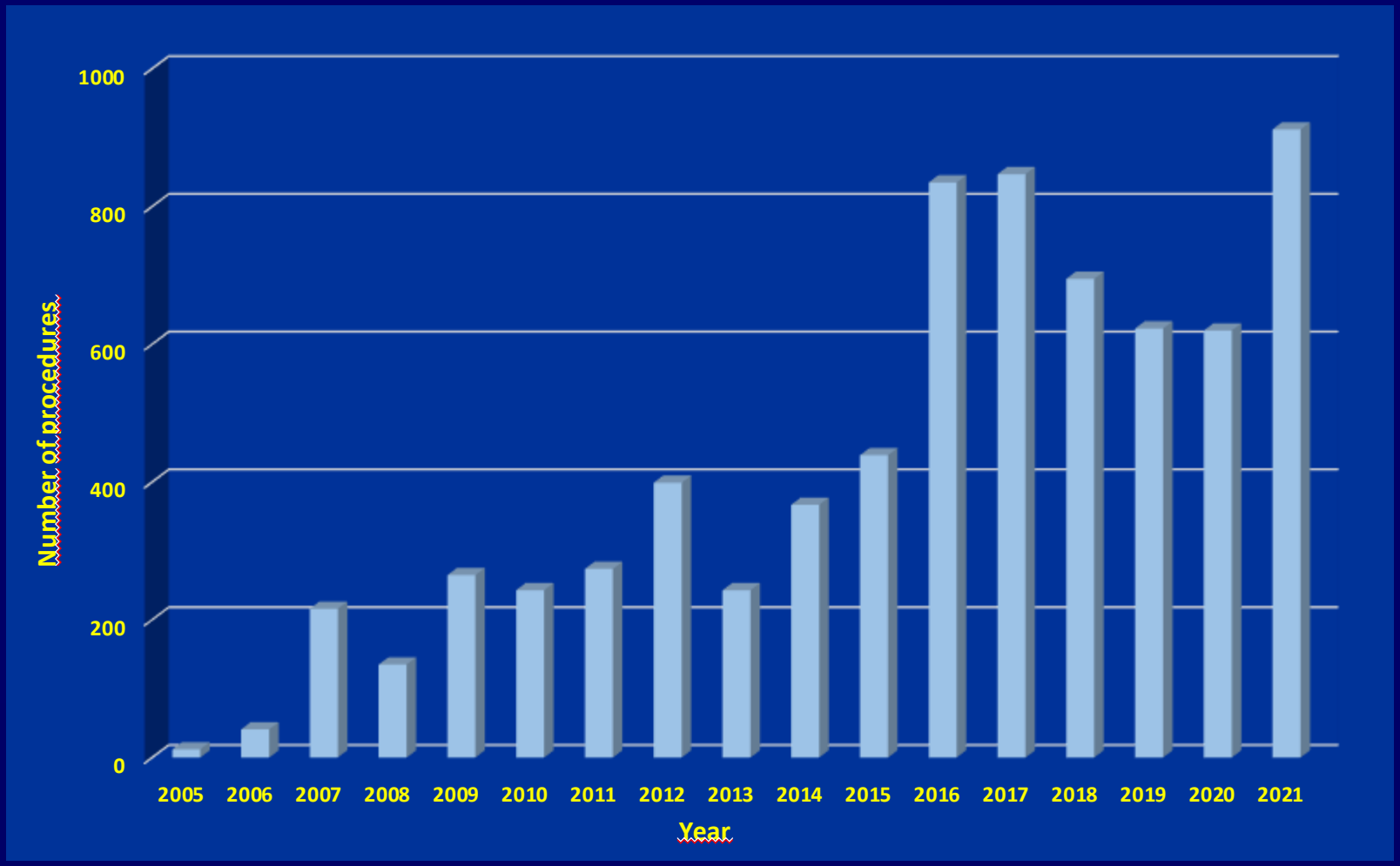
Medical Faculty
University of Ljubljana

Prof. Enrique Gurfinkel, MD, PhD, Favaloro Foundation, Argentina, beleived, that non-invasive technique like CT coronary angiography will be in the future the substitute for invasive angiography.
Orlando, ACC, 2005

MC Medicor Slovenia, 2005
Team for CT diagnostic procedures

CT Coronary angiography
MC Medicor SLOVENIA
(December 2005 – December 2021)



Prof. Enrique Gurfinkel, MD, PhD
Favaloro Foundation, Argentina

What the analysis taught us?

- In patients without known CAD, CT enables exclusion of CAD.
- If done correctly, CT enables identification of CAD.
- CAD findings by CT carry important prognostic significance.
- Prognostic utility of CT extend beyond high-grade stenoses.
- Treatment of high-grade and non-high-grade stenoses diagnosed by CT improves outcomes.
- Identification of different atherosclerotic plaques and new technologies ($CT_{FFR,}$ CT fat attenuation index) improve treatment strategies.

CTA Clinical Trial Evidence

- Several clinical trials report high diagnostic accuracy

Curr Cardiovasc Imaging Rep (2017) 10: 14
DOI 10.1007/s12410-017-9411-7

CARDIAC COMPUTED TOMOGRAPHY (T VILLINES, SECTION EDITOR)

Cardiac CT Improves Outcomes in Stable Coronary Heart Disease: Results of Recent Clinical Trials

Michelle C. Williams[1] · Alastair Moss[1] · Edward Nicol[2] · David E. Newby[1]

The PROMISE Trial: The CTA Perspective

Jul 28, 2015 | Brandon Scott Oberweis, MD, FACC; Allen J. Taylor, M.D., FACC

Expert

CT coronary angiography in patients with suspected angina due to coronary heart disease (SCOT-HEART): an open-label, parallel-group, multicentre trial

The SCOT-HEART

Summary

Background Tl

been systemat

patients referr

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NICE National Institute for Health and Care Excellence

NICE guidance

HeartFlow FFRCT for estimating fractional flow reserve from coronary CT angiography

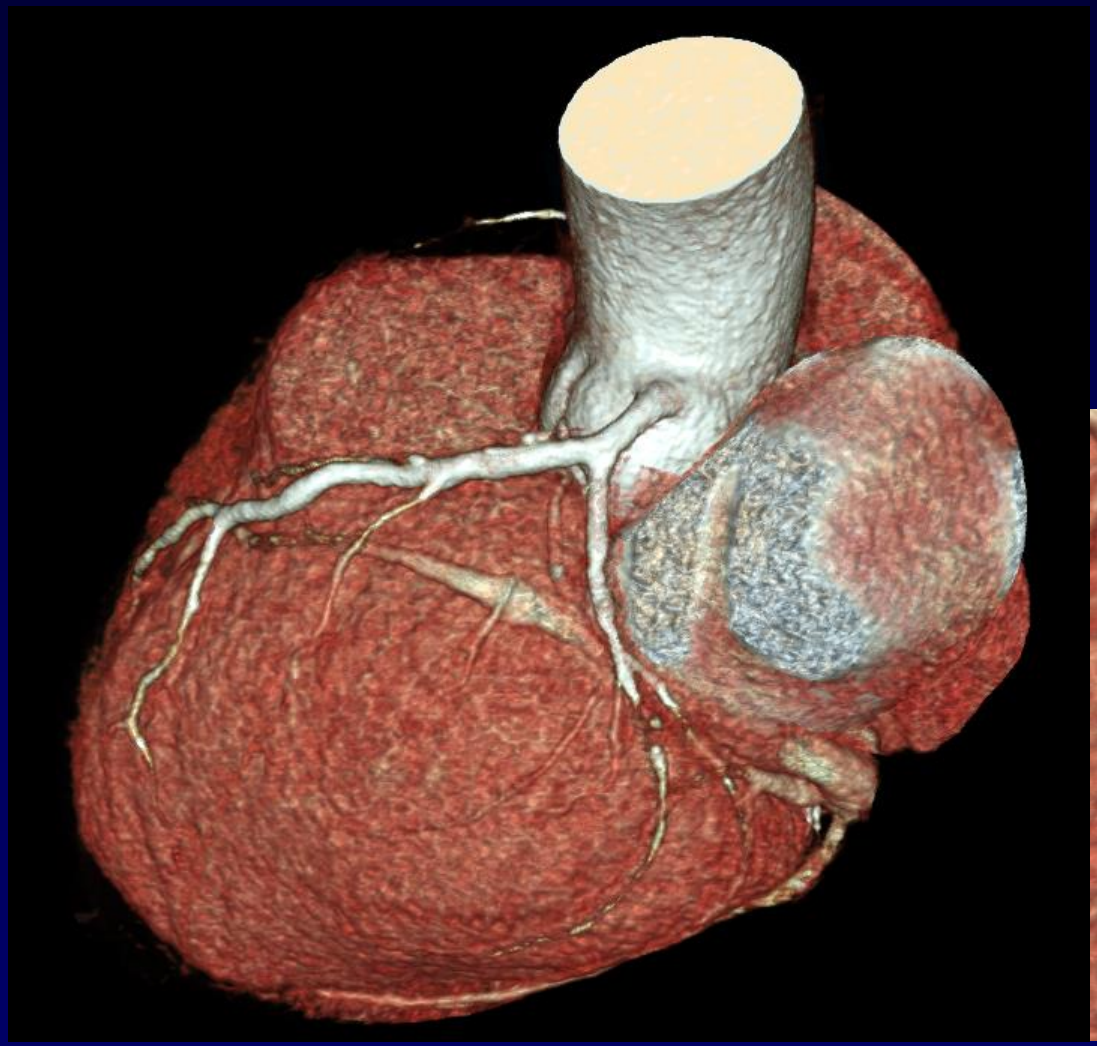
Medical technologies guidance
Published: 13 February 2017
nice.org.uk/guidance/mtg32

ORIGINAL RESEARCH

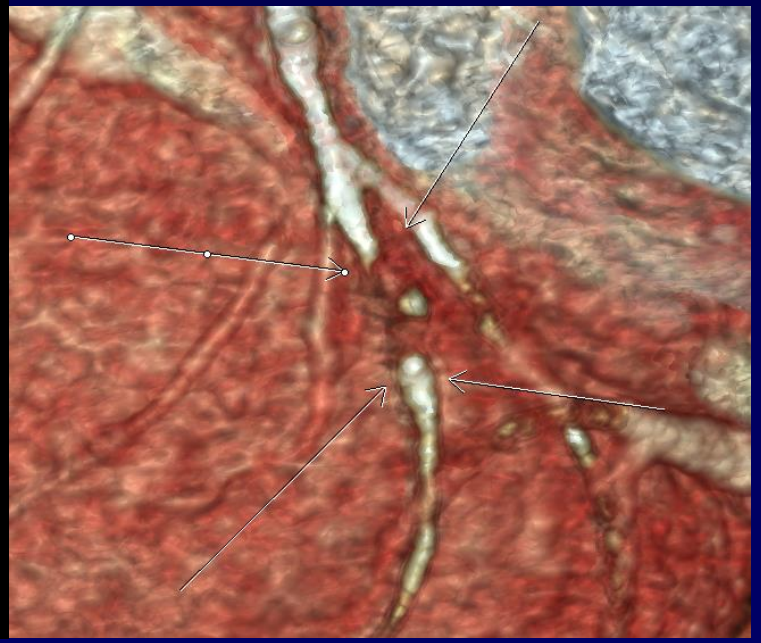
CT Angiography Followed by Invasive Angiography in Patients With Moderate or Severe Ischemia-Insights From the ISCHEMIA Trial

G.B. John Mancini, MD,[a] Jonathan Leipsic, MD,[a] Matthew J. Budoff, MD,[b] Cameron J. Hague, MD,[a,c] James K. Min, MD,[d] Susanna R. Stevens, MS,[e] Harmony R. Reynolds, MD,[f] Sean M. O'Brien, PhD,[e] Leslee J. Shaw, PhD,[g] Cholenahally N. Manjunath, MD,[h] Kreton Mavromatis, MD,[i] Marcin Demkow, MD,[j] Jose Luis Lopez-Sendon, MD,[k] Alexander M. Chernavskiy, MD, PhD,[l] Gilbert Gosselin, MD,[m] Herwig Schuchlenz, MD,[n] Gerard P. Devlin, MD,[o] Anoop Chauhan, MD,[p] Sripal Bangalore, MD, MHA,[f] Judith S. Hochman, MD,[f] David J. Maron, MD[q]

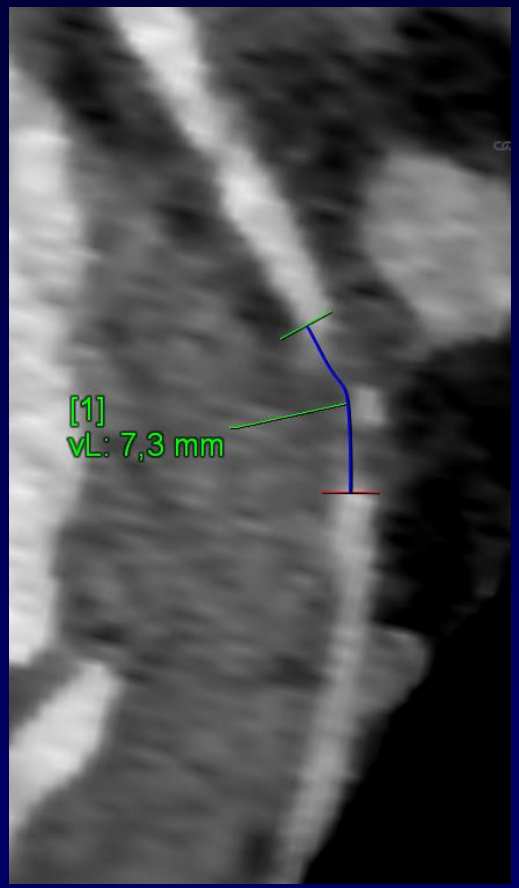
Coronary stenosis



95% stenosis of OM1
Measurement of lenght with SYNGO.VIA software, VRT

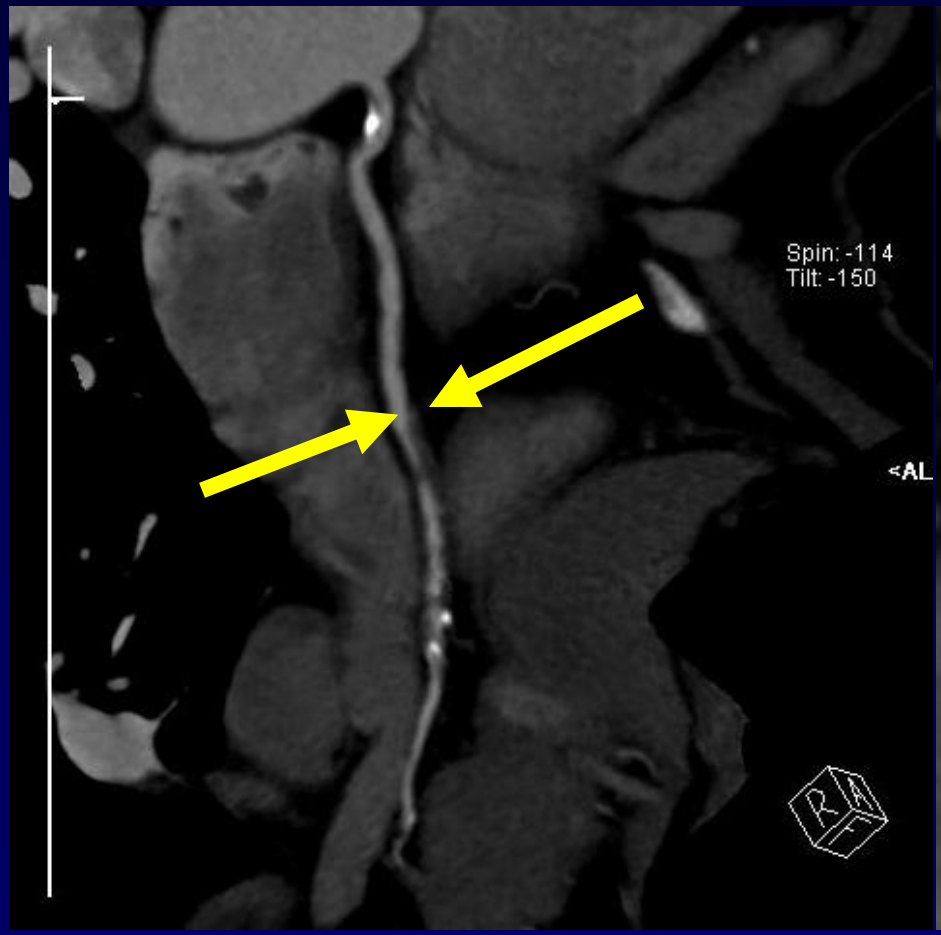


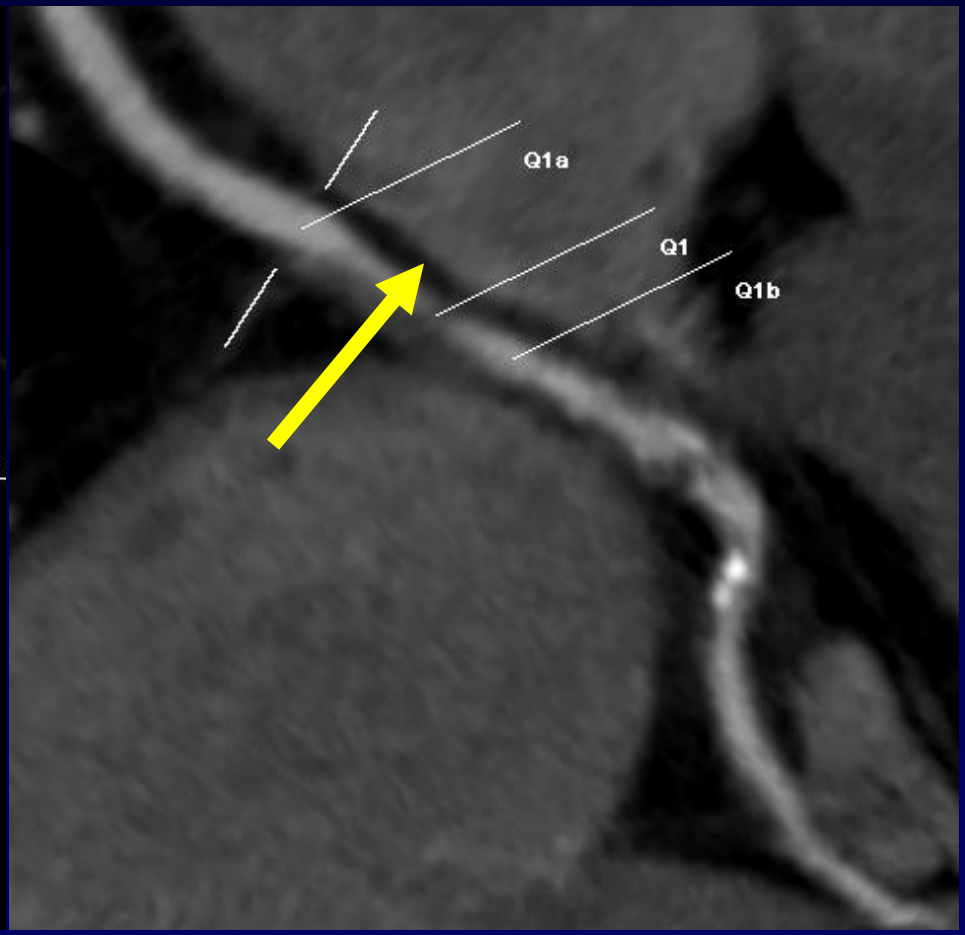
Atherosclerosis is primary, stenosis is secondary, ischemia is tertiary



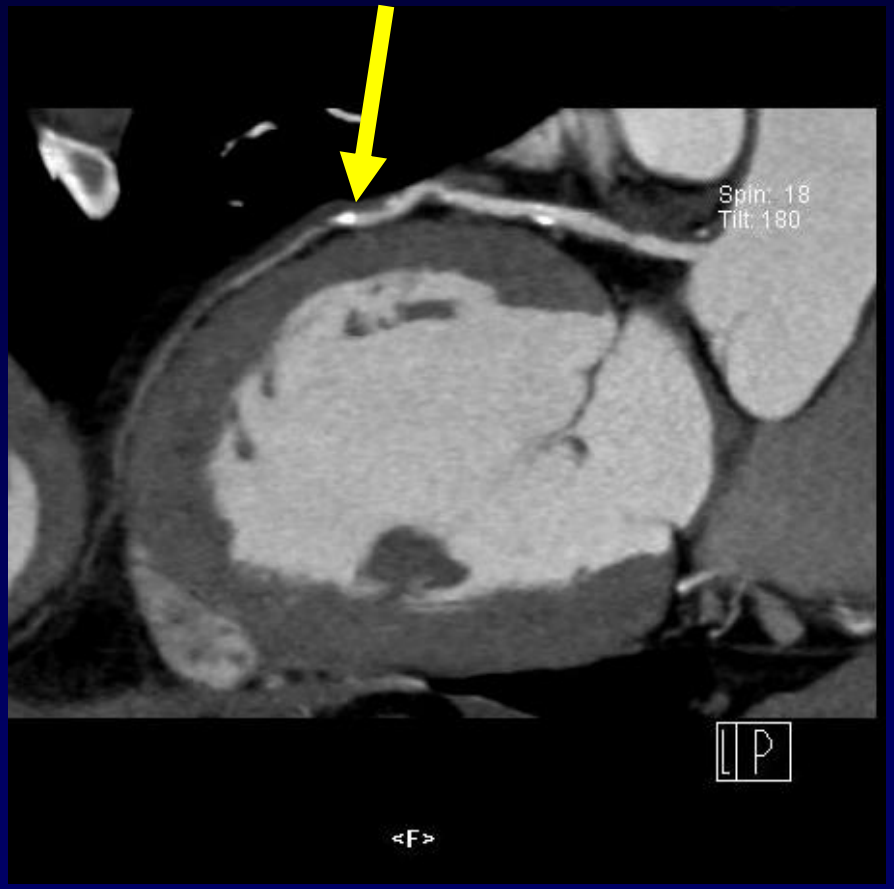
Cardiac CT is the only method for whole-heart characterization of atherosclerosis

MIP reconstruction - RCA

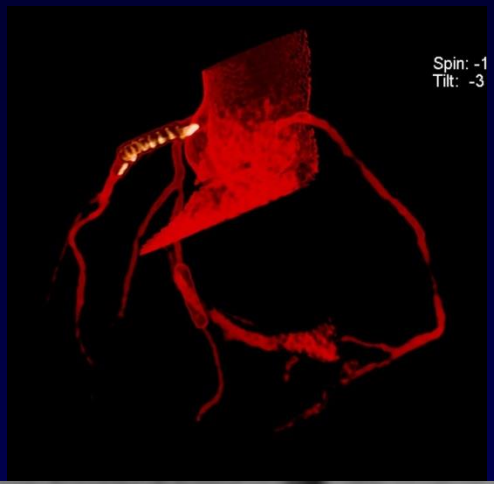


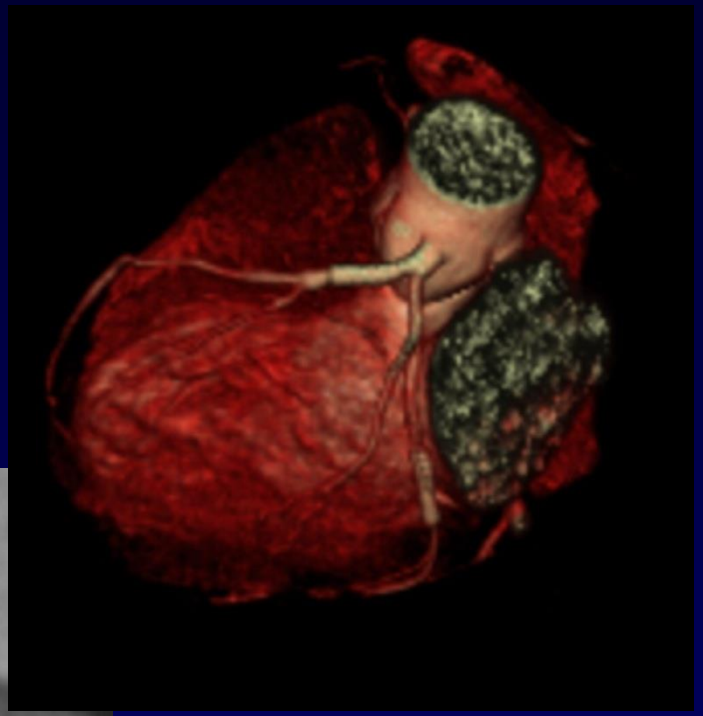


MIP reconstruction - LAD

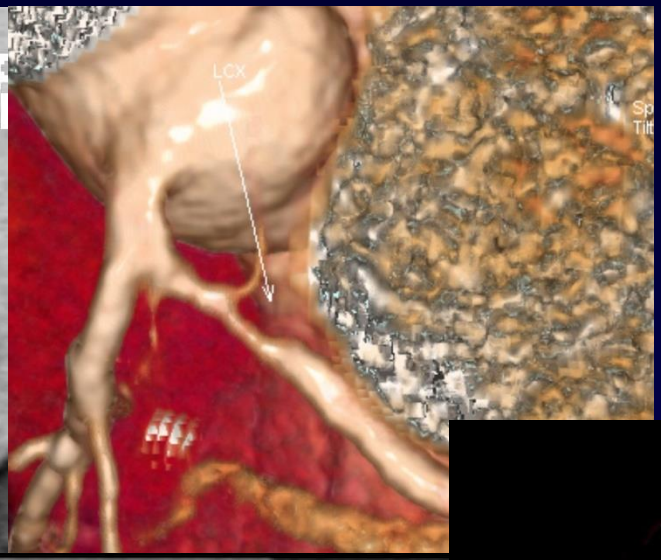


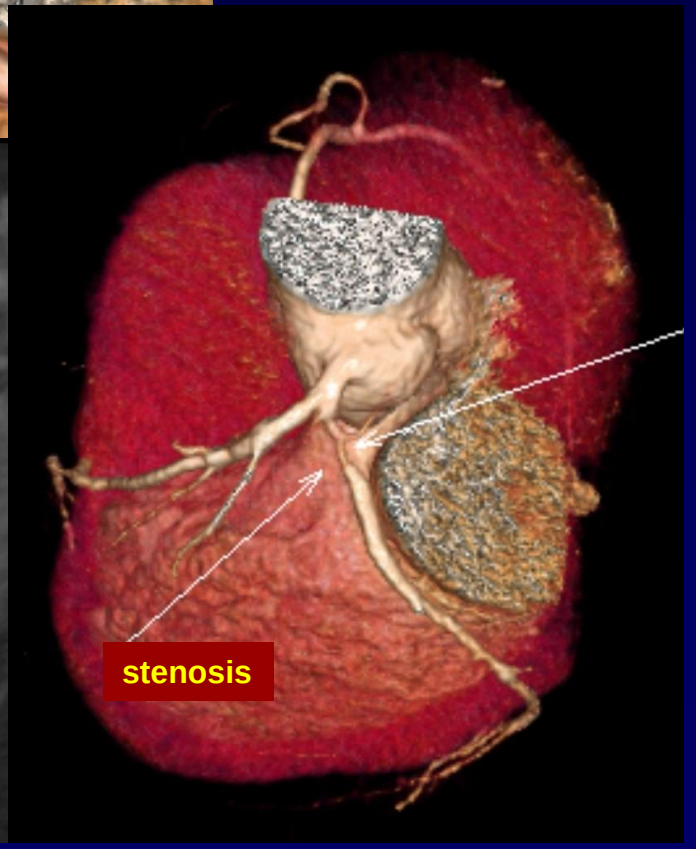
Coronary stents

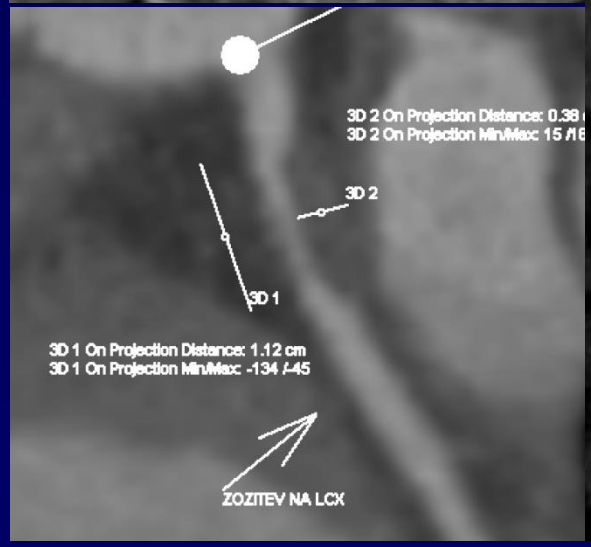




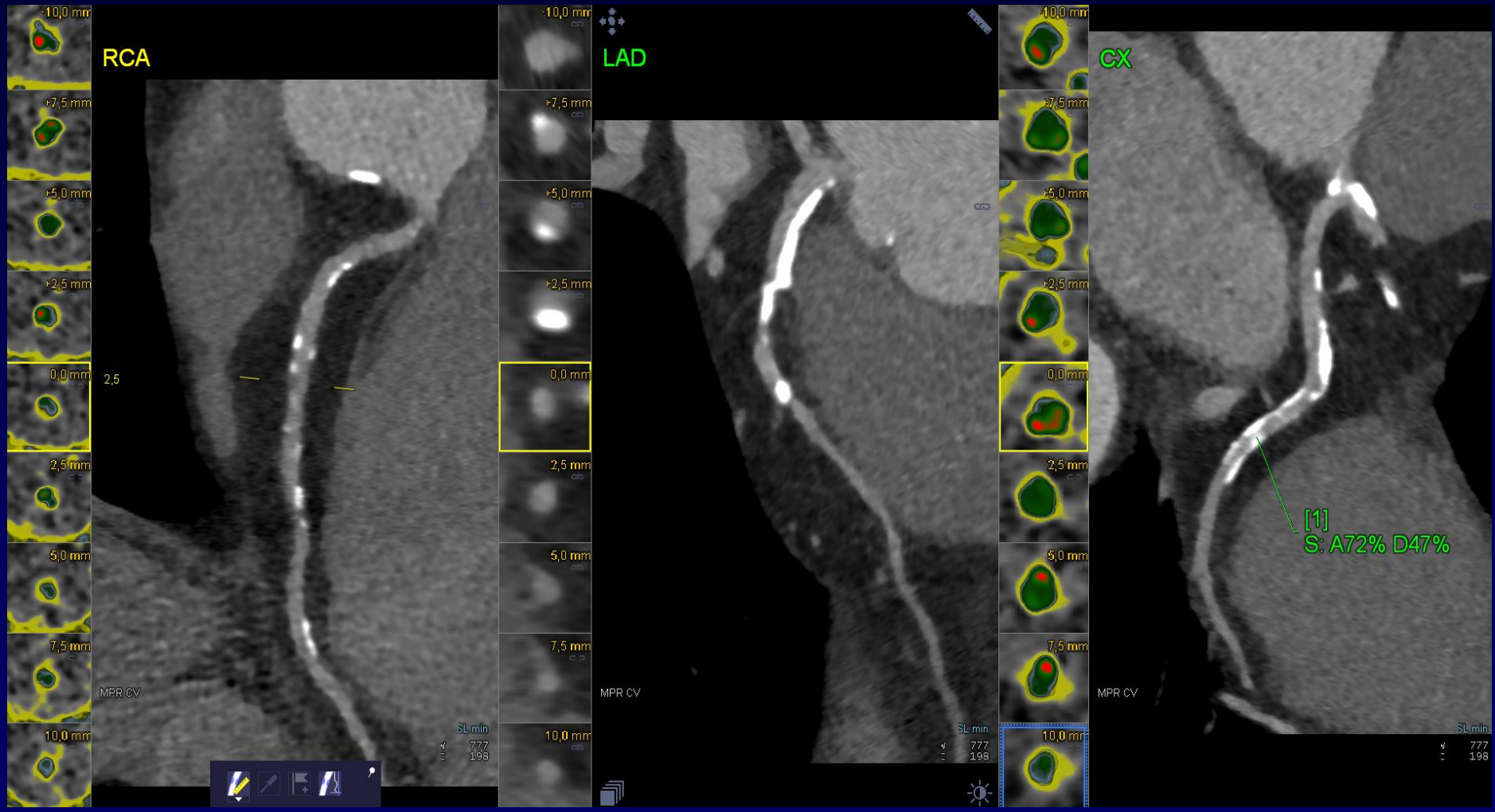
Coronary plaques





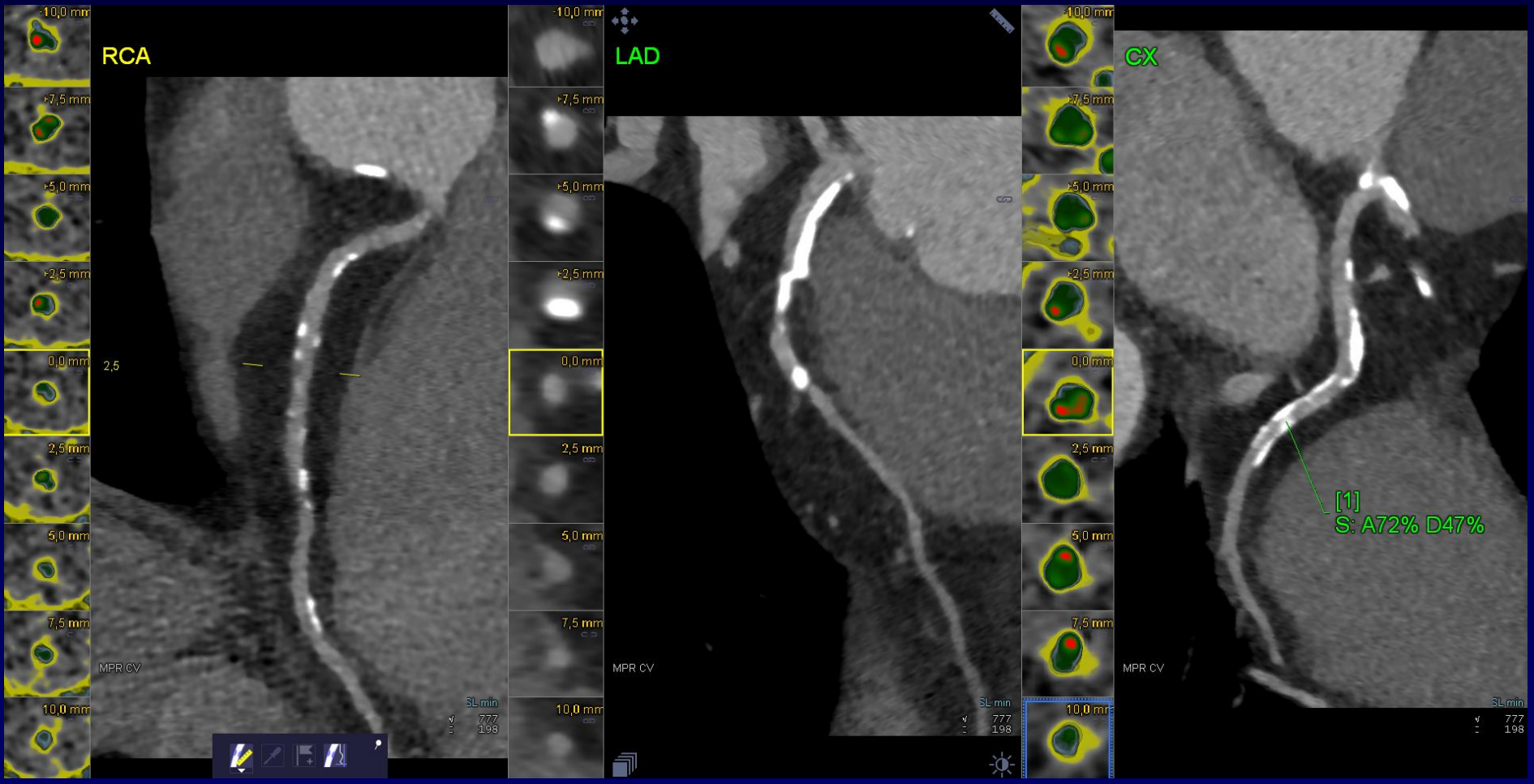


Plaque characteristics

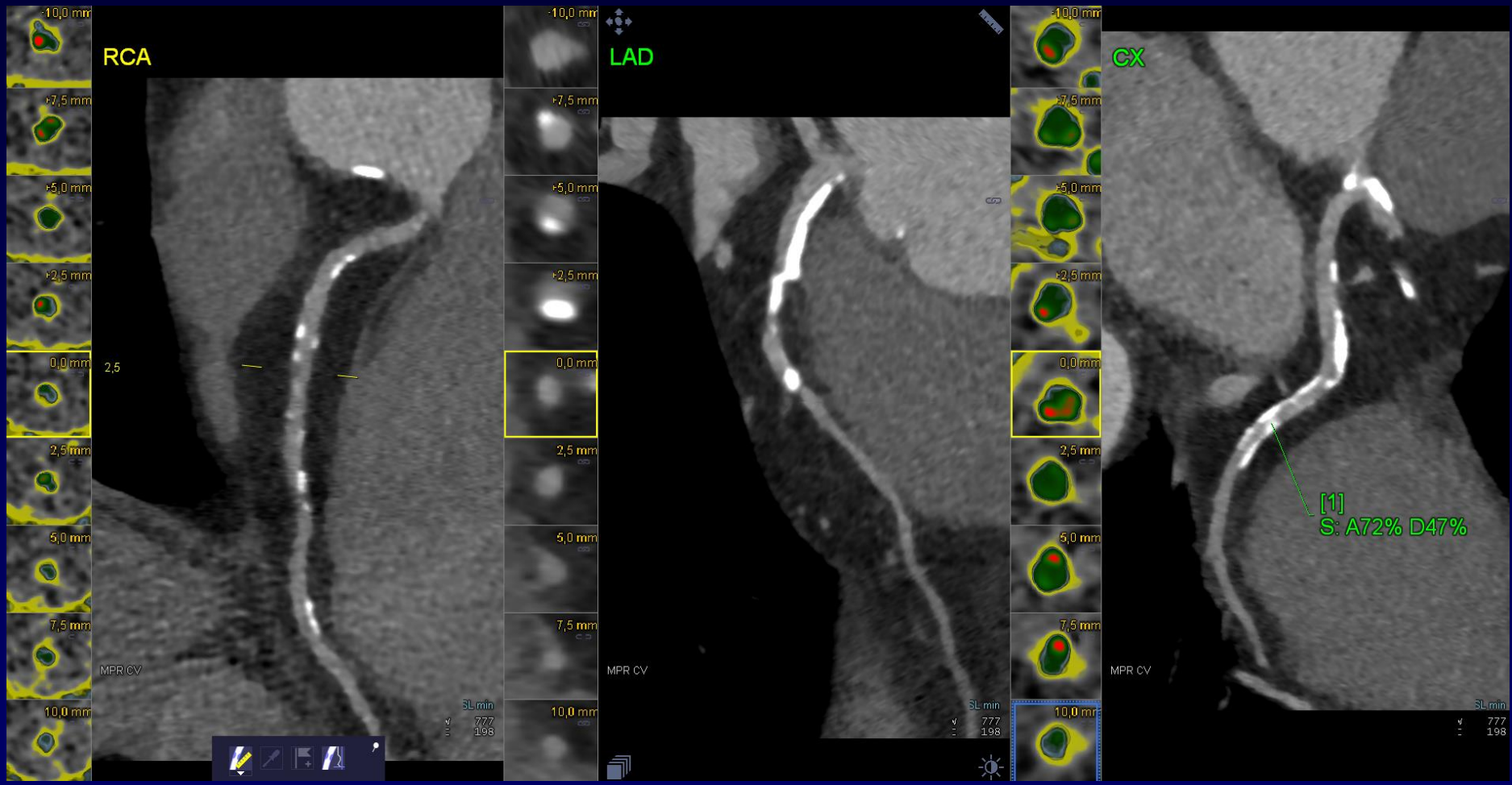


Unstable and calcified plaques

In little windows cross-sections of plaques could be seen; coloring according to density: red is calcium, dark green is lumen with contrast

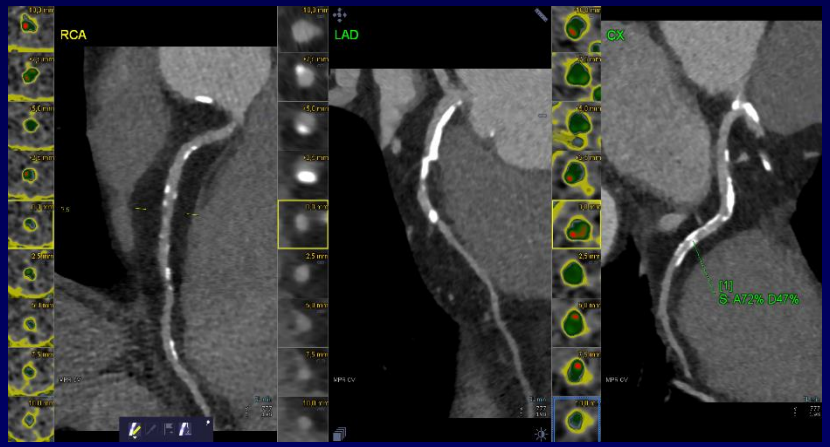


Plaques look different because they behave differently



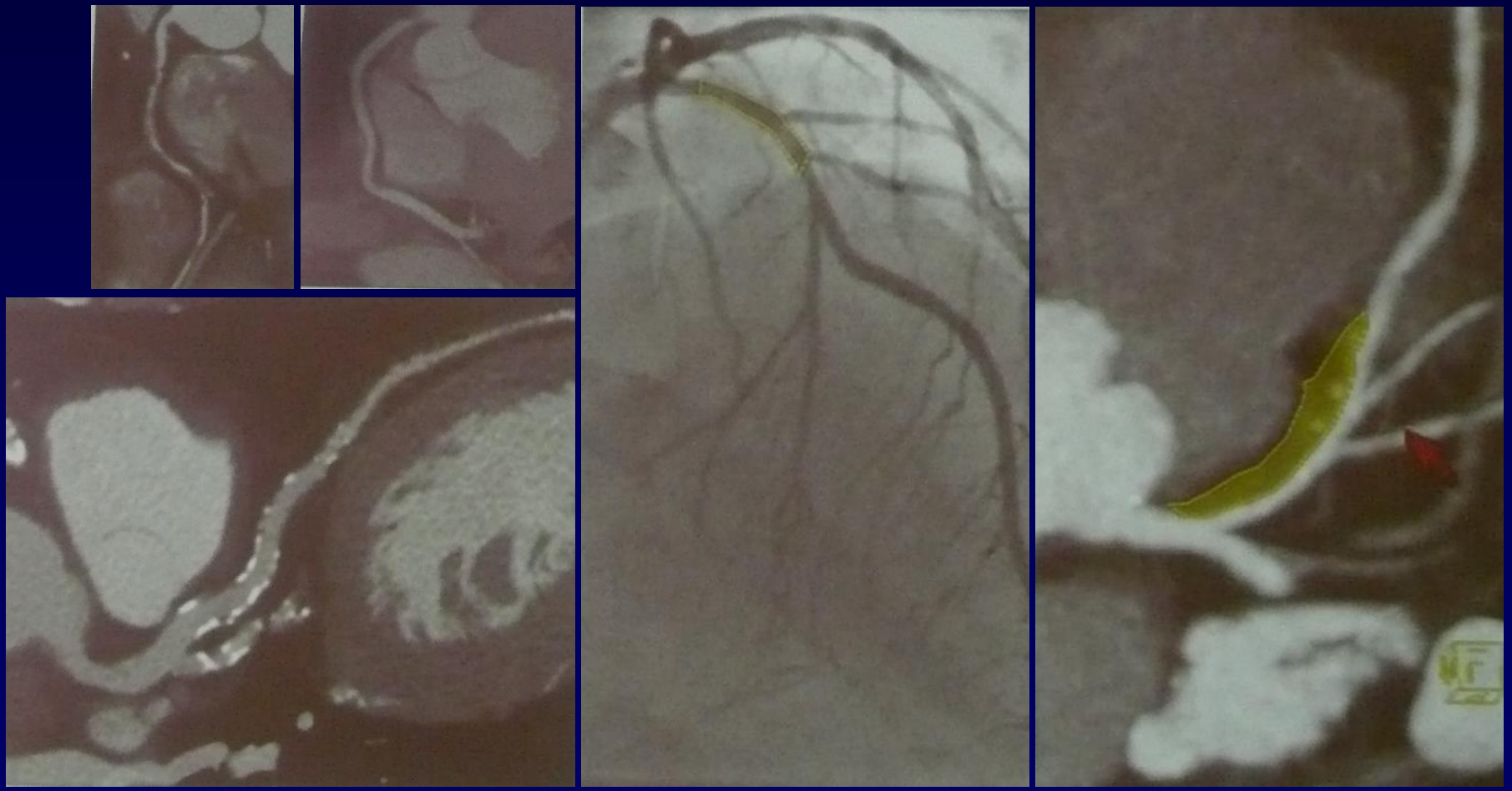
Impact of non-obstructive CAD: only visualized by CTA

Normal CTA	Diffuse non-obstructive (3-vessels)	Non-obstructive with high-risk plaque



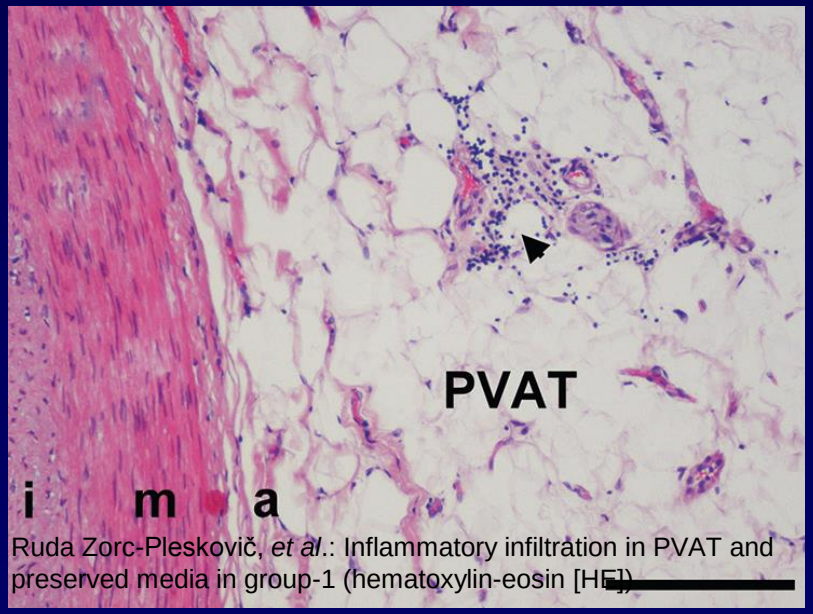
Inflammatory plaques

New technology - CT fat attenuation index

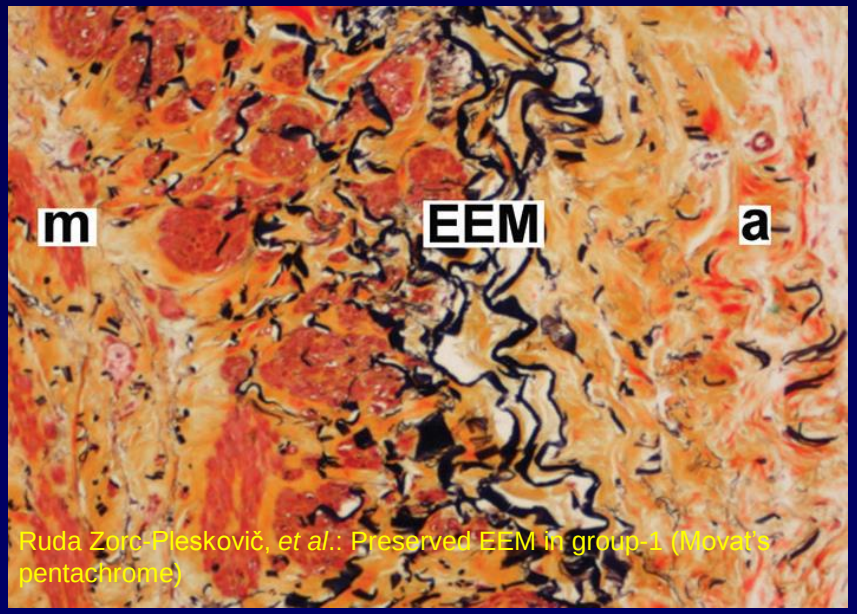


Inflammation in perivacular fat may identify the vulnerable patients before the development of vulnerable plaques

- The study of histological analisysis of endarterectomy sequesters of coronary arteries (our experiences)
- Inflammation in fat tissue of tunica adventicia



Ruda Zorc-Pleskovič, *et al*.: Inflammatory infiltration in PVAT and preserved media in group-1 (hematoxylin-eosin [HE])

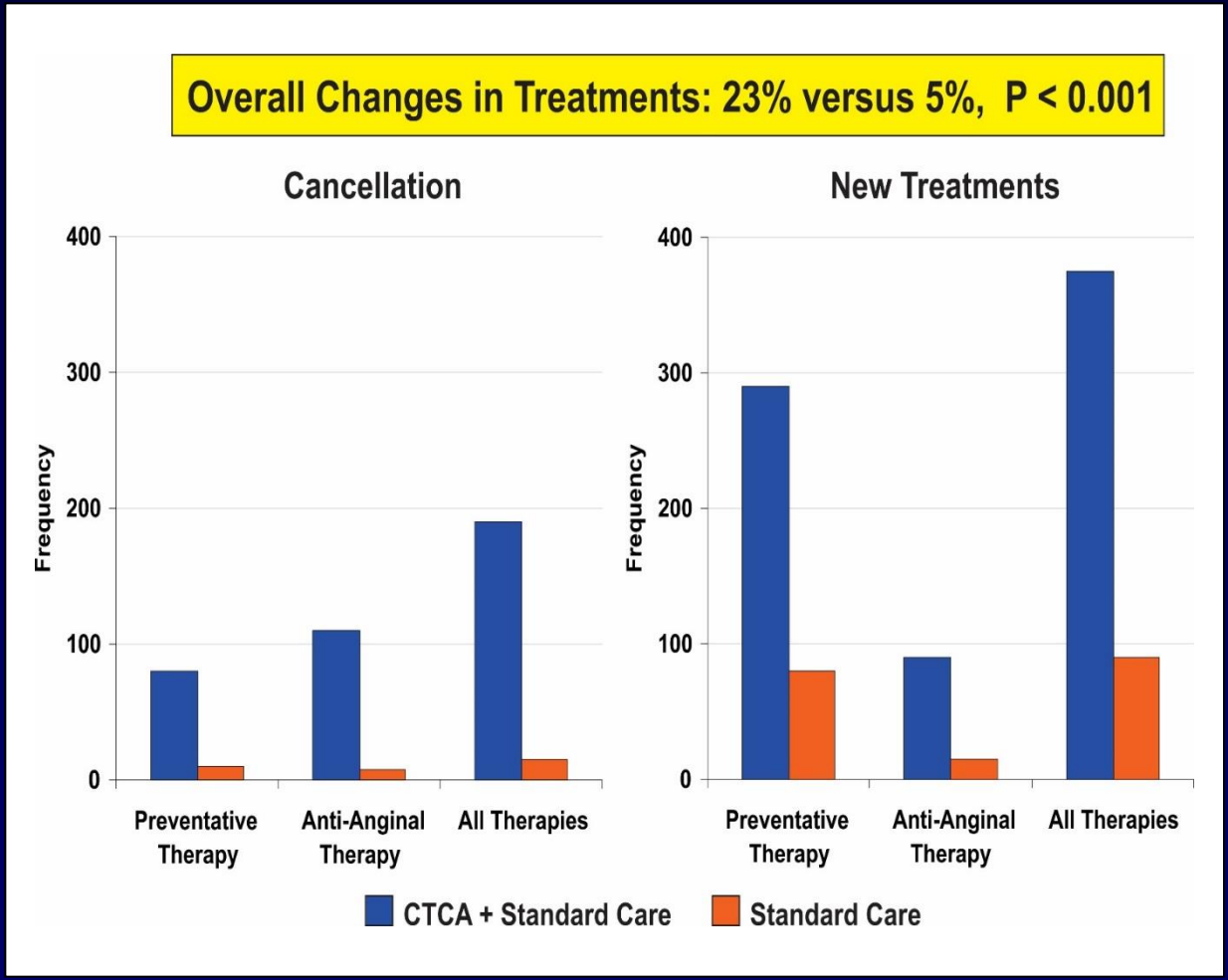


Ruda Zorc-Pleskovič, *et al*.: Preserved EEM in group-1 (Movat's pentachrome)

R. Zorc-Pleskovič, M. Zorc, D. Šuput, A. Milutinović, Inflammatory cells in perivascular adipose tissue and the integrity of the tunica media in atherosclerotic coronary arterie. Bosn J Basic Med Sci., research article, 2020;20(2):183-187 183.

CT Coronary angiography – Medical therapy

Visualization of the plaques affects medical decision-making



Source: The SCOT-HEART investigators Lancet 2015; 385: 2383-2391

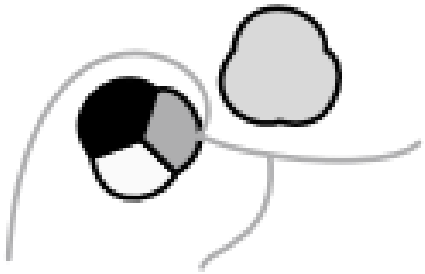
Additional important diagnostics findings

(our experiences)

Anomalies of coronary artery

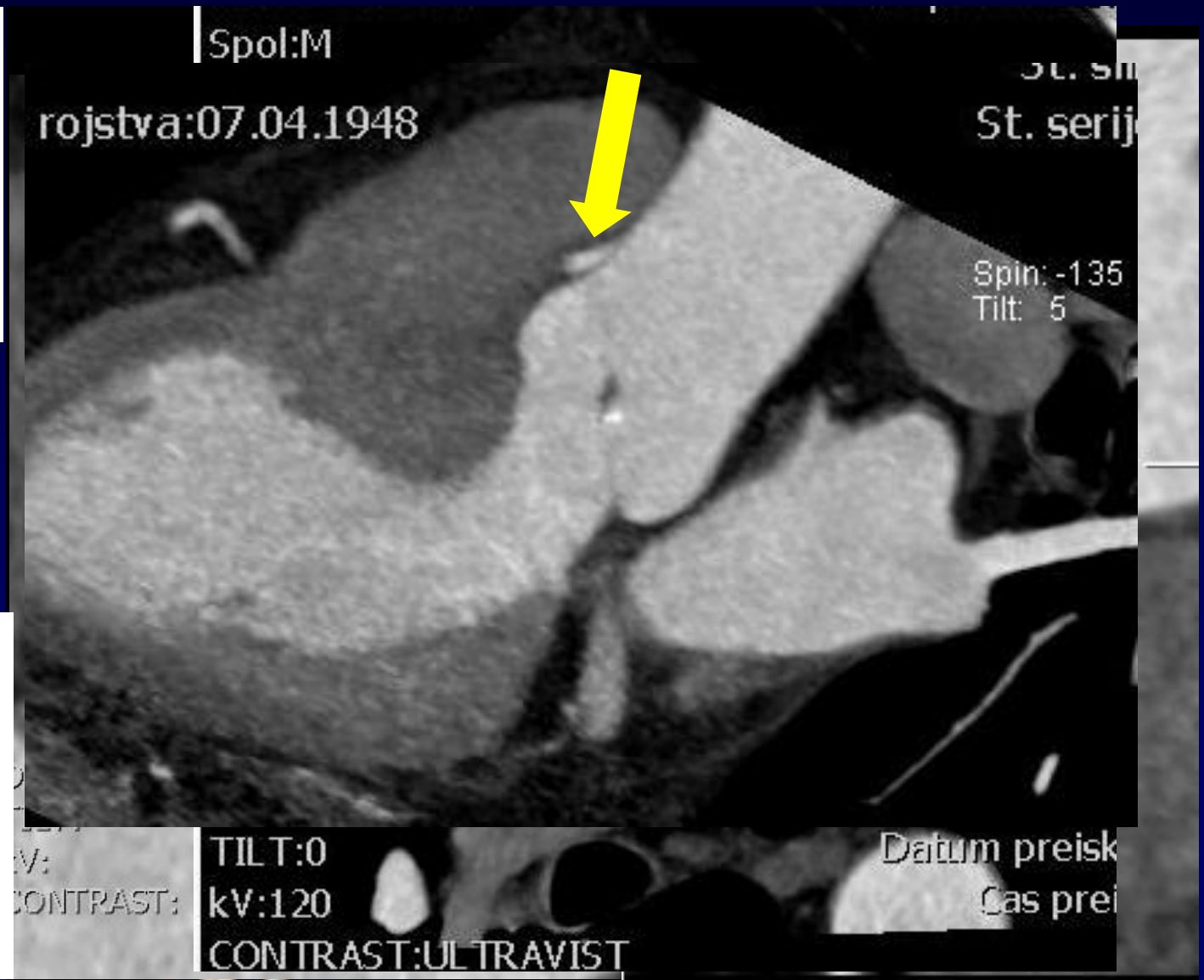
- Relatively rare
- Anomalies of coronary artery might be clinically important at less patients
- Anomalies of coronary artery are present at 1.3 % patients
- Terminology is not standardized
- Mostly benign variants are present
- Study: in 30% of sudden death at young people anomalies of coronary artery are present

Interarterial course

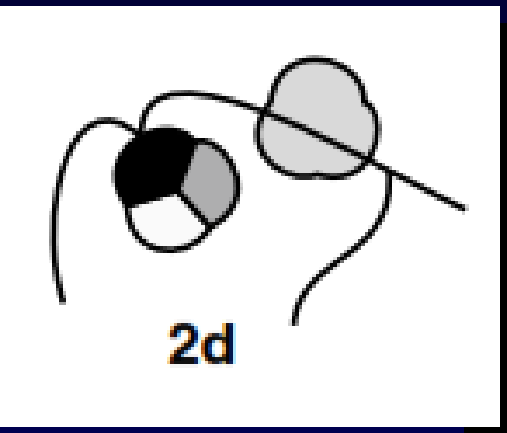


1a

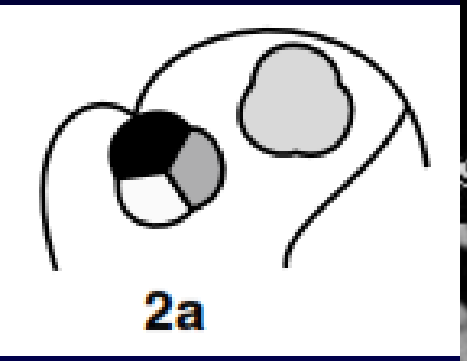
2c



Septal course

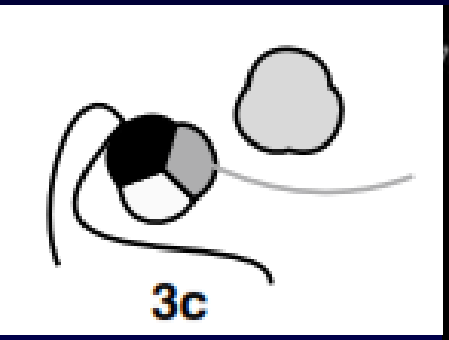


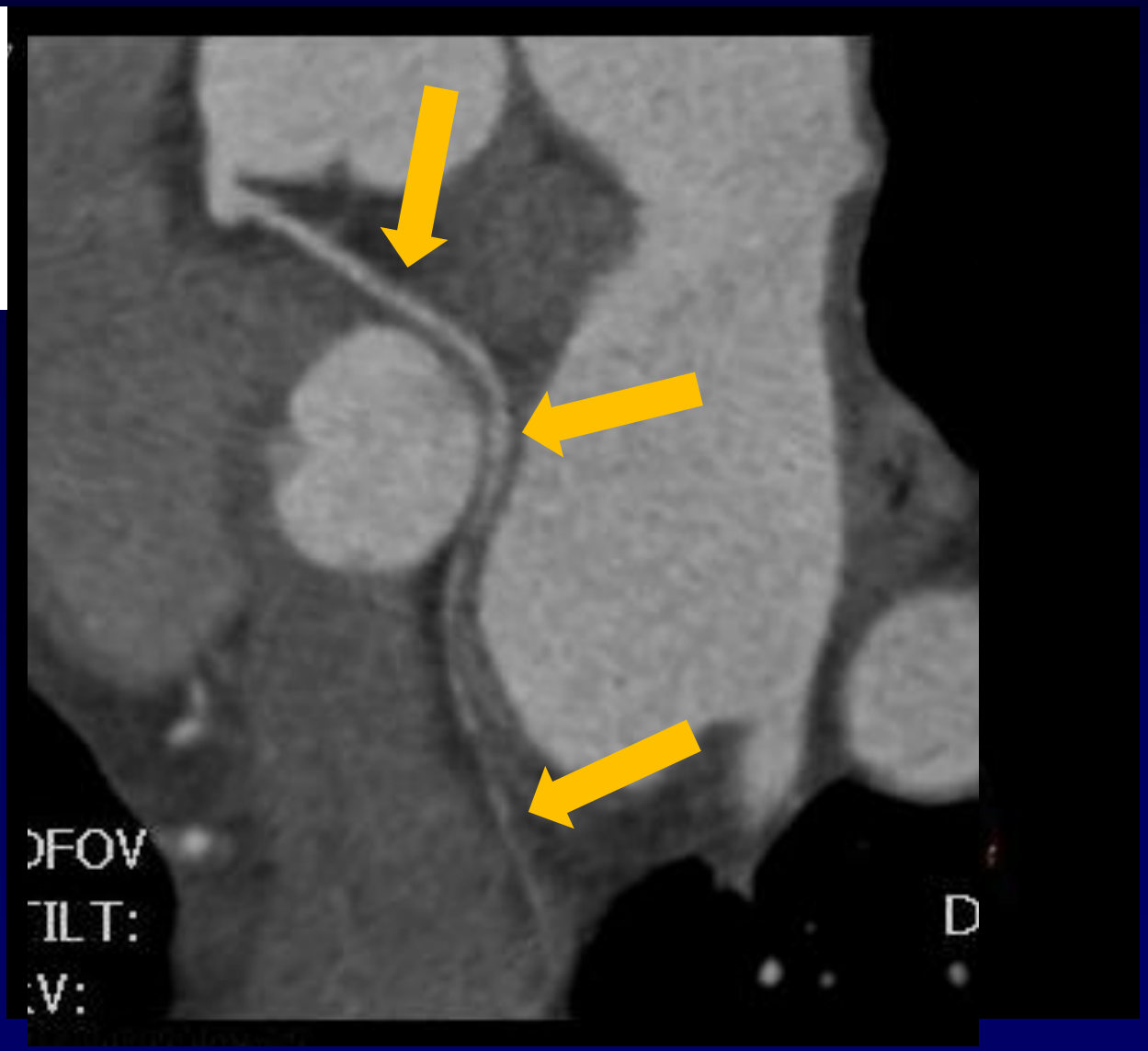
Anterior course



2a

Retroaortic course





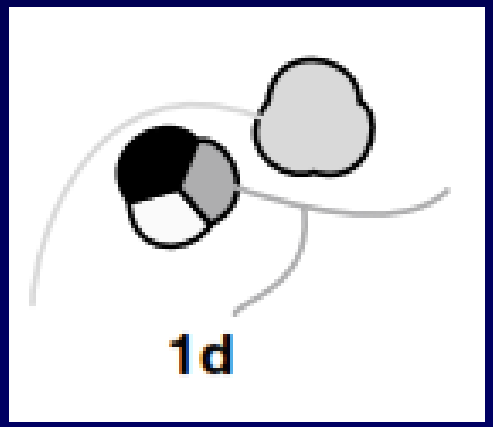
Coronary artery from pulmonary artery

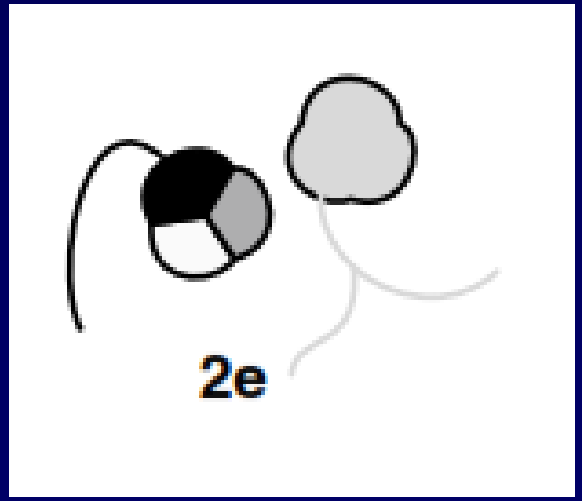
- **From pulmonary artery 1 : 300.000 births**

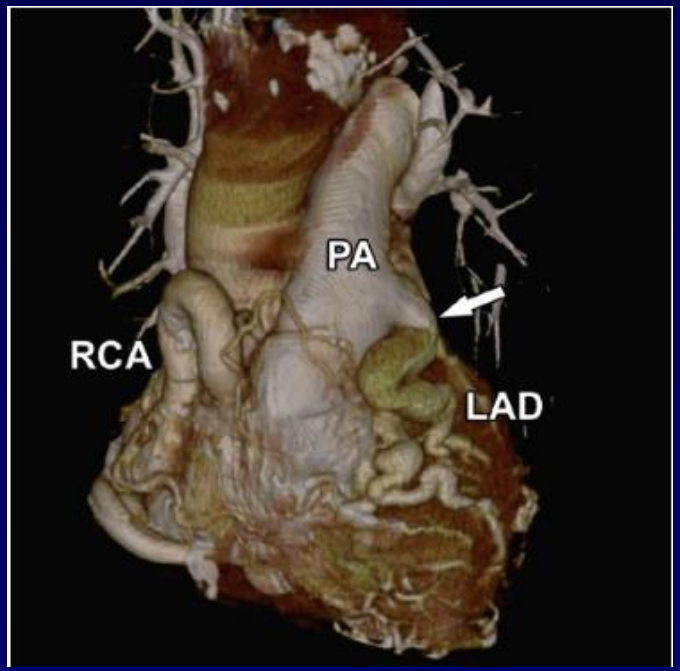
  If it is not treated 90% of children die before they are one year old.

  LCA from PA - RCA from Ao – Bland-White-Garland syndrome

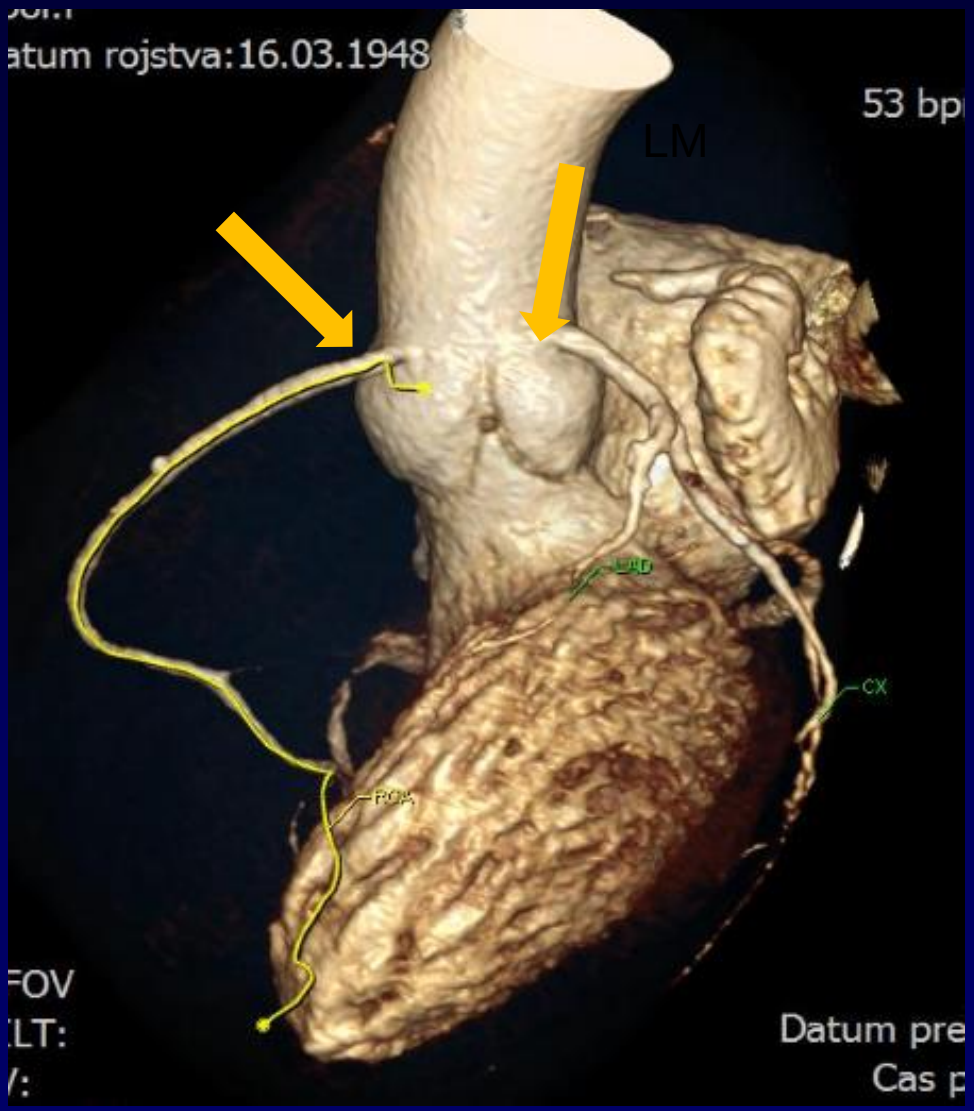
  Usually there are also other anomalies present: DB persistens, tetralogia Fallot, coarctation, VSD …



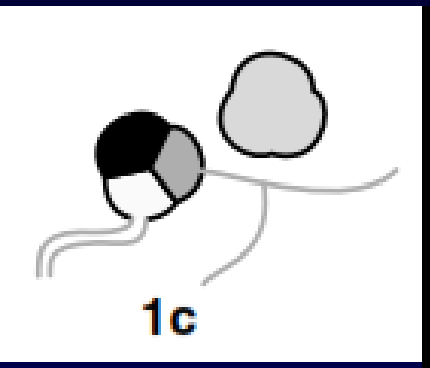


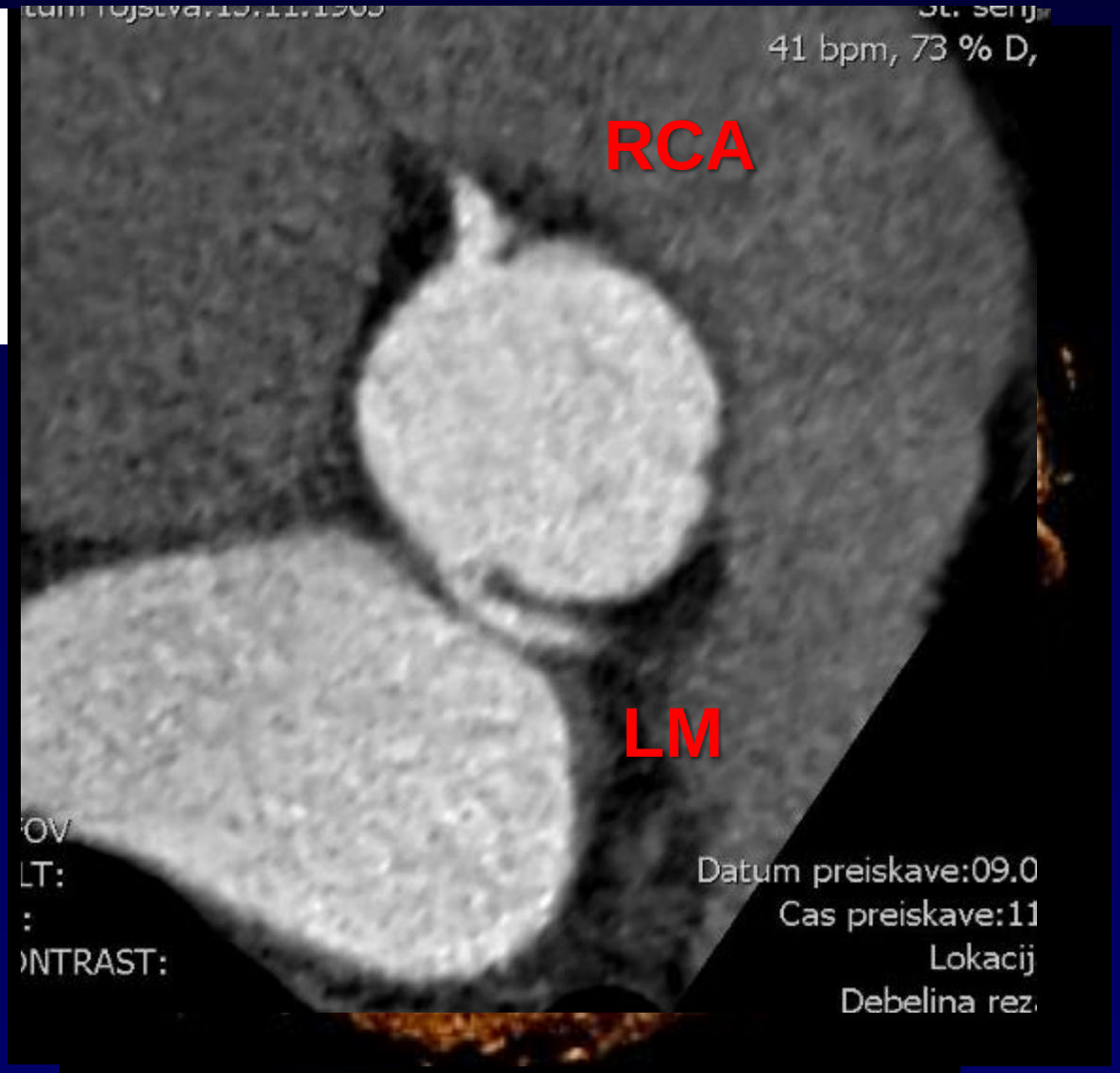


Abnormal location of coronary artery ostium – outside of coronary sinus



Non coronary sinus valsalva



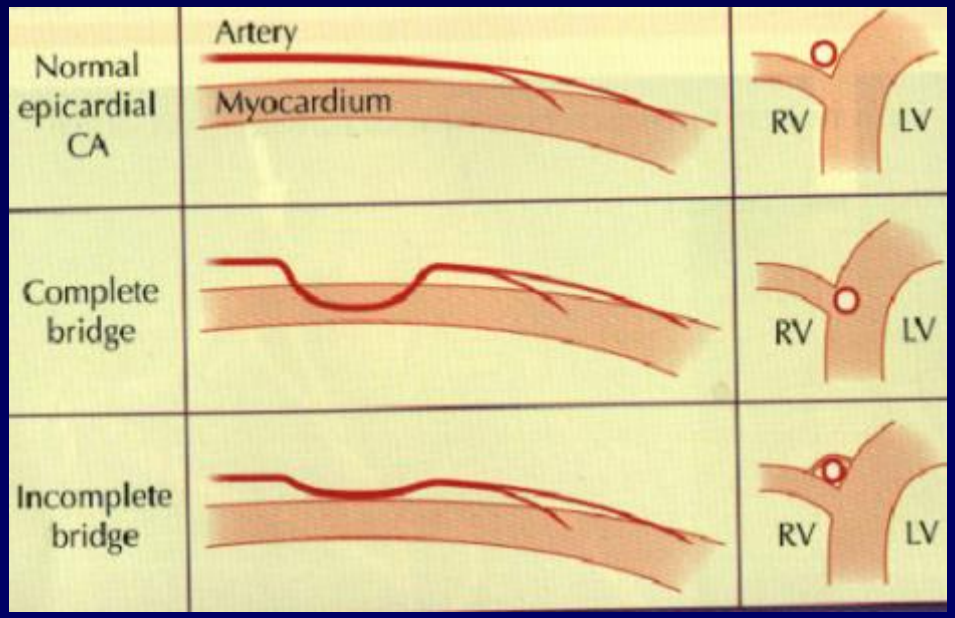


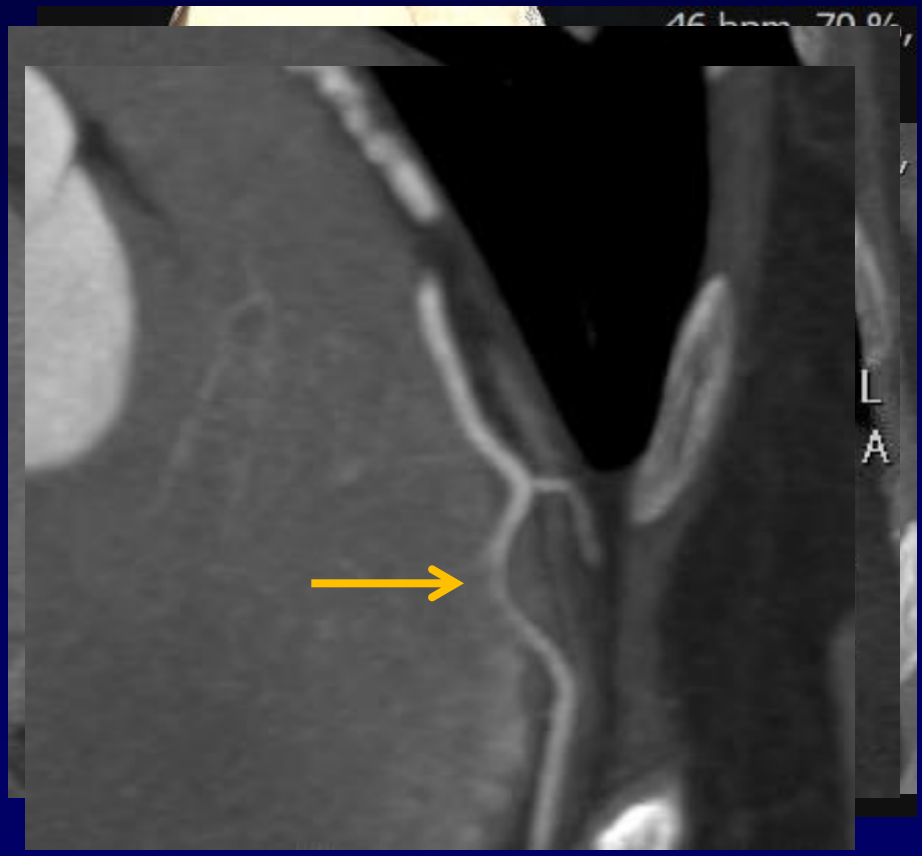
Myocardial bridging

- **Usually in the middle of LAD**

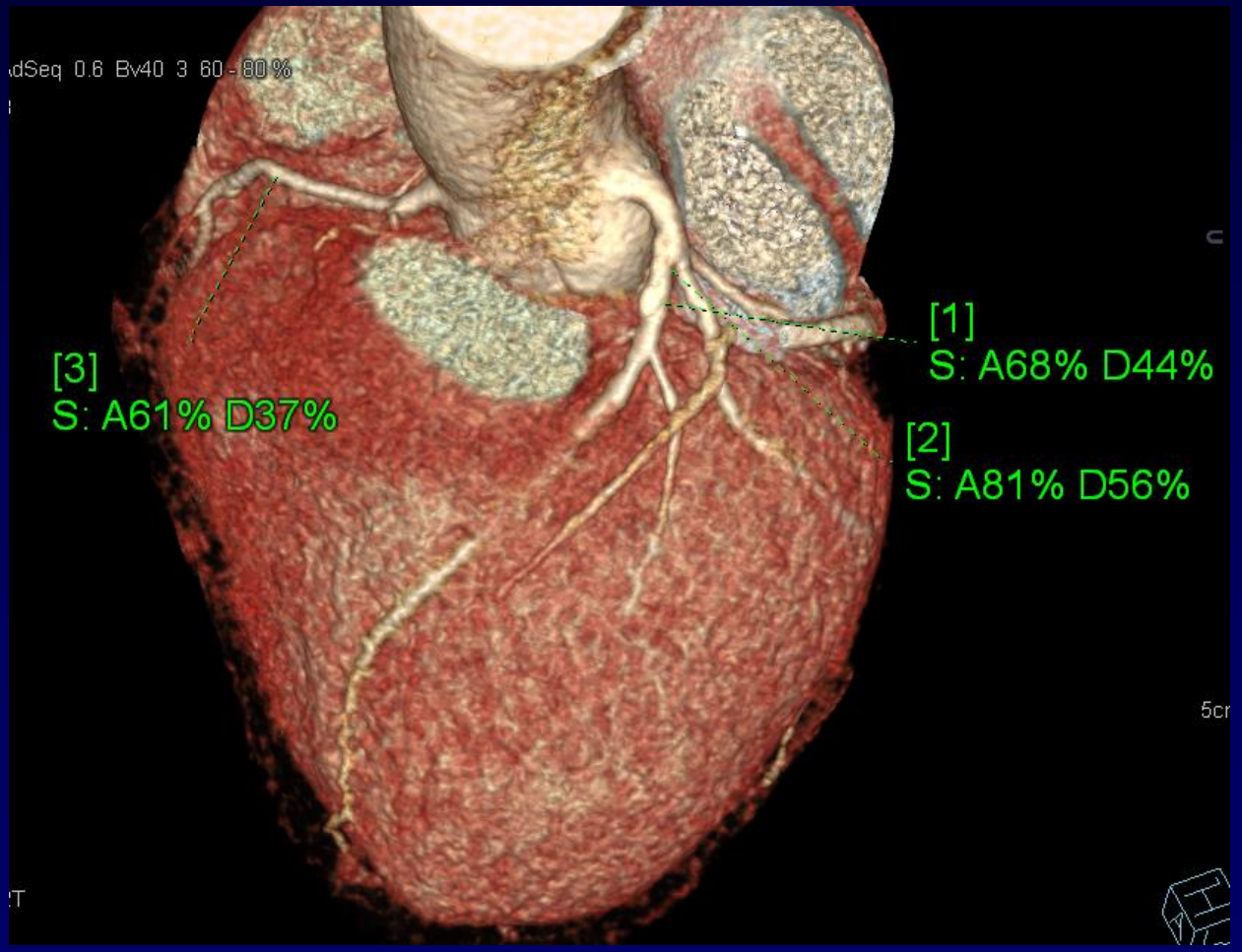
  - Complete bridging was found at 20% of healthy asymptomatic patients

  - Myocardial bridging is very rare reason for Syn AP, AMI, arythmies and sudden death

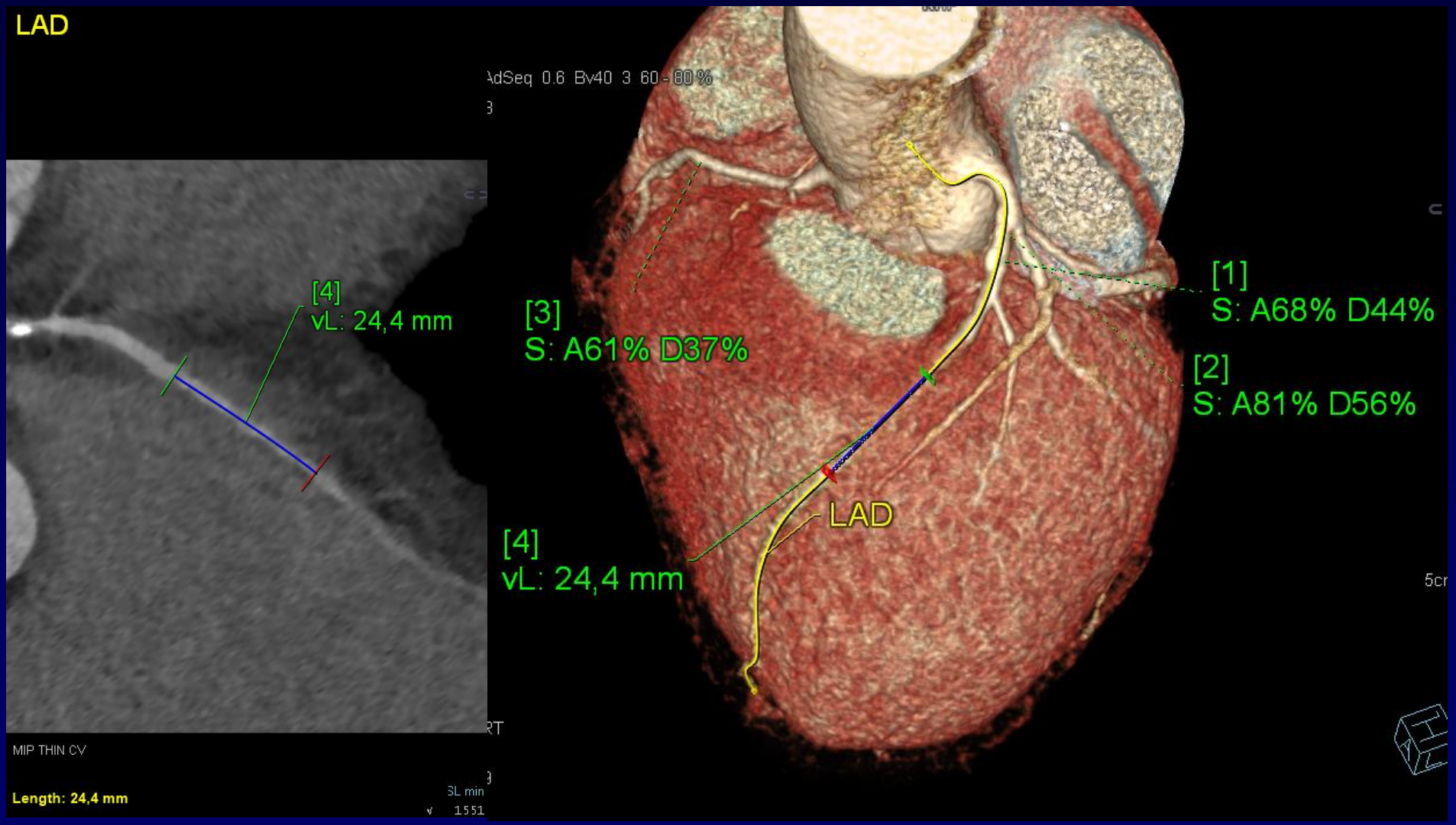




Bridging LAD, without markers, measurement of lenght

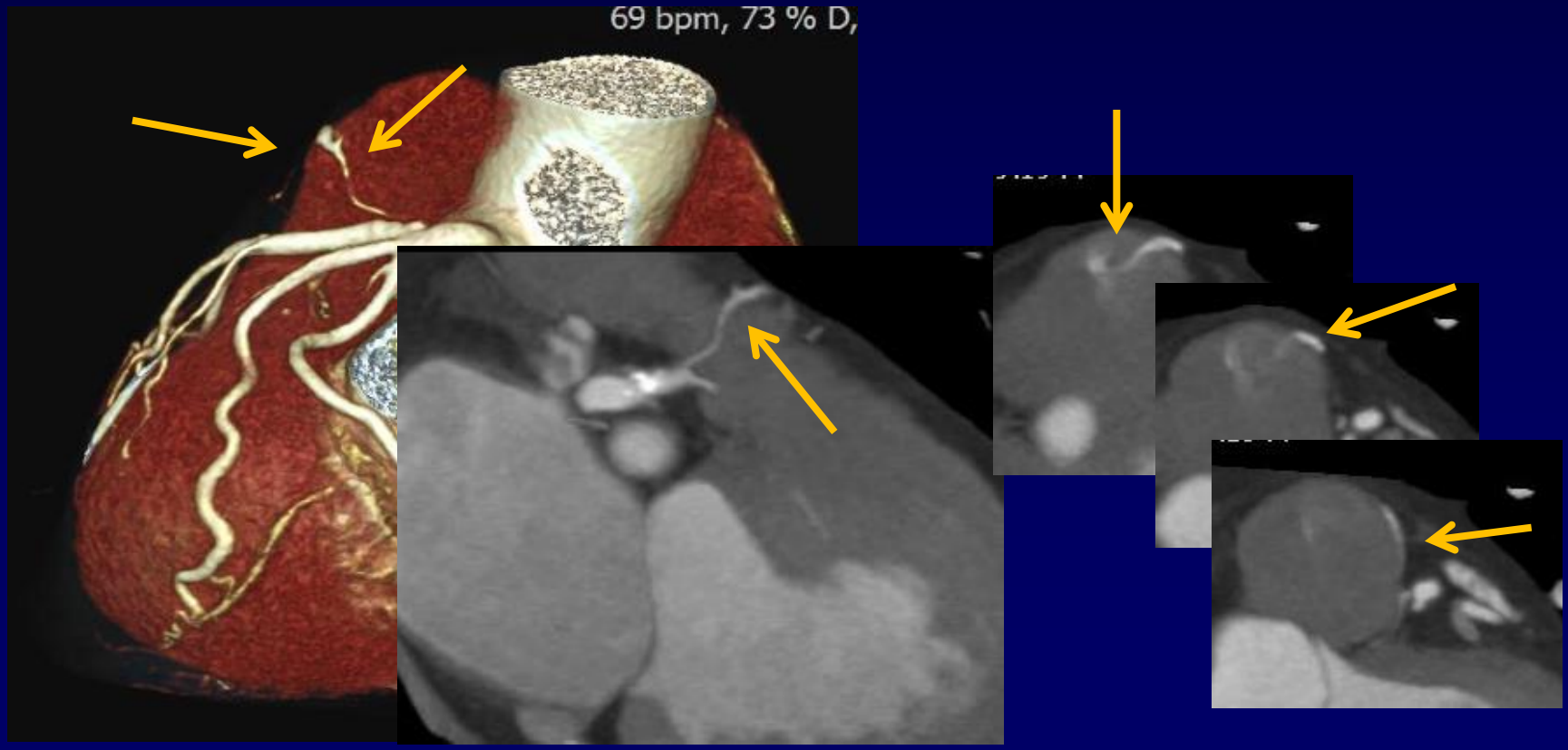


Bridging LAD
Analysis with SYNGO.VIA software
Besides bridging LAD also measurement of lenght and measurements of stenosis LAD (1,2), RCA3 could be noticed



Anomalies of coronary termination

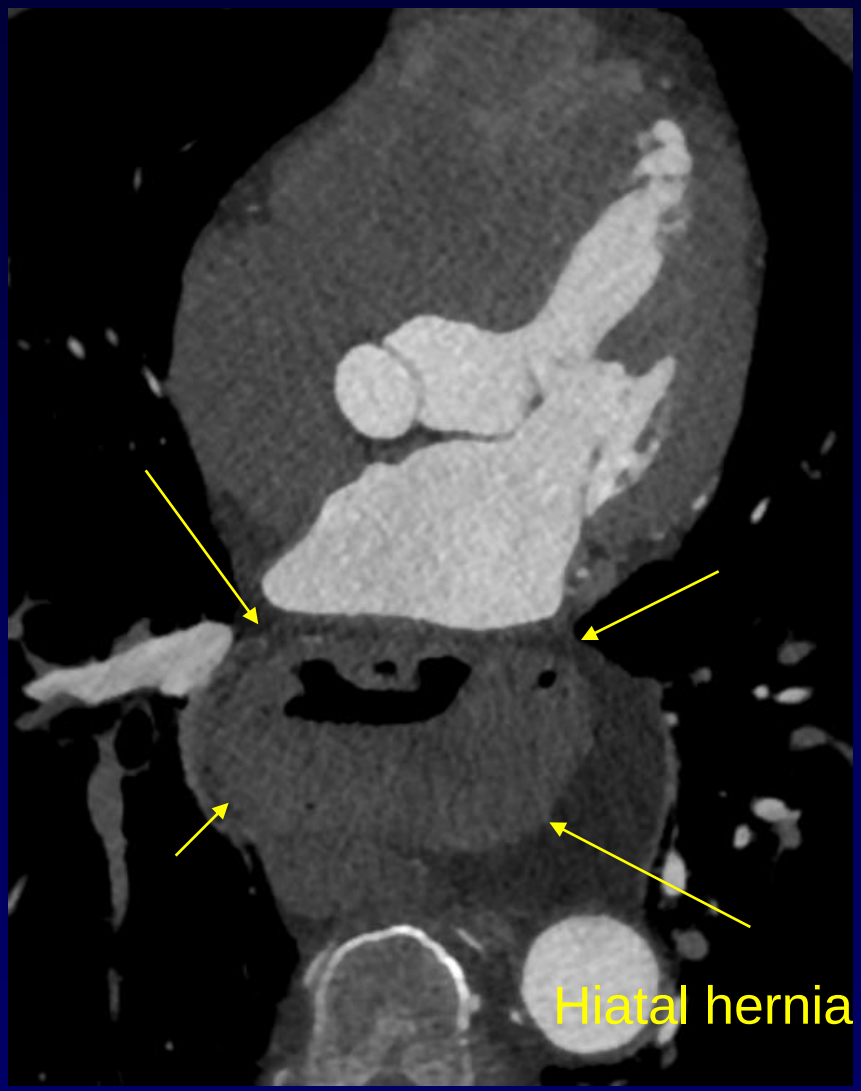
- **Anomalies of termination**
  - Coronary artery fistula
  - Abnormal junction between coronary artery and pulmonary artery, coronary sinus, cardiac cavity: 0.1-0.2% patients

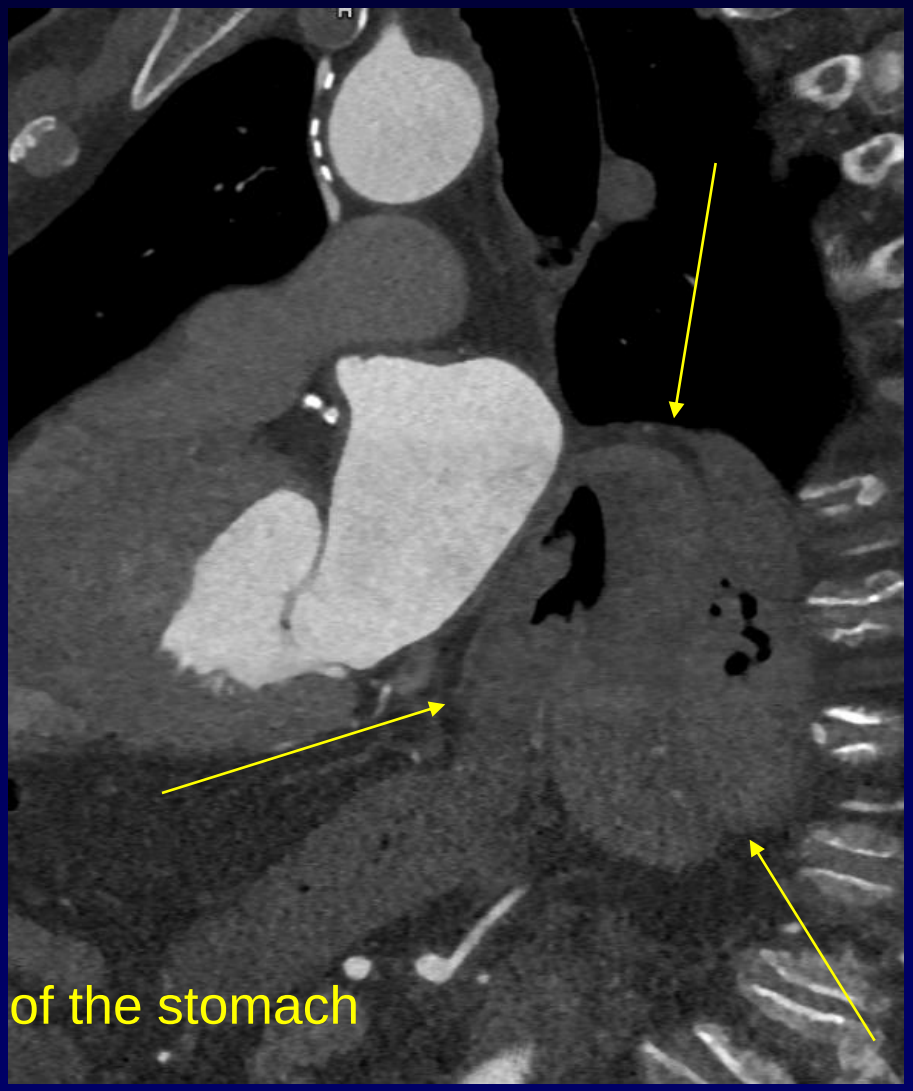


Additional benefit of CT Coronary angiography

- Personal patients treatment (our view)
- Multidiciplinary patient treatment (Javier Ruiz Aburto)
- Multi-analisysis approach for the benefit of the patient (our radiologists strategy)

Multi-analisysis approach for the benefit of the patient (our radiologists strategy)

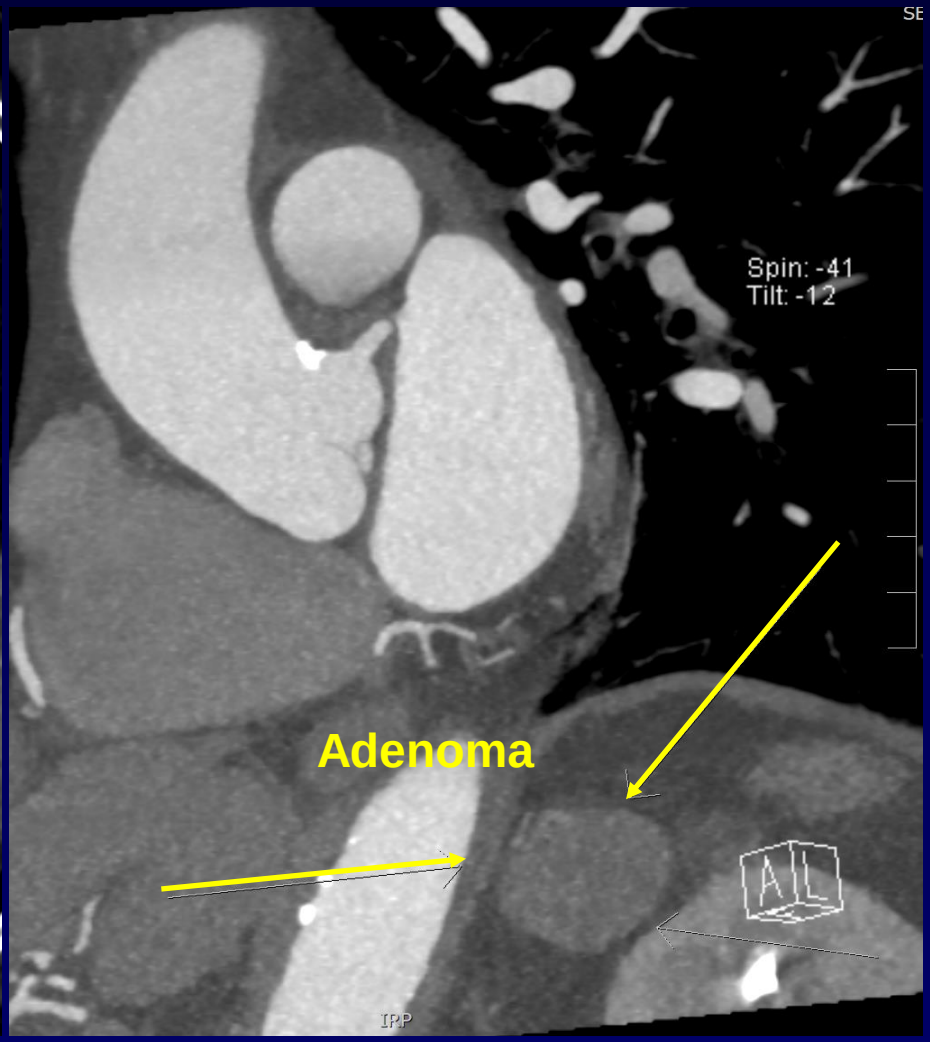




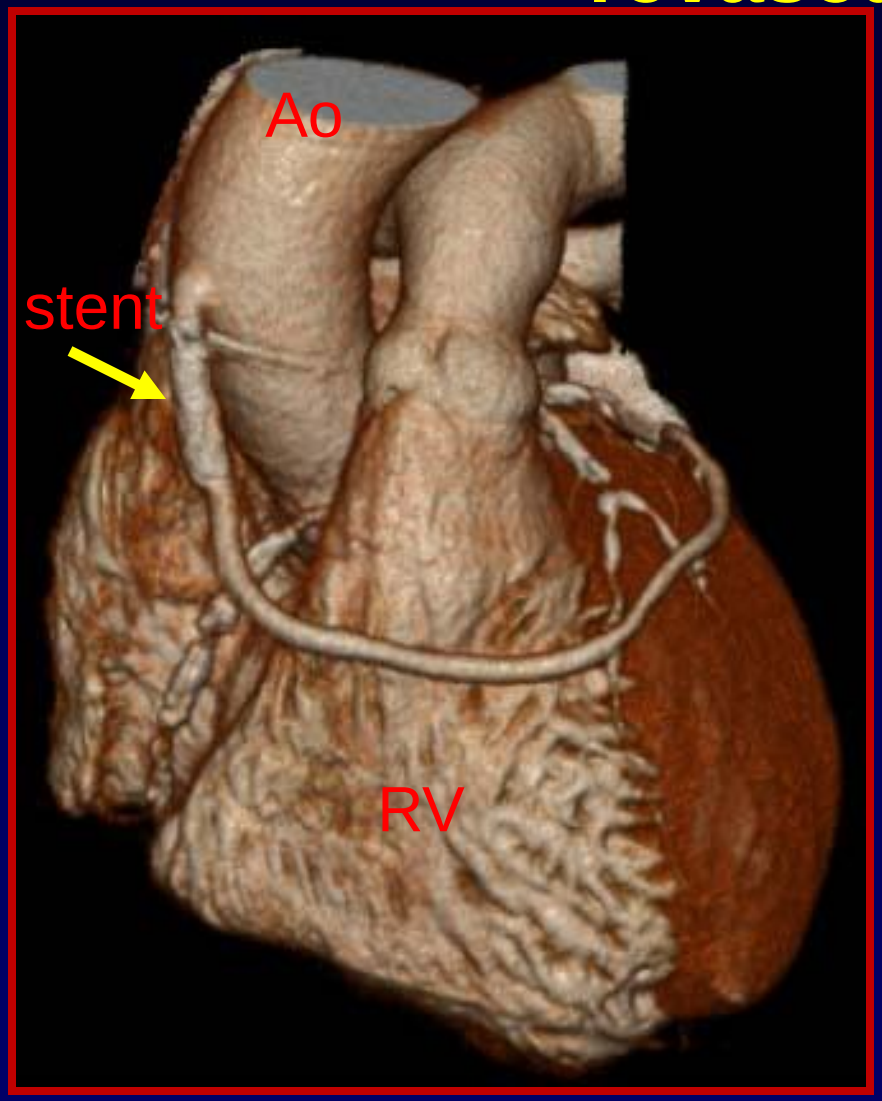
Hiatal hernia of the stomach

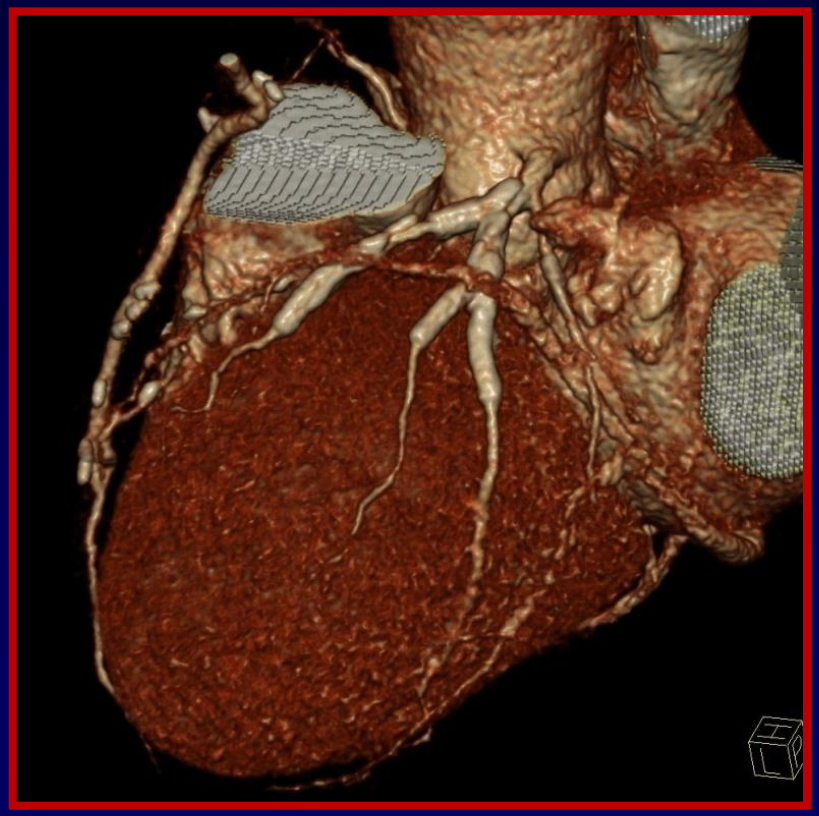
Tumor formation in the lung

Tumor formation in suprarenal gland



CT Coronary angiography is the best choice to guide coronary revascularization

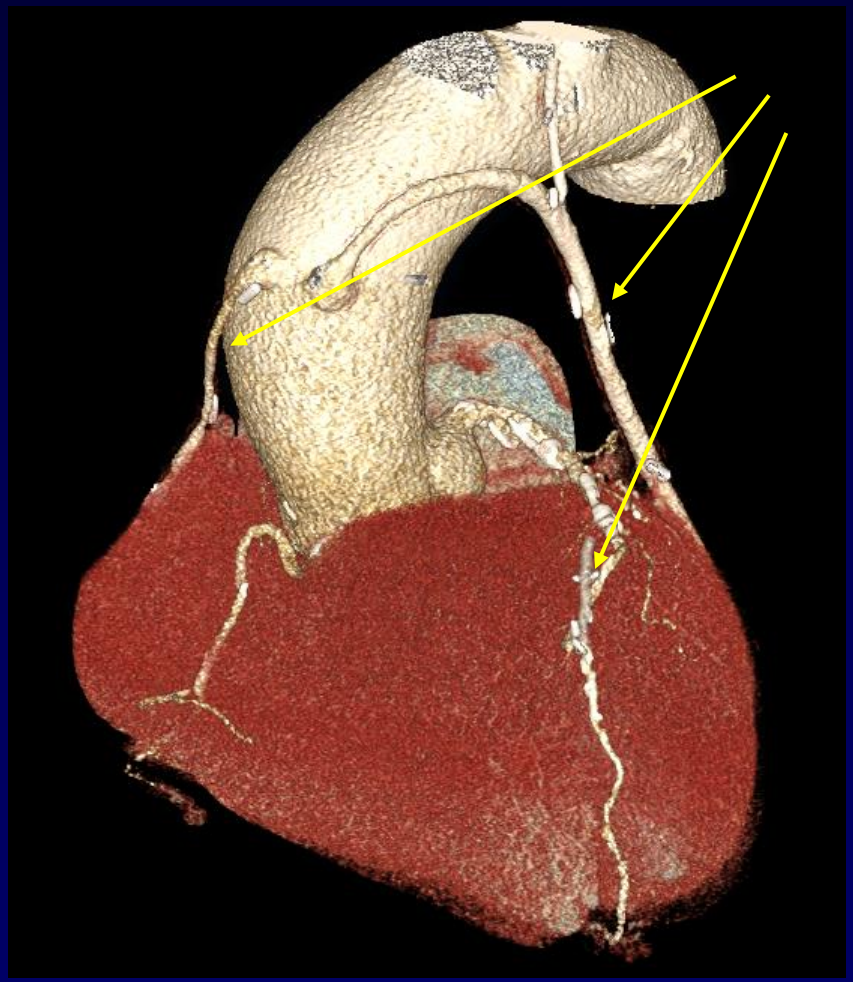


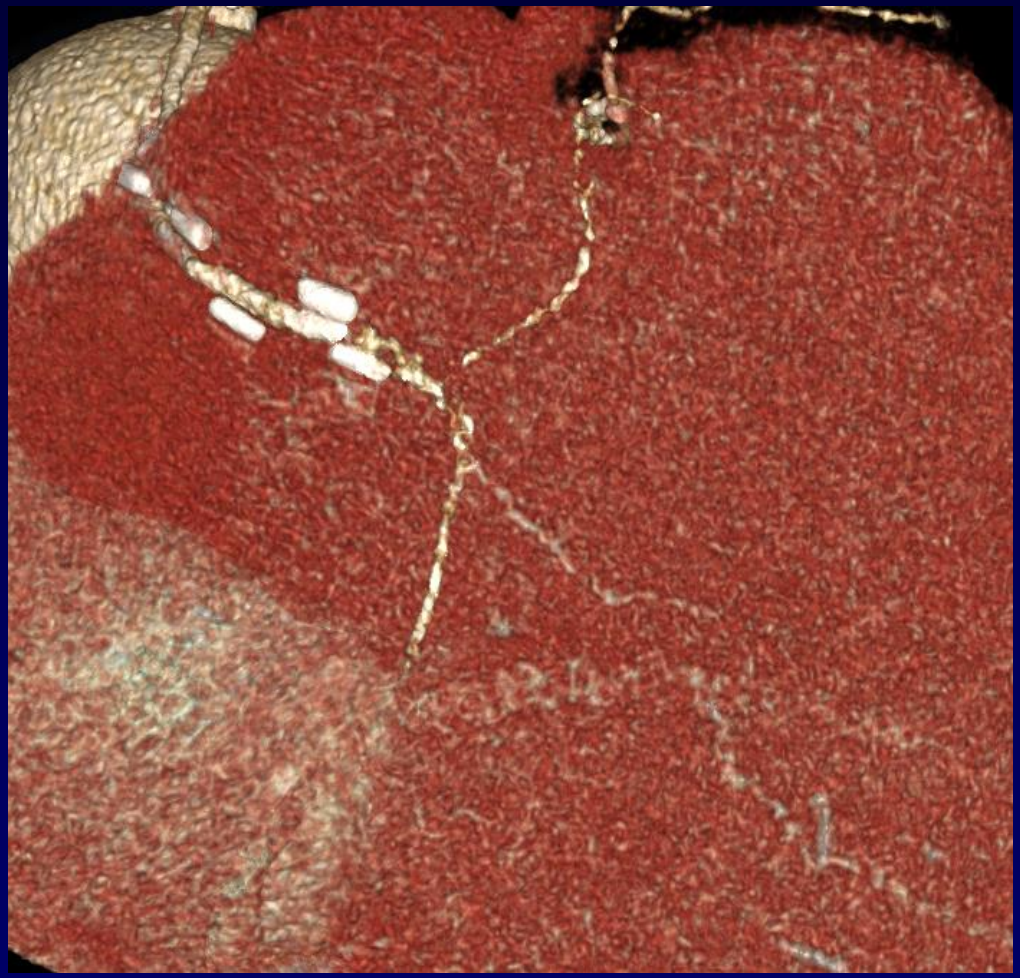


By-pass analysis

Stenosis of AO-RCA graft

Stenosis of AO-RCA graft
Besides stenosis of AO-RCA graft there are also AO-LCX, LIMA-LAD





Conclusions

CT Coronary angiography could help us to choose proper treatment for our patients

Conclusions

MC Medicor experiences

- We predict, that CT angiography will replace invasive coronary angiography (the idea of professor Gurfinkel more than 15 years ago).
- CT angiography is cost effective for the society and more kind for the patients.
- The cat-labs in new era will be upgraded in the „interventional suites“.

The main message of the DISCHARGE is:

- CT may represent an effective gatekeeper in enriching the low-risk population of patients referred for invasive coronary angiography;
- it is not currently ready to be utilized for final therapeutic decision-making;
- development is swift and CT technology is catching up on its invasive counterpart.

European Heart Journal Supplements (2022) 24 (Supplement I), I25-I28
The Heart of the Matter
https://doi.org/10.1093/eurheartjsupp/suac067

ESC
European Society
of Cardiology

Computed tomography to replace invasive coronary angiography? The DISCHARGE trial

Leonardo Bolognese * and Matteo Rocco Reccia

Cardiovascular Department, Azienda Ospedaliera Toscana Sudest, Arezzo, Italy

Coronary Computed Tomographic Angiography for Complete Assessment of Coronary Artery Disease

Patient with chest pain

Case history
- Risk profile
- Physical examination
- **ECG at rest**
- Blood work **(cardiac biomarkers)**
- Chest X-ray

"Stable angina":
- ECG nondiagnostic
- Troponin normal

Invasiveness is required only for revascularization

Cardiac CT as "1-stop shop"
- CT - Angiography (stenosis detection)
- CT - Fraction flow reserve (epicardial conductance)
- CT - Perfusion with hyperemia (microcirculation)
- CT - Plaque anatomy (tissue composition, morphology, high-risk lesion)
- CT - Inflammation
- CT - Ejection fraction
- CT - Wall motion analysis
- CT - Leaman score, anatomic or functional SYNTAX score
- CT - Calcification activity

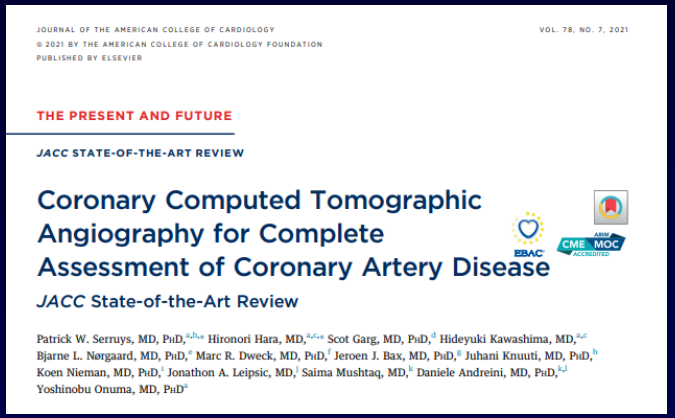
Cath lab

Carefully planned coronary intervention based on pre-existing information: interventional suite

Operating room

Bypass surgery

- Pristine coronaries
- Nonobstructive disease; is a risk for cardiovascular events; needs primary prevention



Serruys et al., A Noninvasive Approach to Plaque Anatomy, Ischemia, and Risk. JACC, vol. 78 , No. 7, 2021: 713-736


PREVENTION
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My Vision for the Future … ?
Interventional Prevention
Disease without inducing damage …