관상동맥 CT 검사의 이해

성균관대학교 삼성창원병원
순환기내과 오주현

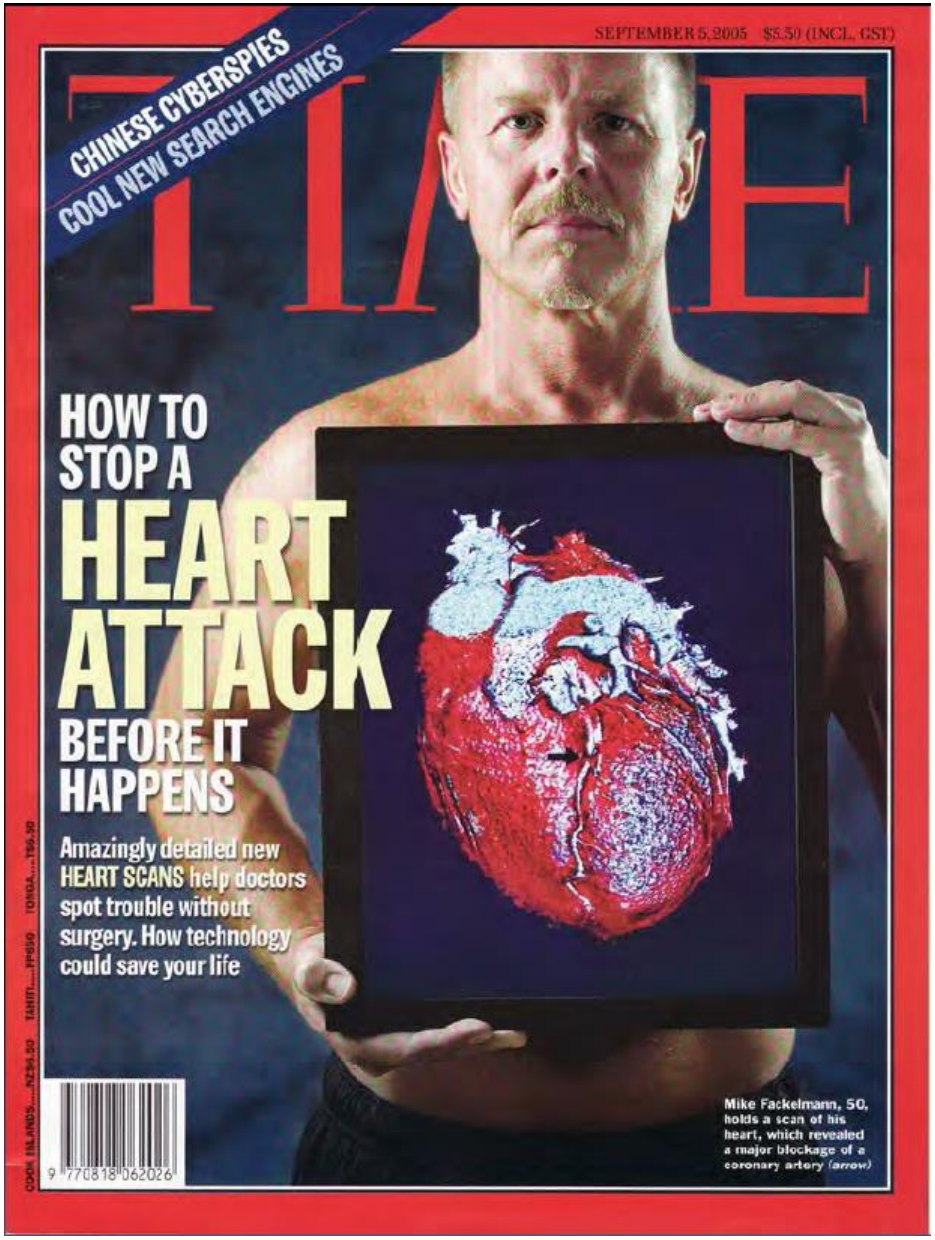
Imaging Options for Assessment of Coronary Artery Disease

- Coronary angiography

noninvasive

- Echocardiography
- Nuclear cardiac imaging
- Cardiac MRI
- Cardiac CT

2005.9.5. TIME



HEALTH & MEDICINE

How New Heart-Scanning Technology Could Save Your Life

(Health)

More and more, doctors are diagnosing coronary disease without any invasive tests whatever

Do You Know Your Calcium Score?

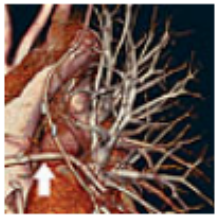
(Health)

The Newest Risk Factor

Interactive

Your Choices in Heart Scans

Here's a guide to the many choices available



Multimedia

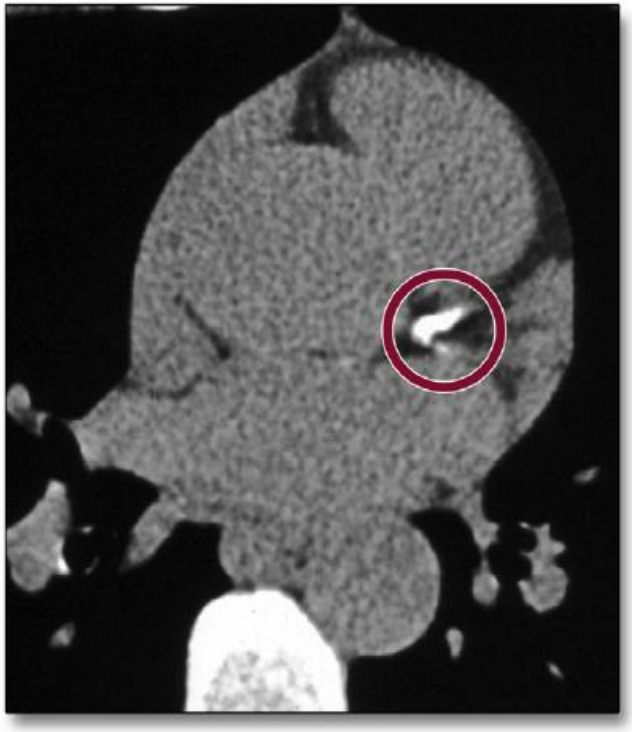
A Look Inside

The new 64-slice CT scanners enable more accurate diagnoses

Coronary Aartery Calcium Score

Agatston Score

Agatston Lesion Score = Lesion Area x Density Weighting Factor
Total Agatston Score = Σ Lesion Scores



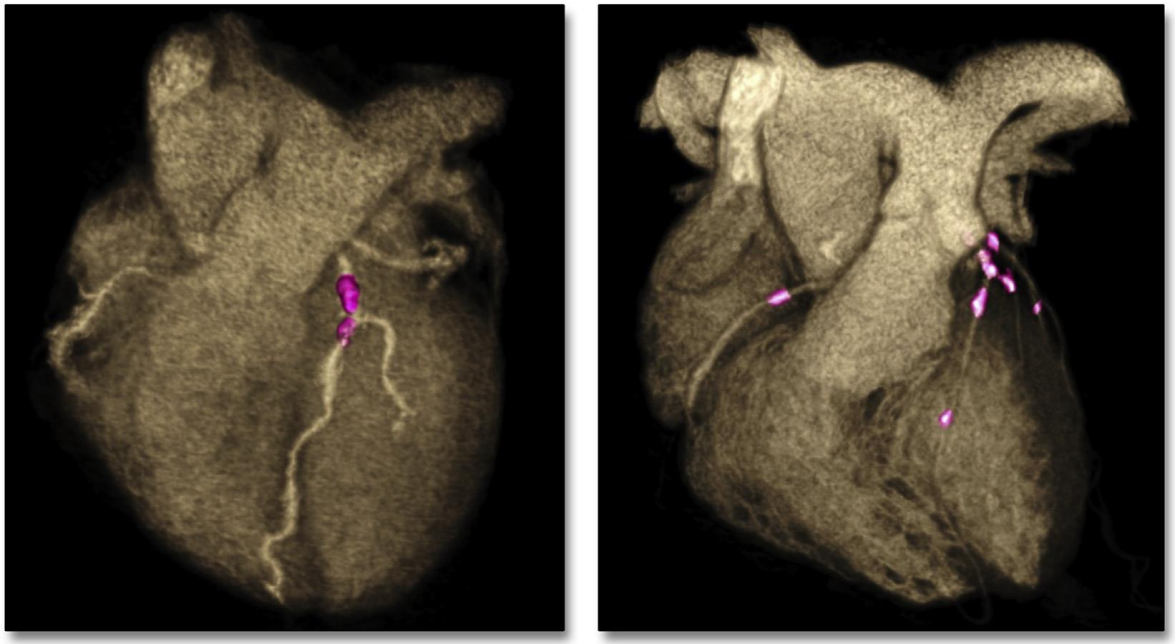
Left Coronary Descending
Area = 15 mm², Peak = HU = 450
Lesion Score = 15 x 4 = 60

Peak Attenuation Weighting Factor

Hounsfield Units	
130** - 199	1
200 - 299	2
300 - 399	3
>400	4

Right Coronary Descending
Area = 8 mm², Peak = HU = 290
Lesion Score = 8 x 2 = 16

Comparison of the Agatston Score and Advanced CAC Metrics



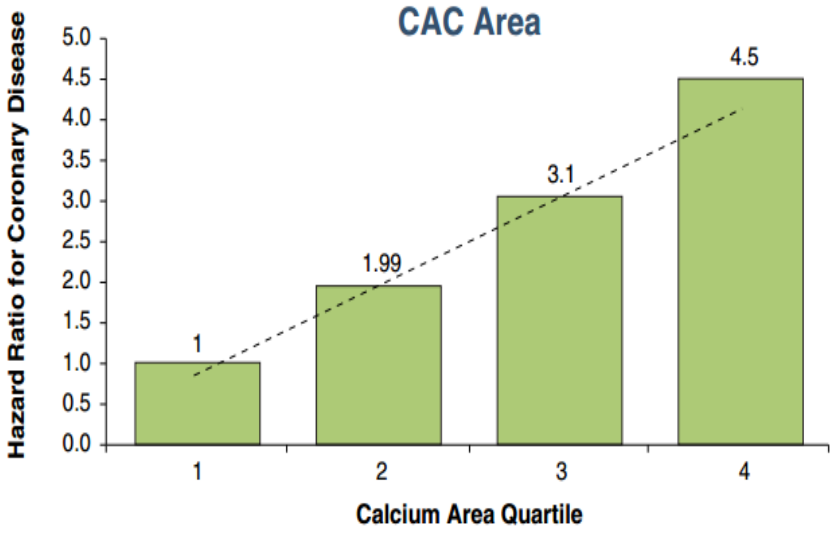
Agatston Score = 200
Area of CAC = 50 mm^2
Mean Density = 450 HU (weighting factor = 4)
Number of Vessels = 1
Pattern = Concentrated
Number of Lesions = 2
Lesion Type = Large

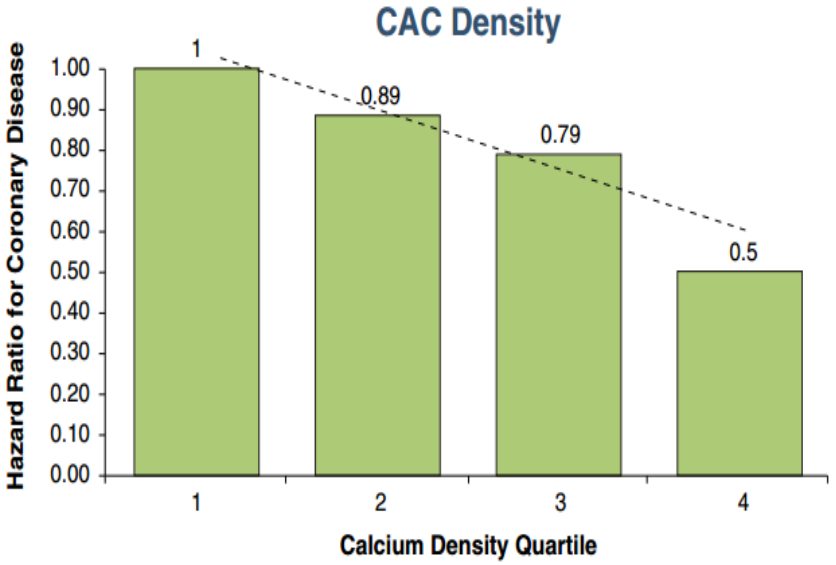
Agatston Score = 200
Area of CAC = 100 mm^2
Mean Density = 232 HU (weighting factor = 2)
Number of Vessels = 4
Pattern = Diffuse
Number of Lesions = 8
Lesion Type = Small

The Agatston CAC score for each scan is 200.
However, the 2 scans vary in their CAC area, CAC density, regional distribution of CAC, total number of calcified lesions, and average lesion size.

JACC Cardiovasc Imaging. 2017:923–37

Relationship of CAC Volume and CAC Density to Coronary Risk

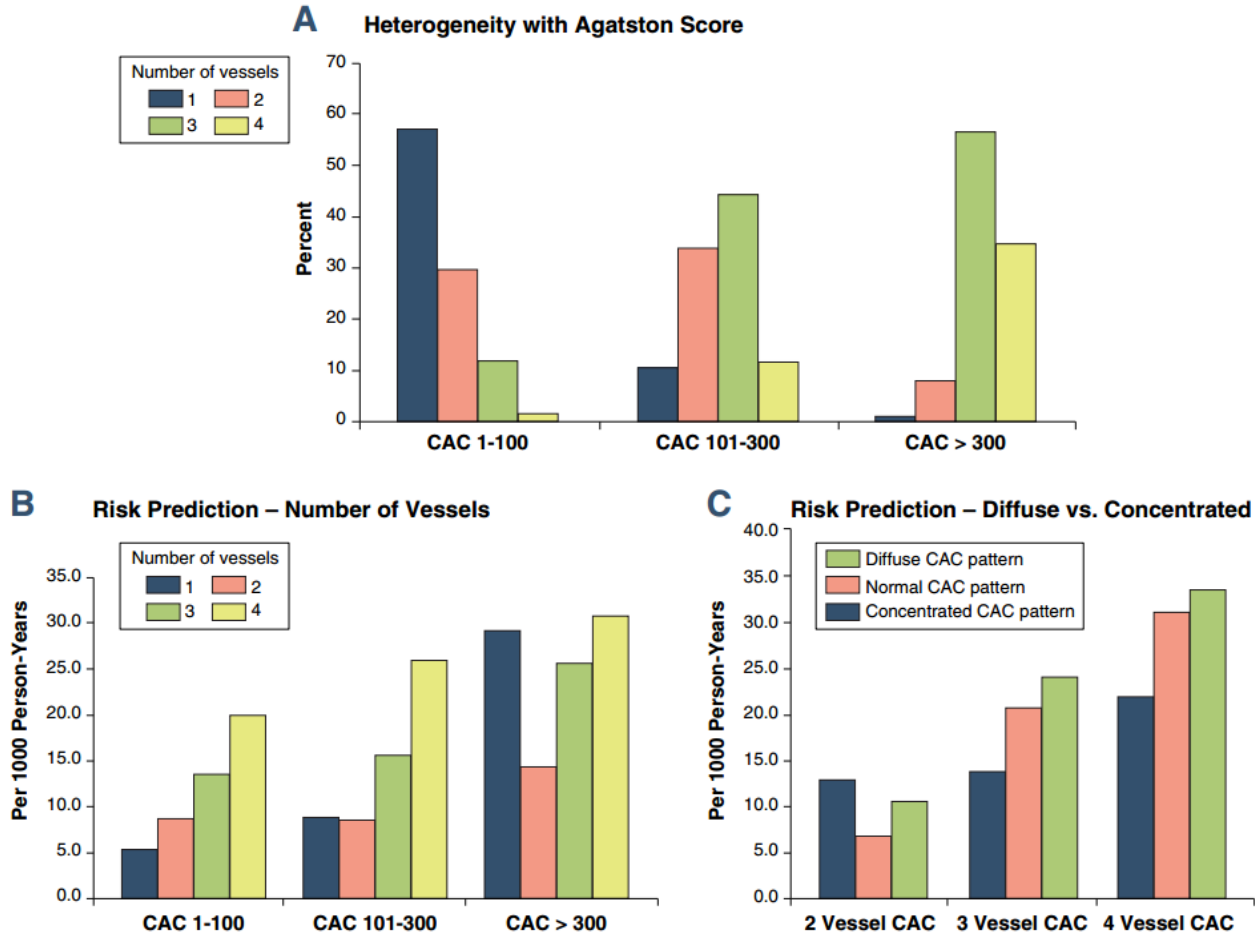




In adjusted models, although there is positive association between CAC volume and coronary risk, there is an inverse relationship between CAC density and risk.

JAMA 2014;311:271-8

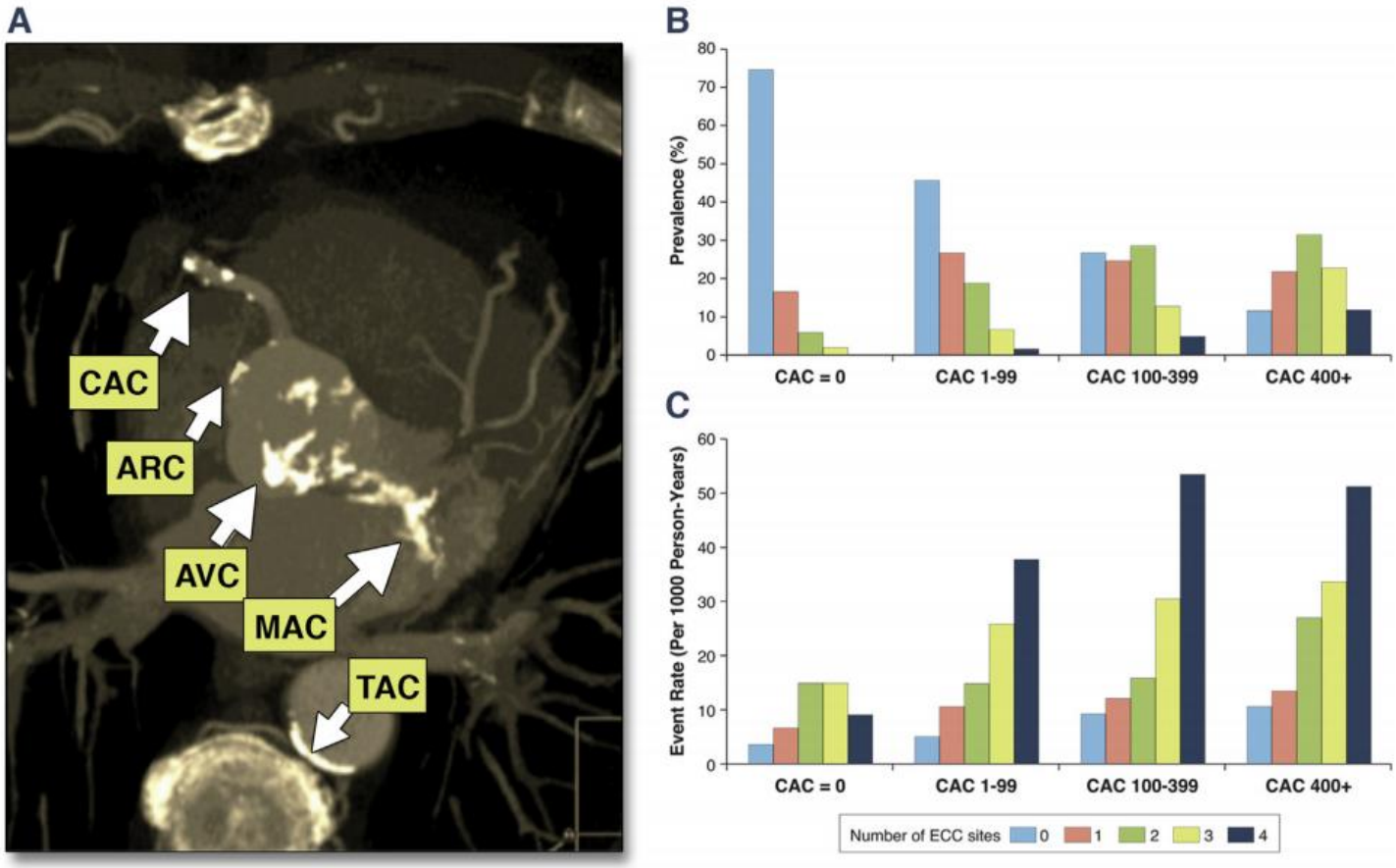
Regional Distribution of CAC and Coronary Risk



(A) The heterogeneity between Agatston CAC score and number of vessels with CAC, demonstrating a variety of CAC patterns among individuals with intermediate Agatston CAC scores. (B and C) Enhanced risk prediction when accounting for number of vessels with CAC and overall CAC pattern, respectively

J Am Colls. Cardiol Img 2014;476–86

Extracoronary Calcification on Routine Cardiac CT



Accounting for extracoronary calcification improves risk prediction beyond the Agatston CAC score.

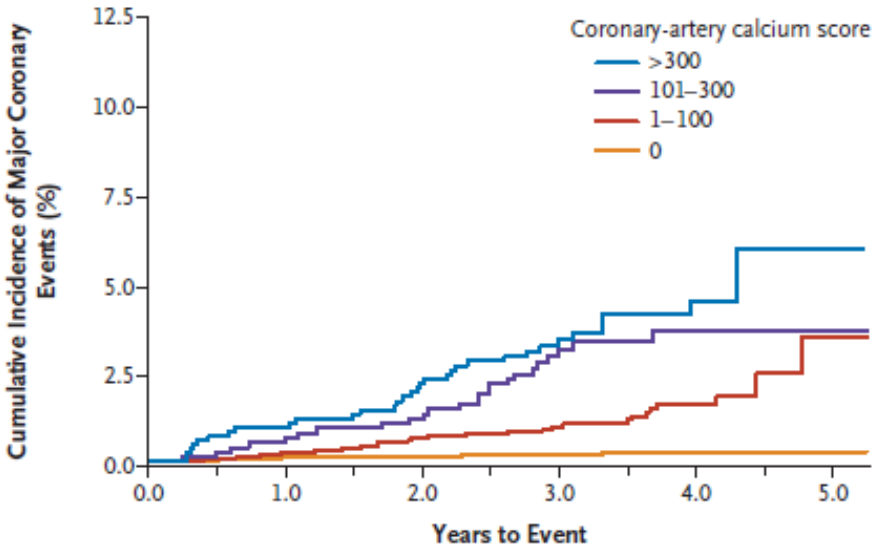
J Cardiovasc Comput Tomogr 2015;9:406–14

Coronary calcium as a predictor of coronary events in four racial or ethnic groups

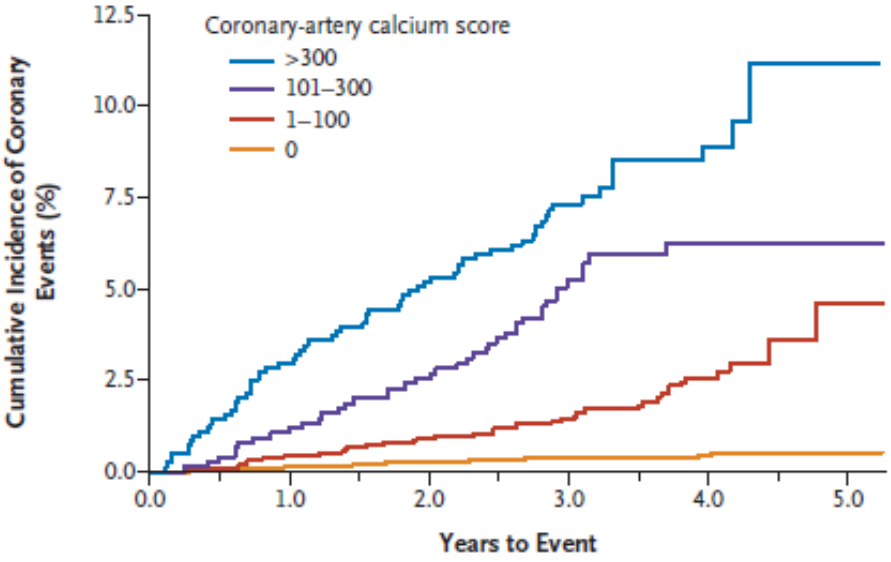
평균 62세, 6722 명(3.8 년 추적)

White - 38.6%, black - 27.6%, Hispanic - 21.9%, Chinese – 11.9%

심근경색증 또는 관상동맥질환에 의한 사망



관상동맥 사건



관상동맥 석회화 점수가 2배 증가할 수록 심근경색증 또는 사망이 20% 증가하고, 관상동맥 사건 발생이 26% 증가한다

NEJM. 2008;358:1336-45

Coronary calcium as a predictor of coronary events in four racial or ethnic groups

Table 4. Risk of Coronary Heart Disease Associated with Coronary-Artery Calcium Score in Four Racial or Ethnic Groups.*

Racial or Ethnic Group	Major Coronary Event†			Any Coronary Event		
	No.	Hazard Ratio (95% CI)‡	P Value	No.	Hazard Ratio (95% CI)‡	P Value
White	41	1.17 (1.06–1.30)	<0.005	74	1.22 (1.13–1.32)	<0.001
Chinese	6	1.25 (0.95–1.63)	0.11	14	1.36 (1.12–1.66)	<0.005
Black	18	1.35 (1.16–1.57)	<0.001	38	1.39 (1.25–1.56)	<0.001
Hispanic	24	1.15 (1.02–1.29)	<0.025	36	1.18 (1.07–1.30)	<0.001

* CAC denotes coronary-artery calcium score, and CI confidence interval.
† Major coronary events were myocardial infarction and death from coronary heart disease.
‡ Hazard ratios were calculated with the use of Cox regression for coronary heart disease (major event and any event) for baseline levels of $\log_2(CAC+1)$ after adjustment for risk factors and interactions between racial or ethnic group and coronary calcium score and between racial or ethnic group and diabetes (the only significant interaction). Hazard ratios are calculated on the basis of a doubling of CAC+1.

CONCLUSIONS:

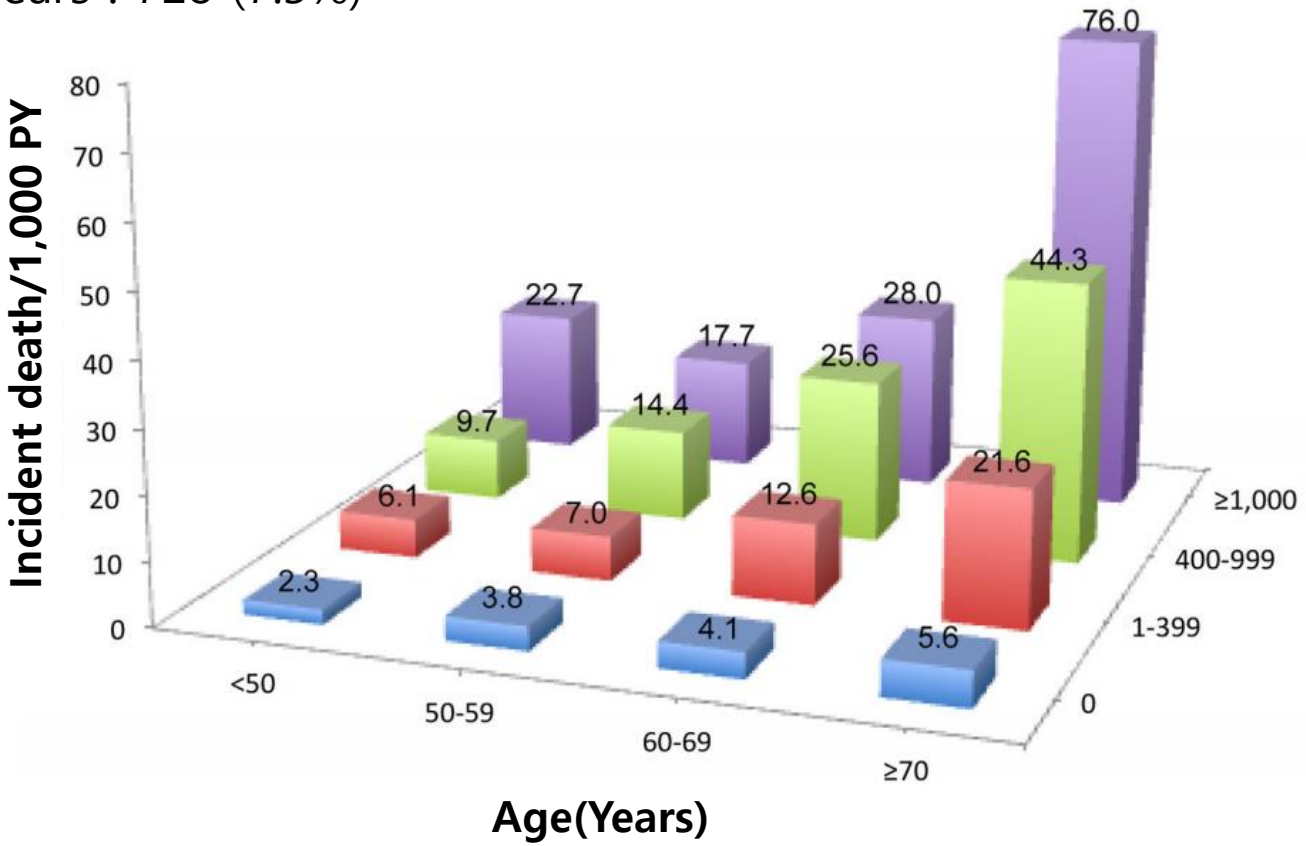
The coronary calcium score is a strong predictor of incident coronary heart disease and provides predictive information beyond that provided by standard risk factors in four major racial and ethnic groups in the United States.

No major differences among racial and ethnic groups in the predictive value of calcium scores were detected.

NEJM. 2008;358:1336-45

15-Year prognostic utility of CAC scoring for All-cause mortality in the Elderly.

9,715 asymptomatic individuals
≥ 70 years : 728 (7.5%)



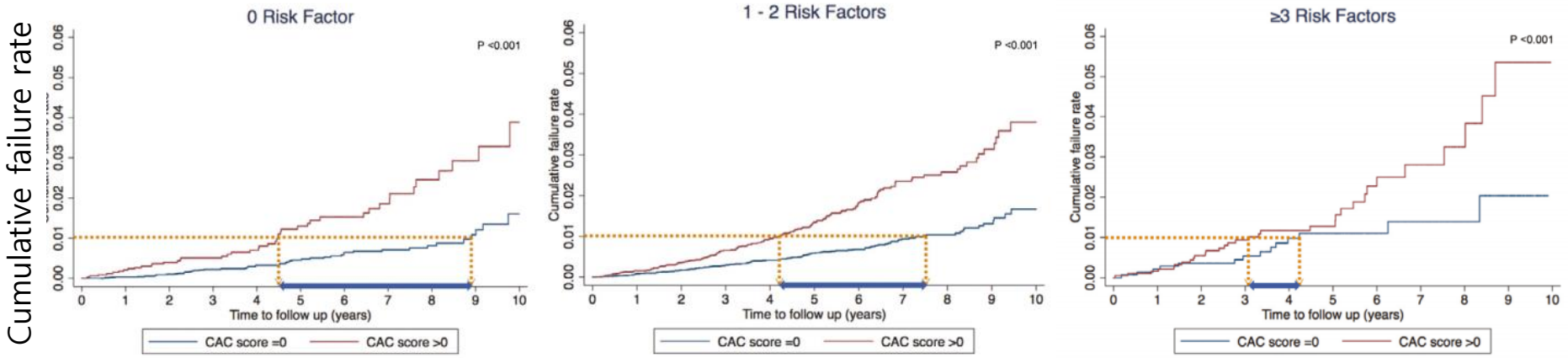
Incident rate for all-cause death according to age groups and coronary artery calcium categories.

Atherosclerosis. 2016; 246: 361–6

Warranty Period of Zero CAC Score for Predicting All-Cause Mortality According to Cardiac Risk Burden in Asymptomatic Korean Adults

warranty period : the time to cumulative mortality rate >1%

48,215 participants, 3 health-care centers
mean age : 54.1±8.8 years, 75.1% male
30,605 (63.5%) : zero CAC score
median follow-up duration : 4.4 years



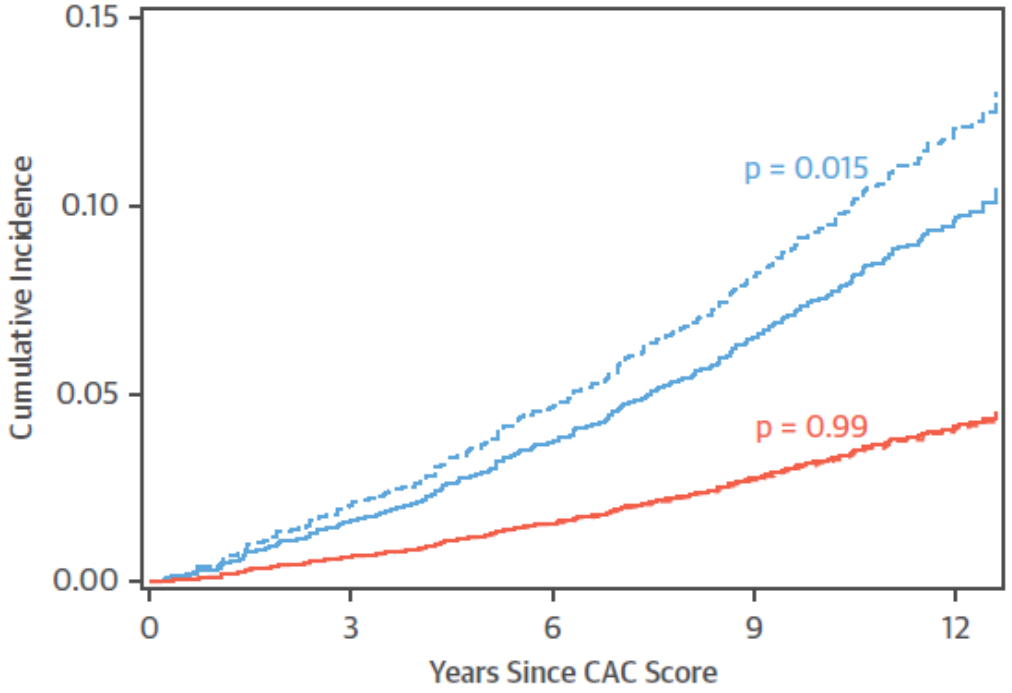
The warranty period was substantially longer (eg, 9 vs. 5 years) for CAC=0 compared with CAC >0.

Circ J. 2016; 80: 2356–61

Impact of Statins on CV Outcomes following CAC Scoring groups

Cumulative incidence of MACE stratified by statin treatment and CAC presence

13,644 patients
mean age 50 years
median FU 9.4 years



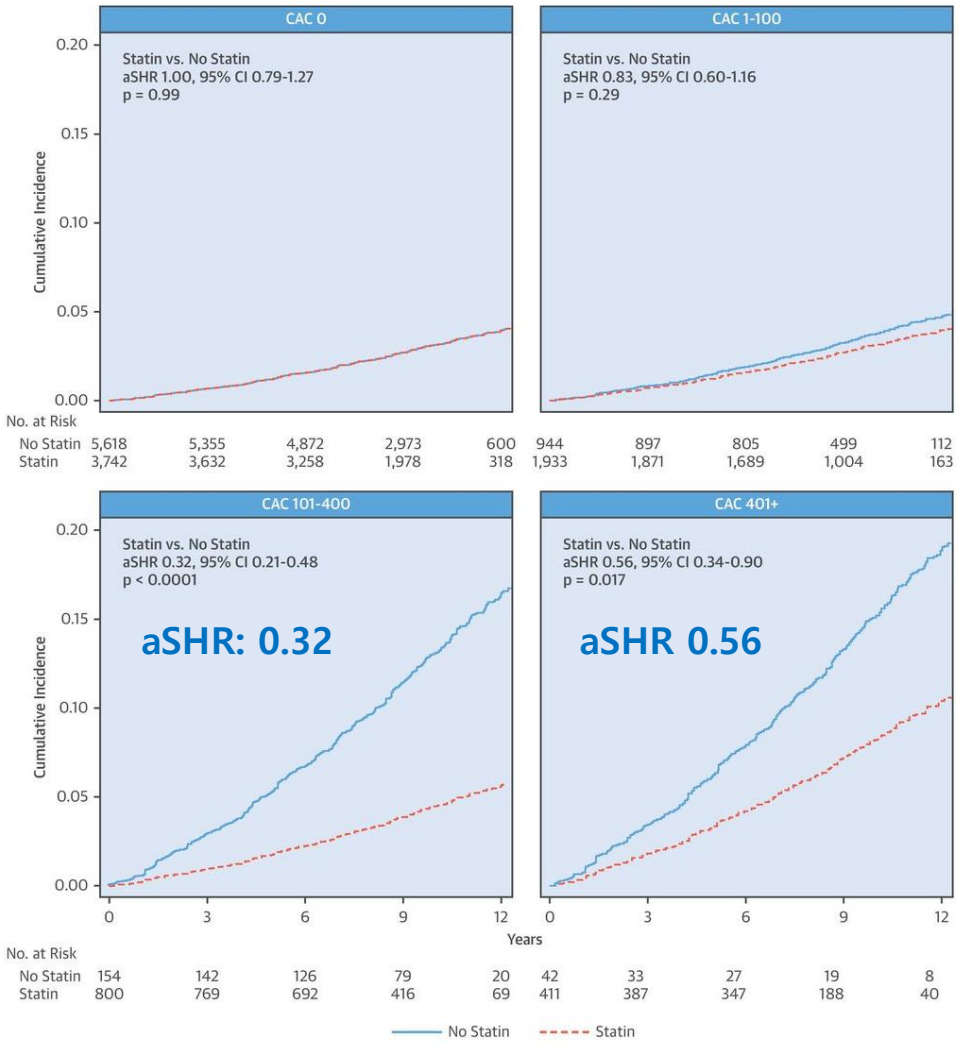
No. at risk					
CAC >0, No Statin	1,140	1,072	958	597	140
CAC >0, Statin	3,144	3,027	2,728	1,608	272
CAC = 0, No Statin	5,618	5,355	4,872	2,973	600
CAC = 0, Statin	3,742	3,632	3,258	1,978	318

aSHR: 0.76;
95% CI: 0.60 to 0.95

J Am Coll Cardiol. 2018;72:3233-3242

Impact of Statins on CV Outcomes following CAC Scoring groups

Cumulative incidence of MACE stratified by statin treatment and CAC severity



J Am Coll Cardiol. 2018;72:3233-3242

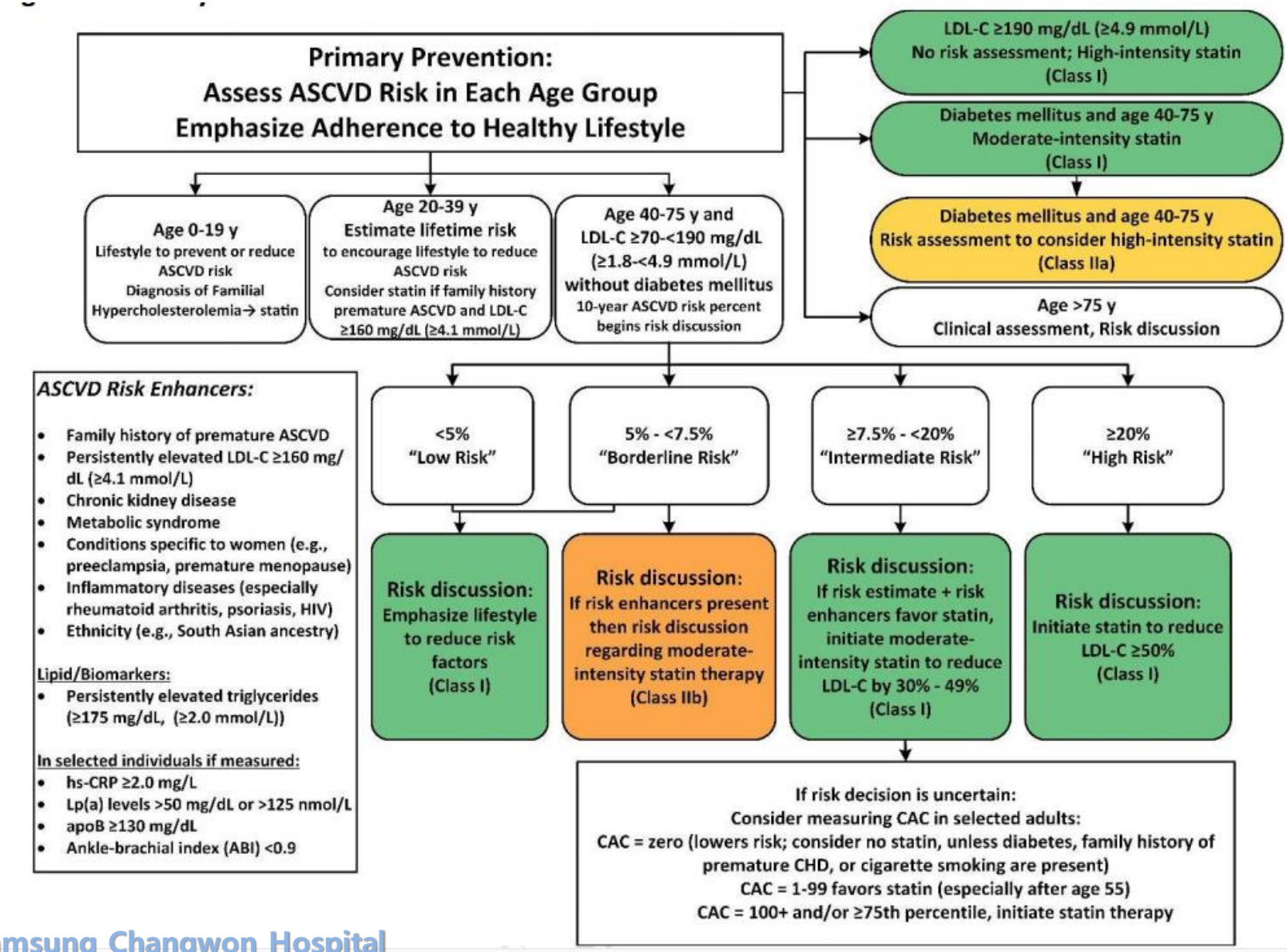
Coronary Calcium Score and Cardiovascular Risk

Proposed Decision-Making Approach to Selective Use of Coronary artery Calcium measurement for Risk Prediction

Using 10-year ASCVD risk estimate plus coronary artery calcium (CAC) score to guide statin therapy				
Patient's 10-year atherosclerotic cardiovascular disease (ASCVD) risk estimate:	<5%	5-7.5%	>7.5-20%	>20%
Consulting ASCVD risk estimate alone	Statin not recommended	Consider for statin	Recommend statin	Recommend statin
Consulting ASCVD risk estimate + CAC				
If CAC score =0	Statin not recommended	Statin not recommended	Statin not recommended	Recommend statin
If CAC score >0	Statin not recommended	Consider for statin	Recommend statin	Recommend statin
Does CAC score modify treatment plan?	✗ CAC not effective for this population	✓ CAC can reclassify risk up or down	✓ CAC can reclassify risk up or down	✗ CAC not effective for this population

J Am Coll Cardiol. 2018;72:434-447

2019 ACC/AHA Guideline on the Primary Prevention of CVD



2019 ACC/AHA Guideline on the Primary Prevention of CVD

Intermediate Risk(≥ 7.5 ~ < 20 %)

Assess CAC if risk decision is uncertain and additional information is needed to clarify ASCVD risk.

- **If the CAC score is zero**, it is reasonable to withhold statin therapy and reassess in 5 to 10 years, as long as higher risk conditions are absent (diabetes mellitus, family history of premature CHD, cigarette smoking)

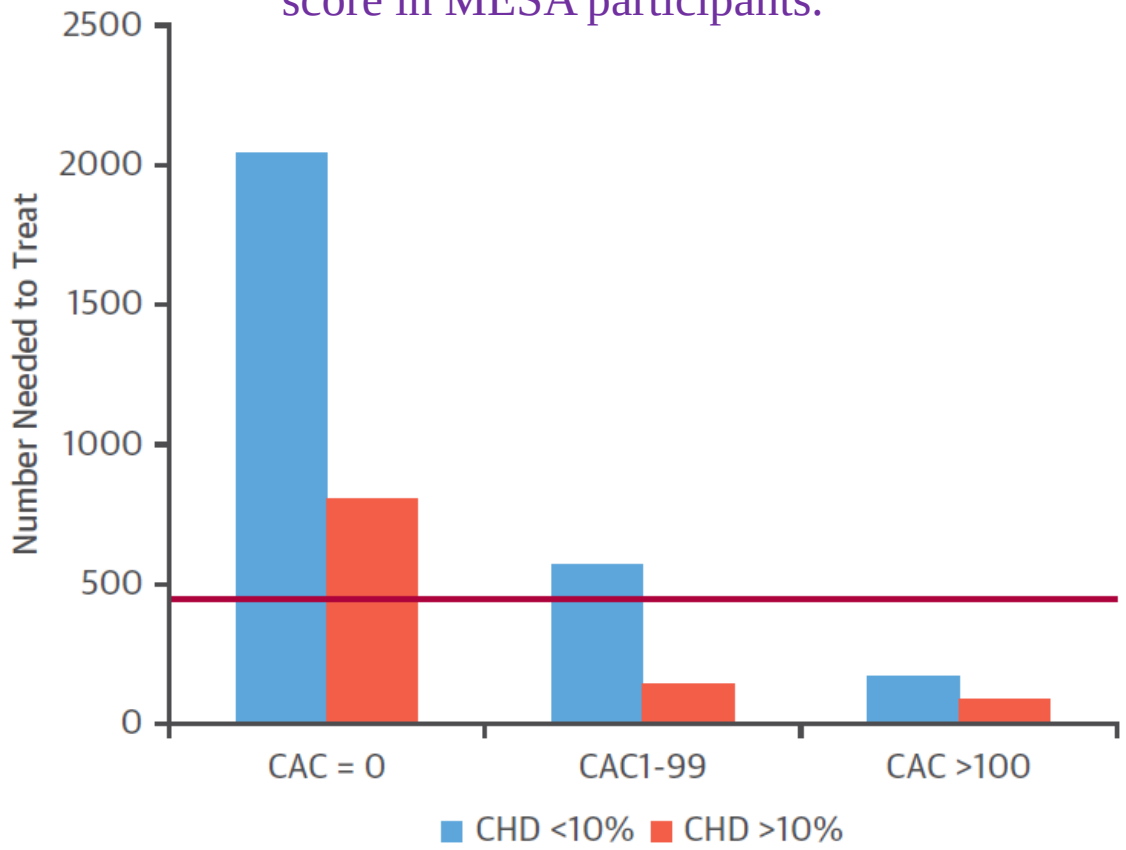
- **If CAC score is 1 to 99,** it is favorable to initiate statin therapy, especially ≥55 years of age

- **If CAC score is 100 or higher or in the 75th percentile** or higher, it is indicated to initiate statin therapy.

J Am Coll Cardiol. 2018;72:434-447

The Use of Coronary Artery Calcium Testing to Guide Aspirin Utilization for Primary Prevention: Estimates from the MESA

Estimated risk/benefit of aspirin in primary prevention by coronary artery calcium score in MESA participants.



* Red lines represents estimated 5-year number needed to harm estimations based on a 0.23% increase in major bleeding over 5 years.

Circ Cardiovasc Qual Outcomes. 2014;7:453–460

2017. Coronary Artery Calcium Scoring – Position Statement

The Cardiac Society of Australia and New Zealand

Table 4: Suggested management based on CAC results for asymptomatic patients

CAC	10-year risk	Guidance
0	Very Low (< 1%)	Reassure; maintenance of healthy diet and lifestyle.
1-100	Low (<10%)	Maintenance of healthy diet and lifestyle
101 - 400	Moderate (10-20%)	Aspirin **recommended** Statins **considered reasonable**
101 – 400 & >75th centile	Moderately High (15-20%)	Reclassify as high risk; Aspirin **recommended** Statins **considered reasonable**
>400	High (>20%)	Aspirin **recommended** Statin **recommended**, to achieve target LDL < 2.0 mmol/L Consider functional assessment.

2019 ACC/AHA Guideline on the Primary Prevention of CVD

Recommendations for Aspirin Use Referenced studies that support recommendations are summarized in Online Data Supplements 17 and 18.		
COR	**LOE**	**Recommendations**
IIb	A	1. Low-dose aspirin (75-100 mg orally daily) might be considered for the primary prevention of ASCVD among select adults 40 to 70 years of age who are at higher ASCVD risk but not at increased bleeding risk (S4.6-1–S4.6-8).
III: Harm	B-R	2. Low-dose aspirin (75-100 mg orally daily) should not be administered on a routine basis for the primary prevention of ASCVD among adults >70 years of age (S4.6-9).
III: Harm	C-LD	3. Low-dose aspirin (75-100 mg orally daily) should not be administered for the primary prevention of ASCVD among adults of any age who are at increased risk of bleeding (S4.6-10).

CLINICAL DECISIONS FREE PREVIEW

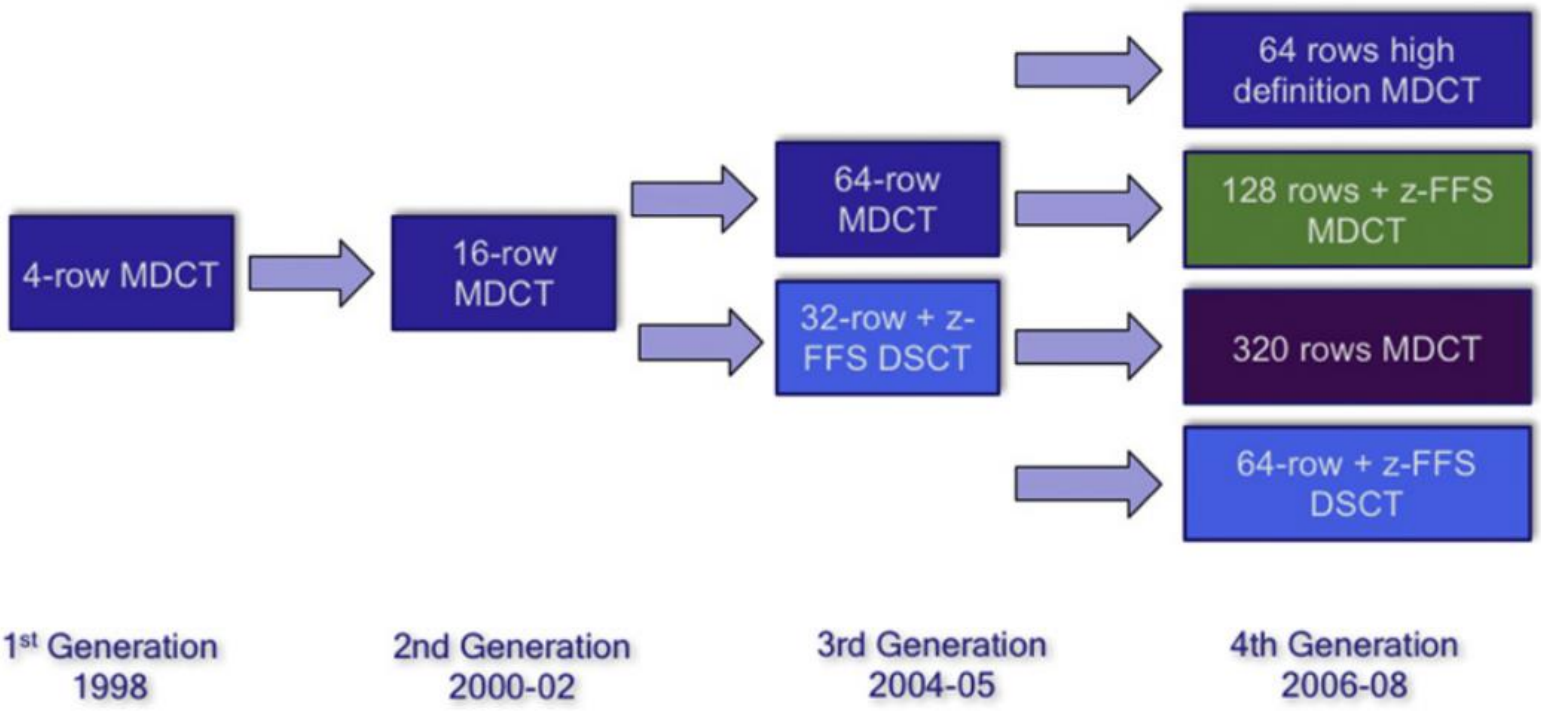
"Doctor, Should I Keep Taking an Aspirin a Day?"

Amanda Fernandes, M.D., John W. McEvoy, M.B., B.Ch., M.H.S., and Sigrun Halvorsen, M.D., Ph.D.

This interactive feature about aspirin for persons at risk for cardiovascular disease offers a case vignette accompanied by essays that either support or discourage the use of aspirin for primary prevention of coronary heart disease and stroke.

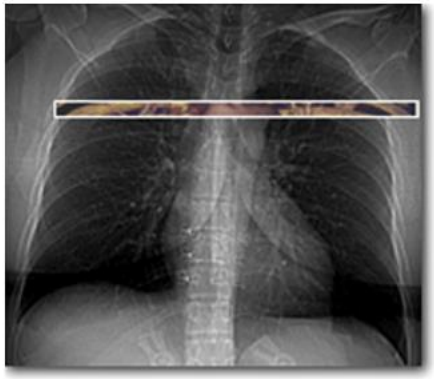
May 16, 2019
N Engl J Med 2019; 380:1967-1970
DOI: 10.1056/NEJMclde1903004

Development of CCTA

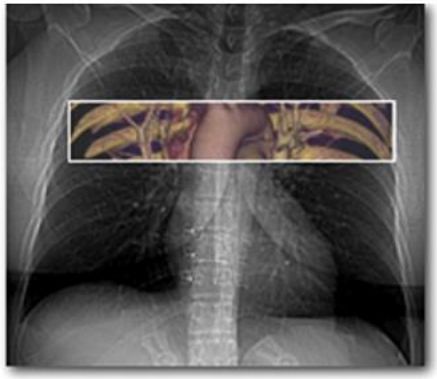


Radiologic Clinics of North America 2010;48:657-674

Development of CCTA

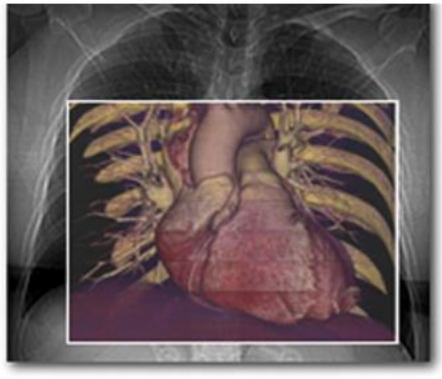


16 row MDCT
1 cm detector
20 SEC SCAN



64 row MDCT
4 cm detector
4-8 SEC SCAN

128 row MDCT
8 cm detector
2-4 SEC SCAN



320 row MDCT
16 cm detector
1-3 SEC SCAN

Radiologic Clinics of North America 2010;48:657-674

Accuracy of CCTA

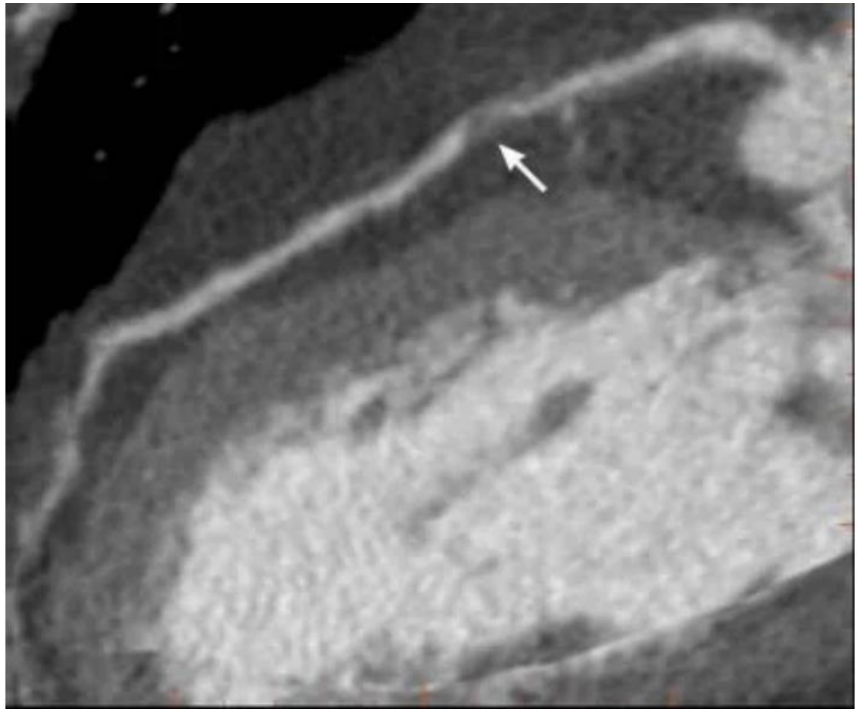
Assessment by Coronary Computed Tomographic Angiography of Individuals Undergoing Invasive Coronary Angiography (ACCURACY) Trial

- prospective multicenter trial of patients with chest pain without known CAD and intermediate disease prevalence
- 64-slice CCTA
- Sensitivity of 94% and a specificity of 83% in detecting stenosis of 70% or greater (comparable values were seen at a 50% stenosis level).
- negative predictive value : 99 %
- calcium scores greater than 400 reduced specificity significantly

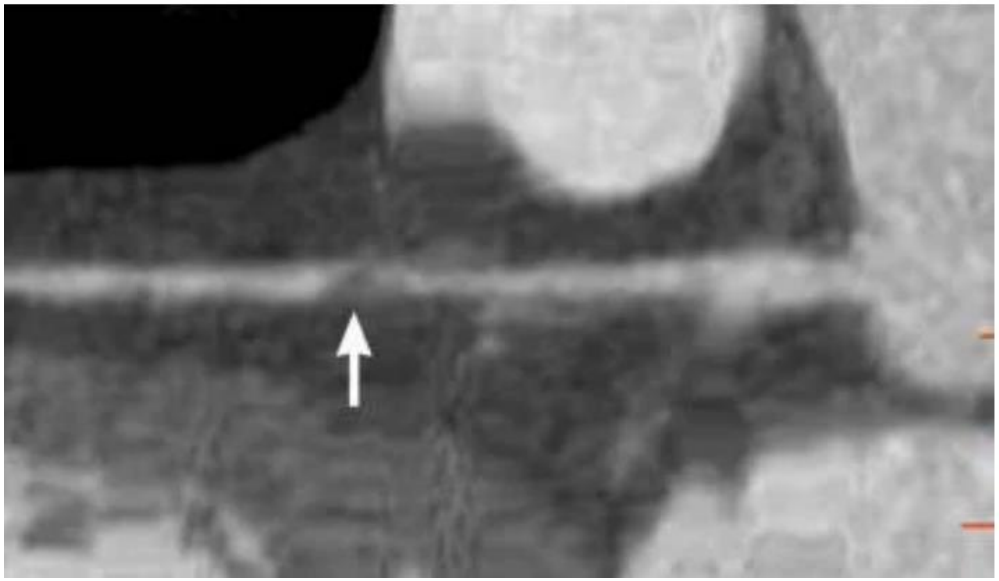
J Am Coll Cardiol 2008;52:1724-3

Postprocessing Techniques

Multiplanar reconstruction (MPR)



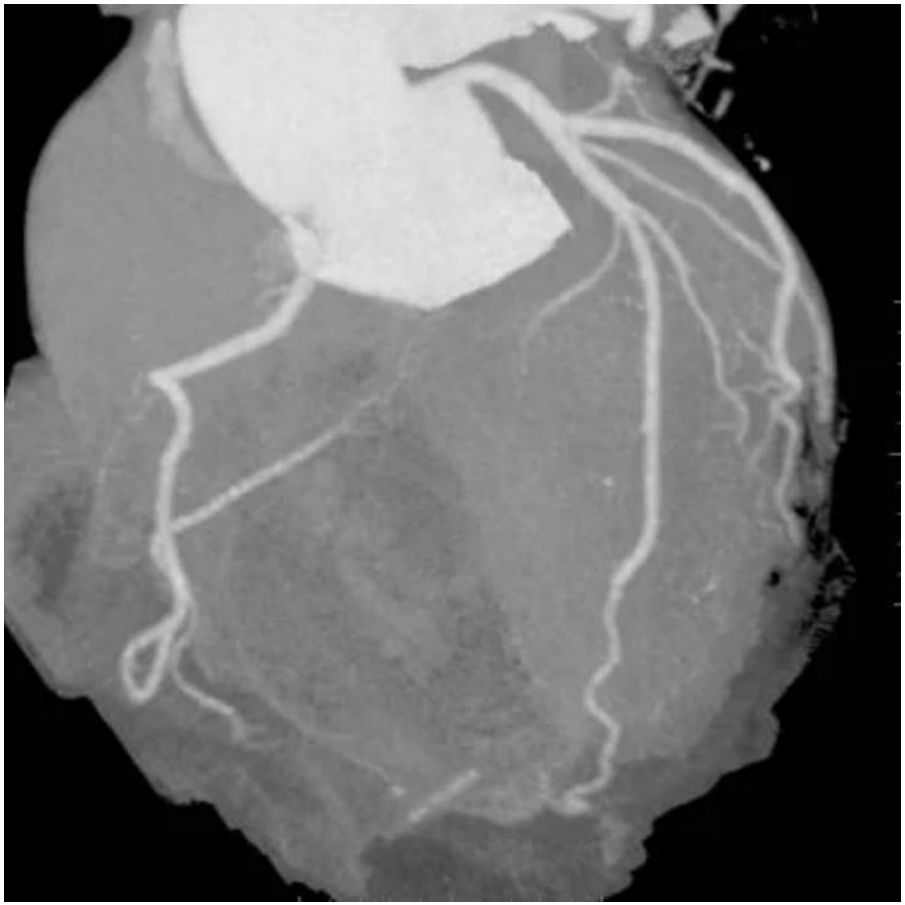
Curved MPR



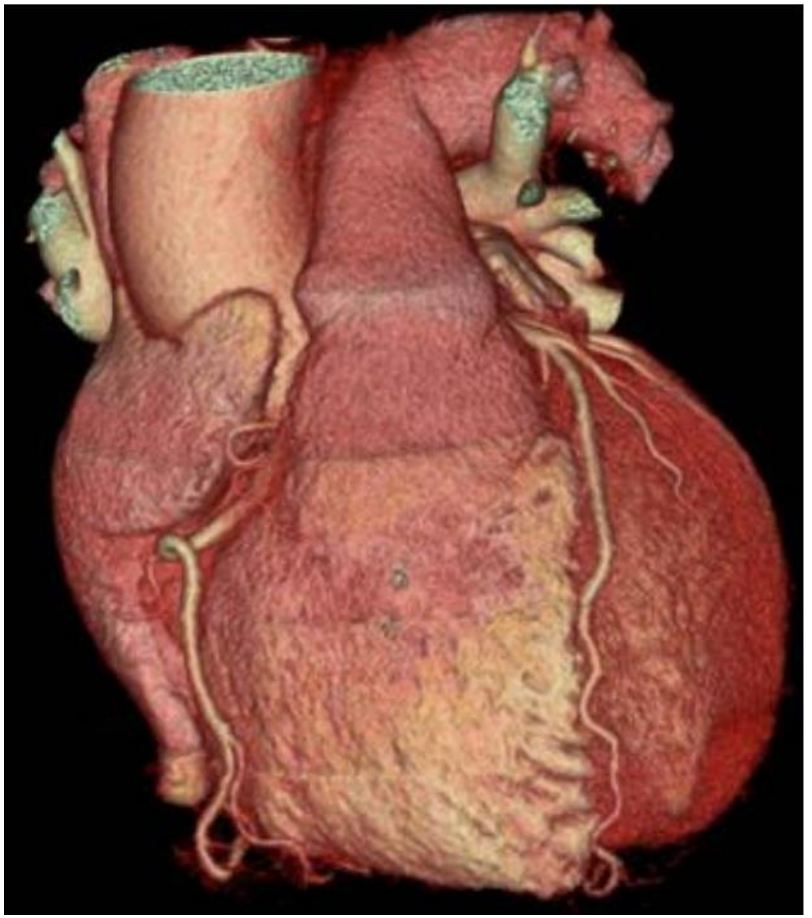
"Ribbon" MPR

Postprocessing Techniques

Maximum intensity projection (MIP)



3D volume rendering



Indication of CCTA

ACCF/SCCT/ACR/AHA/ASE/ASNC/NASCI/SCAI/SCMR 2010 Appropriate Use Criteria for Cardiac Computed Tomography

- Detection of CAD in symptomatic patients without known heart disease, either nonacute or acute presentations
- Detection of CAD in patients with new-onset or newly diagnosed clinical heart failure and no prior CAD
- Preoperative coronary assessment prior to noncoronary cardiac surgery
- Patients with prior electrocardiographic exercise testing - Normal test with continued symptoms or intermediate risk Duke treadmill score
- Patients with prior stress imaging procedures - Discordant electrocardiographic exercise and imaging results or equivocal stress imaging results
- Evaluation of new or worsening symptoms in the setting of a past normal stress imaging study
- Risk assessment post-revascularization - Symptomatic if post-coronary artery bypass grafting or asymptomatic with prior left main coronary stent of 3 mm or greater
- Evaluation of cardiac structure and function in adult congenital heart disease
- Evaluation of cardiac structure and function - Ventricular morphology and systolic function
- Evaluation of cardiac structure and function - Intracardiac and extracardiac structures

Guidelines

2013 ESC Guidelines. Stable Coronary Artery Disease

Table 16 Use of coronary computed tomography angiography for the diagnosis of stable coronary artery disease

Recommendations	Class [a]	Level [b]
Coronary CTA should be considered as an alternative to stress imaging techniques for ruling out SCAD in patients within the lower range of intermediate PTP for SCAD in whom good image quality can be expected.	IIa	C
Coronary CTA should be considered in patients within the lower range of intermediate PTP for SCAD after a non conclusive exercise ECG or stress imaging test or who have contraindications to stress testing in order to avoid otherwise necessary invasive coronary angiography if fully diagnostic image quality of coronary CTA can be expected.	IIa	C
Coronary calcium detection by CT is not recommended to identify individuals with coronary artery stenosis.	III	C
Coronary CTA is not recommended in patients with prior coronary revascularization.	III	C
Coronary CTA is not recommended as a 'screening' test in asymptomatic individuals without clinical suspicion of coronary artery disease.	III	C

CTA = computed tomography angiography; ECG = electrocardiogram; PTP = pre-test probability; SCAD = stable coronary artery disease.

[a] Class of recommendation.

[b] Level of evidence.

Eur Heart J 2013;34:2949-3003

Guidelines

2015 ESC Guidelines. ACS without ST elevation

MDCT coronary angiography should be considered as an alternative to invasive angiography to exclude ACS when there is a low to intermediate likelihood of CAD and when cardiac troponin and/or ECG are inconclusive.	IIa	A

Eur Heart J 2016;37:267-315

Guidelines

2016 NICE Guidelines Update.

Chest pain of recent onset: assessment and diagnosis

1.3.4 Diagnostic testing for people in whom stable angina cannot be excluded by clinical assessment alone

1.3.4.3 Offer 64-slice (or above) CT coronary angiography if:

- clinical assessment (see recommendation 1.3.3.1) indicates typical or atypical angina **or**
- clinical assessment indicates non-anginal chest pain but 12-lead resting ECG has been done and indicates ST-T changes or Q waves. **[new 2016]**

- clinical assessment (see recommendation 1.3.3.1) indicates typical or atypical angina **or**

1.3.5 Additional diagnostic investigations

1.3.5.1 Offer non-invasive functional imaging (see section 1.3.6) for myocardial ischaemia if 64-slice (or above) CT coronary angiography has shown CAD of uncertain functional significance or is non-diagnostic. **[2016]**

1.3.5.2 Offer invasive coronary angiography as a third-line investigation when the results of non-invasive functional imaging are inconclusive. **[2016]**

1.3.5.2 Offer invasive coronary angiography as a third-line investigation when the results of non-invasive functional imaging are inconclusive. **[2016]**

https://www.nice.org.uk/guidance/cg95/chapter/Recommendations

CCTA vs Functional Stress Testing for Patients With Suspected CAD : A Systematic Review and Meta-analysis

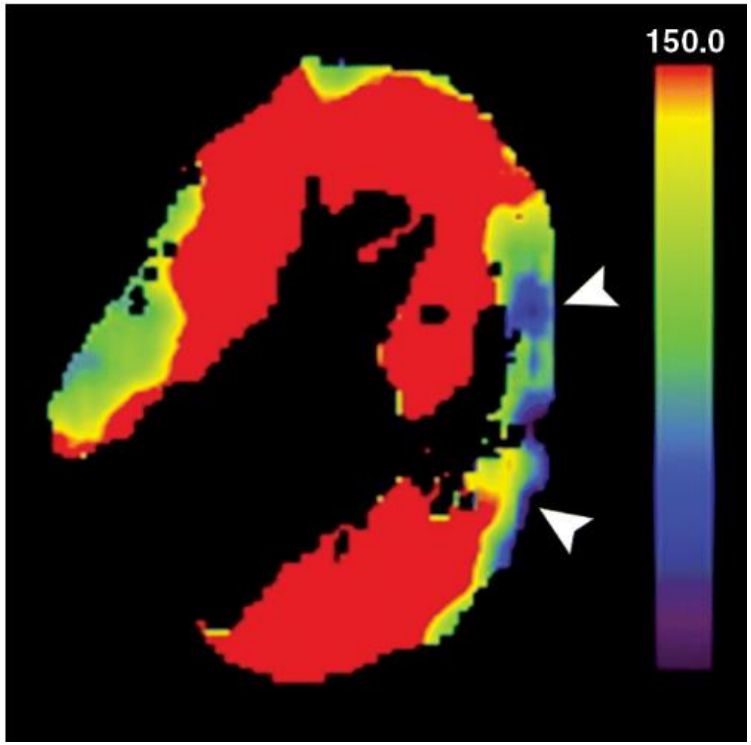
RESULTS:
Thirteen trials were included, with 10,315 patients in the CCTA arm and 9,777 patients in the functional stress testing arm who were followed up for a mean duration of 18 months. There were no statistically significant differences between CCTA and functional stress testing in death (1.0% vs 1.1%; risk ratio [RR], 0.93; 95% CI, 0.71-1.21) or cardiac hospitalization (2.7% vs 2.7%; RR, 0.98; 95% CI, 0.79-1.21), but CCTA was associated with a reduction in the incidence of myocardial infarction (0.7% vs 1.1%; RR, 0.71; 95% CI, 0.53-0.96). Patients undergoing CCTA were significantly more likely to undergo invasive coronary angiography (11.7% vs 9.1%; RR, 1.33; 95% CI, 1.12-1.59) and revascularization (7.2% vs 4.5%; RR, 1.86; 95% CI, 1.43-2.43). They were also more likely to receive a diagnosis of new CAD and to have initiated aspirin or statin therapy.

CONCLUSIONS AND RELEVANCE:
Compared with functional stress testing, CCTA is associated with a reduced incidence of myocardial infarction but an increased incidence of invasive coronary angiography, revascularization, CAD diagnoses, and new prescriptions for aspirin and statins. Despite these differences, CCTA is not associated with a reduction in mortality or cardiac hospitalizations.

JAMA Intern Med. 2017 Nov 1;177(11):1623-1631

CCTA and Ischemia

CT myocardial perfusion imaging



Parametric map of myocardial blood flow derived from stress dynamic CT myocardial perfusion imaging shows well-demarcated area of decreased myocardial blood flow to lateral wall of left ventricle (*arrowhead)*

FFR-CT

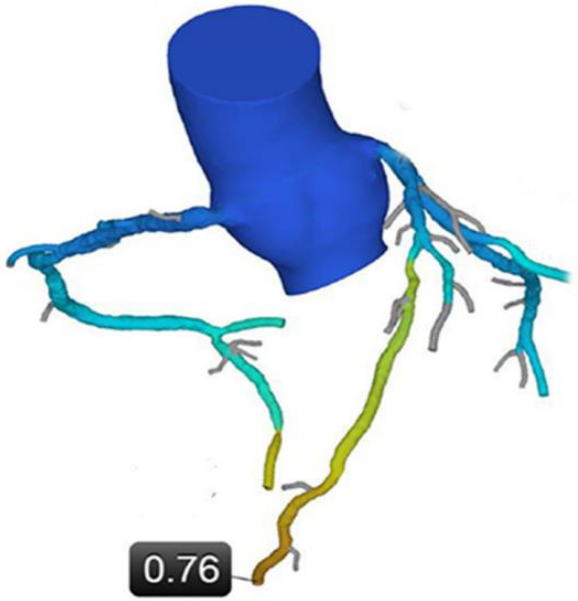


Figure 3 Simulated FFR-CT based on fluid dynamic modeling. FFR-CT, fractional flow reserve determined through fluid dynamic modeling based on coronary CT angiography.

Summary

- Coronary artery calcium is a highly specific feature of coronary atherosclerosis.

- Coronary artery calcium scoring has emerged as a widely available, consistent, and reproducible means of assessing risk for major cardiovascular outcomes, especially useful in asymptomatic people for planning primary prevention interventions such as statins and aspirin.

Summary

- Clinical applications of coronary CT angiography will typically be based on the method´s very high sensitivity to identify coronary stenosis if image quality is good
- Guidelines of international cardiac societies are starting to incorporate coronary CTA into their recommendations for the management of patients with stable and acute chest pain.
- Initial data show that in the future, the use of coronary CTA may not only be able to replace other forms of diagnostic testing, but, in fact, may improve patient outcome.

Case 1. M/58

CC : Aggravated exertional chest pain, CCS class I → III

PHx : Old MI, 15 YA

– coronary angiography, not done

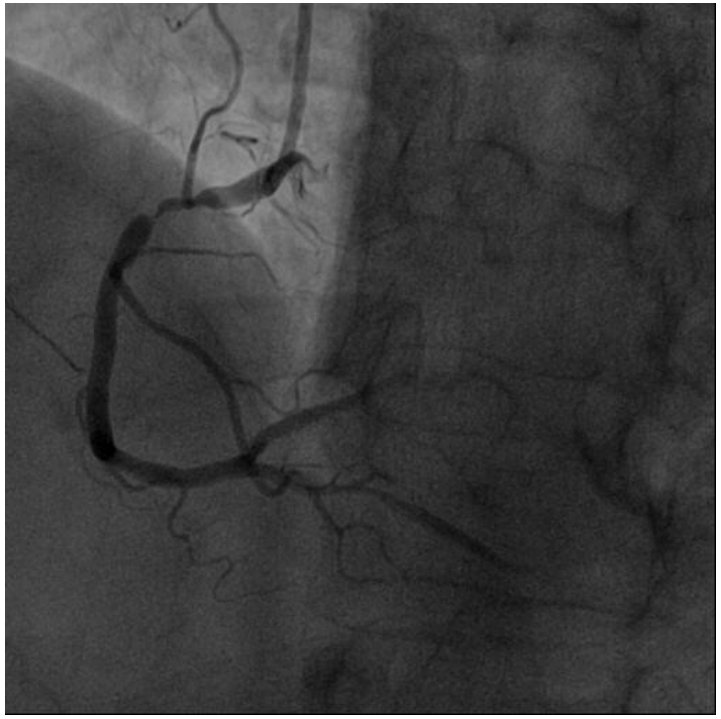
Deep vein thrombosis

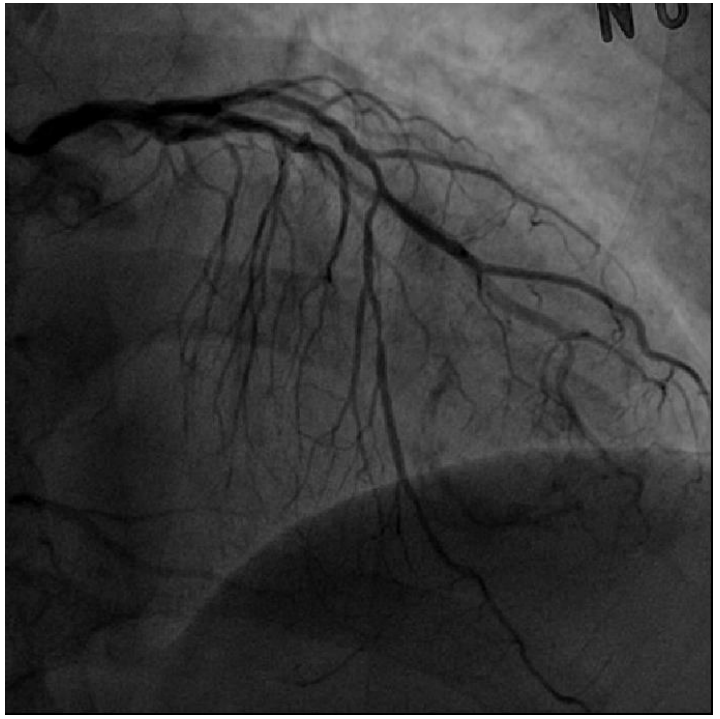
HTN/DM/Dyslipidemia(+/-/-)

Case 1. CCTA

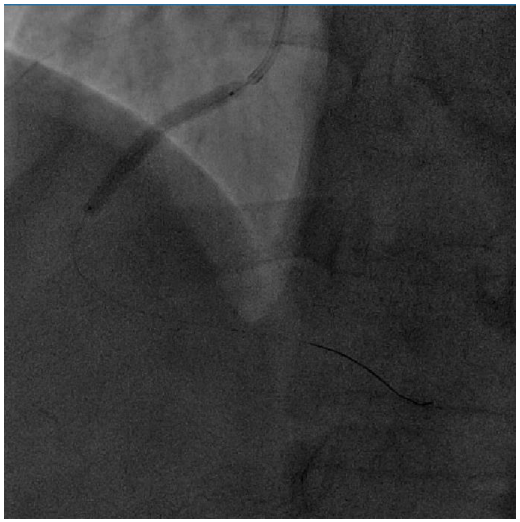
Coronary Artery	Score
Left Main (LM)	111.08
Left Anterior Descending (LAD)	275.51
Left Circumflex (LCX)	134.09
Right Coronary Artery (RCA)	181.57
Total Agatston Score	**702.25**

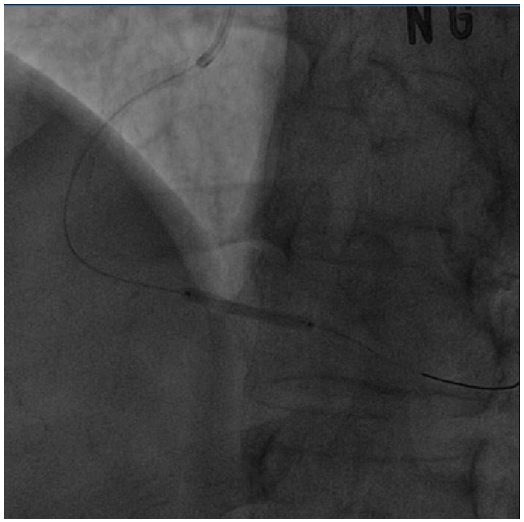
Case 1. CAG

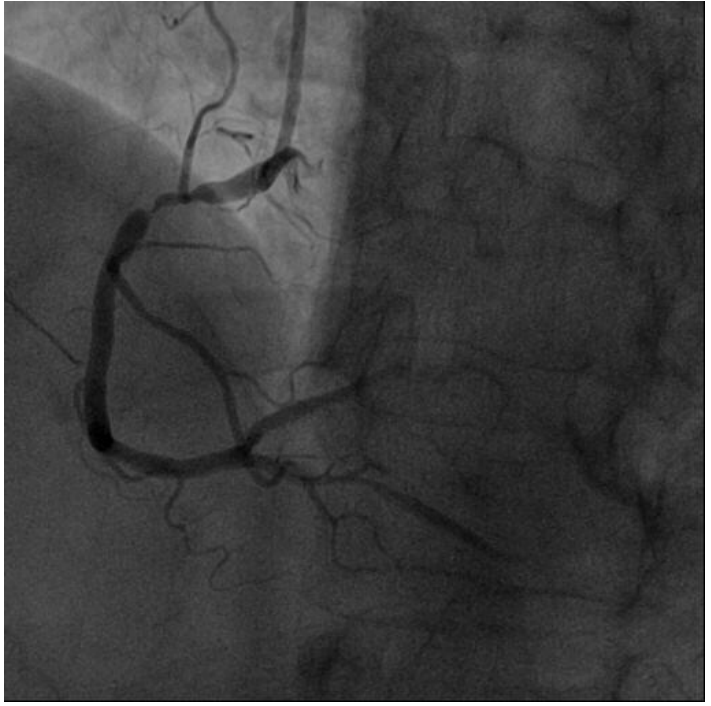


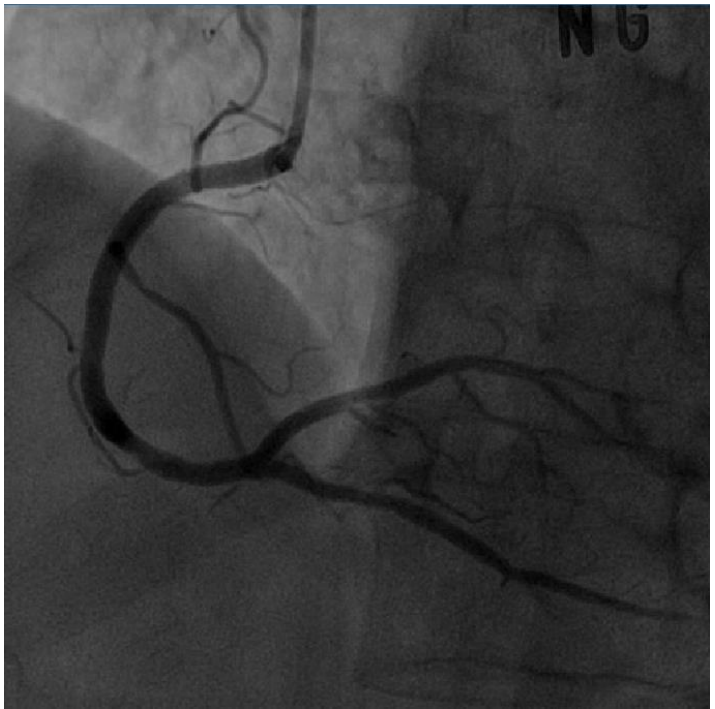


Case 1. PCI

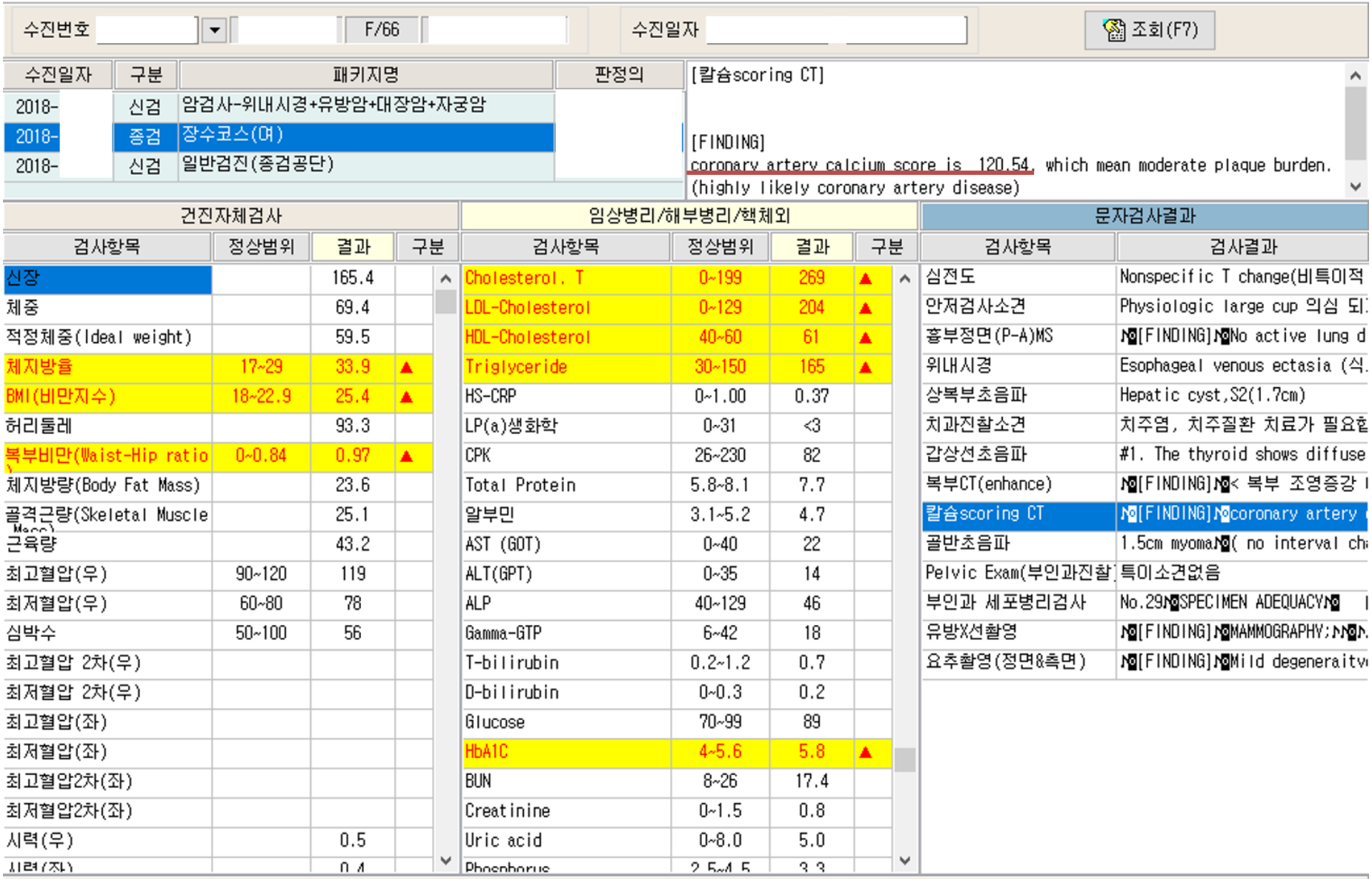








Case 2. F/66



수진번호 F/66 수진일자 조회(F7)

수진일자	구분	패키지명	판정의
2018-	신검	암검사-위내시경+유방암+대장암+자궁암	
2018-	종검	장수코스(여)	
2018-	신검	일반검진(종검공단)	

[칼슘scoring CT]

[FINDING]
coronary artery calcium score is 120.54, which mean moderate plaque burden.
(highly likely coronary artery disease)

건진자체검사

검사항목	정상범위	결과	구분
신장		165.4	
체중		69.4	
적정체중(Ideal weight)		59.5	
체지방율	17~29	33.9	▲
BMI(비만지수)	18~22.9	25.4	▲
허리둘레		93.3	
복부비만(Waist-Hip ratio	0~0.84	0.97	▲
체지방량(Body Fat Mass)		23.6	
골격근량(Skeletal Muscle Mass)		25.1	
근육량		43.2	
최고혈압(우)	90~120	119	
최저혈압(우)	60~80	78	
심박수	50~100	56	
최고혈압 2차(우)			
최저혈압 2차(우)			
최고혈압(좌)			
최저혈압(좌)			
최고혈압2차(좌)			
최저혈압2차(좌)			
시력(우)		0.5	
시력(좌)		0.4	

임상병리/해부병리/핵체외

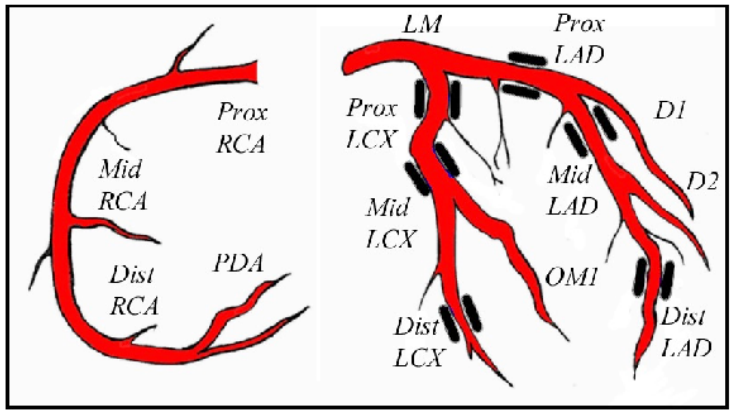
검사항목	정상범위	결과	구분
Cholesterol. T	0~199	269	▲
LDL-Cholesterol	0~129	204	▲
HDL-Cholesterol	40~60	61	▲
Triglyceride	30~150	165	▲
HS-CRP	0~1.00	0.37	
LP(a)생화학	0~31	<3	
CPK	26~230	82	
Total Protein	5.8~8.1	7.7	
알부민	3.1~5.2	4.7	
AST (GOT)	0~40	22	
ALT(GPT)	0~35	14	
ALP	40~129	46	
Gamma-GTP	6~42	18	
T-bilirubin	0.2~1.2	0.7	
D-bilirubin	0~0.3	0.2	
Glucose	70~99	89	
HbA1C	4~5.6	5.8	▲
BUN	8~26	17.4	
Creatinine	0~1.5	0.8	
Uric acid	0~8.0	5.0	
Phosphorus	2.5~4.5	3.3	

문자검사결과

검사항목	검사결과
심전도	Nonspecific T change(비특이적
안저검사소견	Physiologic large cup 의심 되
흉부정면(P-A)MS	[FINDING]No active lung d
위내시경	Esophageal venous ectasia (식
상복부초음파	Hepatic cyst,S2(1.7cm)
치과진찰소견	치주염, 치주질환 치료가 필요함
갑상선초음파	#1. The thyroid shows diffuse
복부CT(enhance)	[FINDING]No< 복부 조영증강
칼슘scoring CT	[FINDING]Nocoronary artery
골반초음파	1.5cm myomaNo(no interval ch
Pelvic Exam(부인과진찰)	특이소견없음
부인과 세포병리검사	No.29NoSPECIMEN ADEQUACYNo
유방X선촬영	[FINDING]NoMAMMOGRAPHY:NoN
요추촬영(정면&측면)	[FINDING]NoMild degeneraitv

Case 2. CAC

Findings:



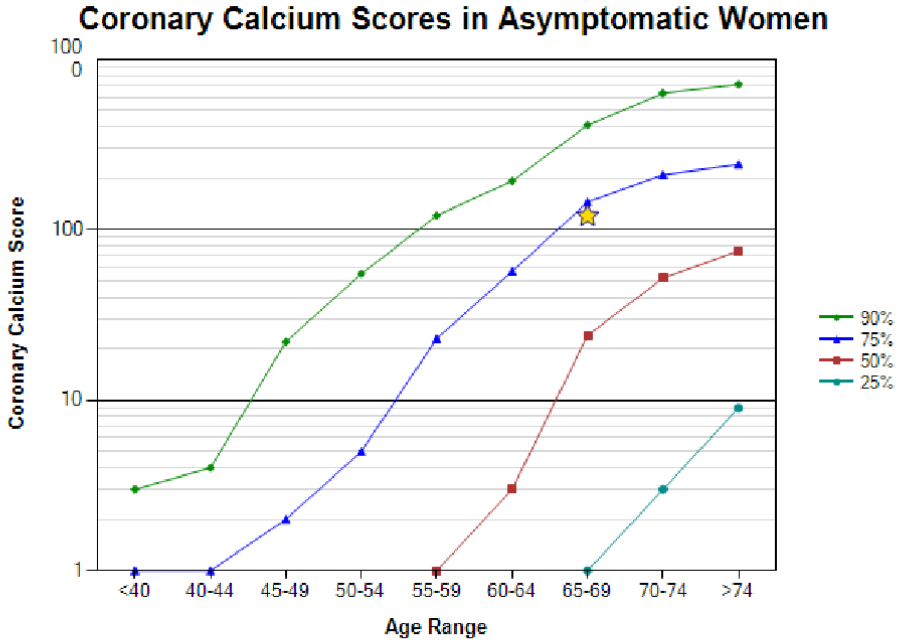
The diagram to the left is a schematic of the coronary artery system. The coronary arteries are segmented into Proximal, Mid, and Distal sections, which may be annotated with black markings to illustrate the **approximate location** of any **calcified** regions detected in the examination. However please note that the markings **do not imply** the presence, absence, location or extent of arterial stenosis or any other condition other than the presence of coronary calcification.

Coronary Artery	Score
Left Main (LM)	0.00
Left Anterior Descending (LAD)	119.14
Left Circumflex (LCX)	1.40
Right Coronary Artery (RCA)	0.00
Total Agatston Score	**120.54**

The Percentile Ranking compares this score with scores for people in a group with the same gender and similar age, as reported in the literature.

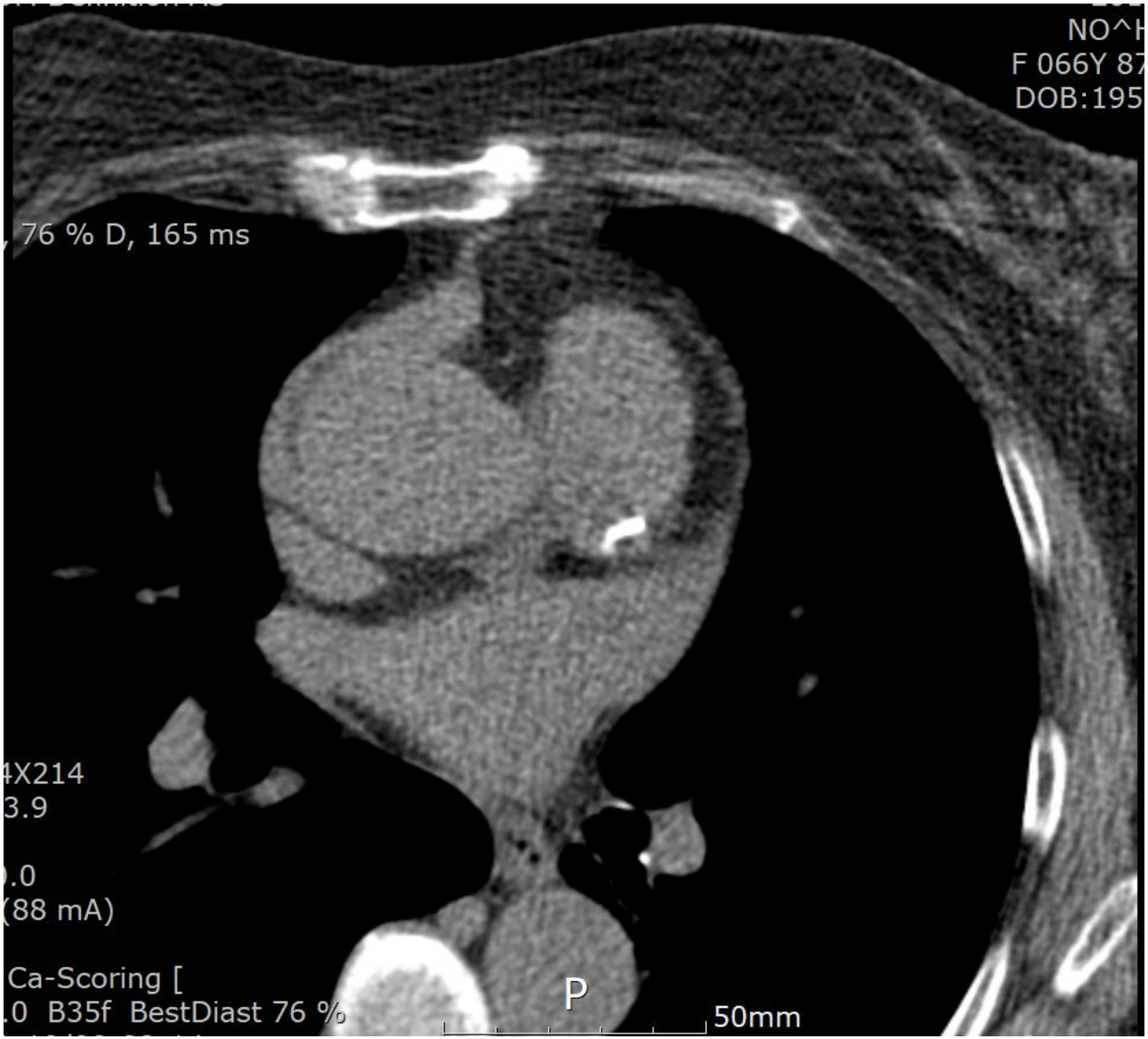
A rank **below** 50% indicates a score **better** than most in that group.
A rank **above** 50% indicates a score **worse** than most in that group.

(J Hoff et al., American Journal of Cardiology, 2001 87:1335-1339).



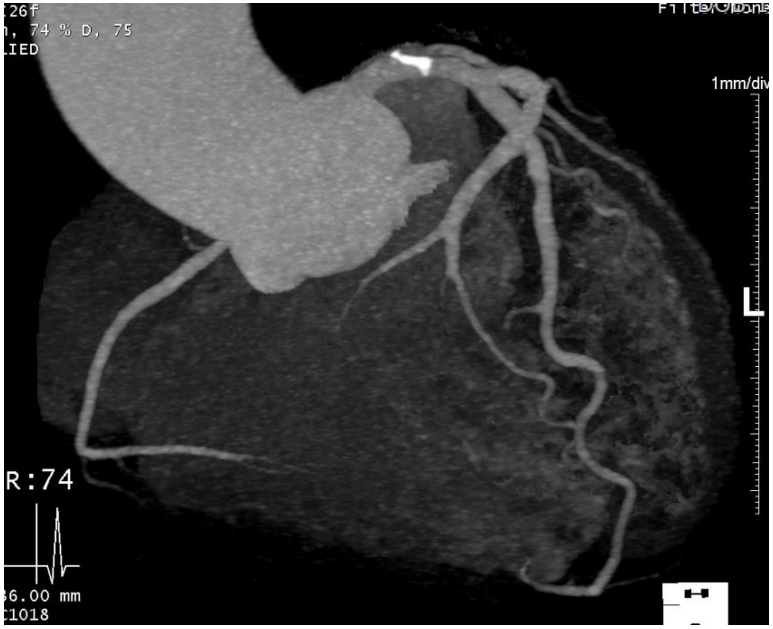
The total calcium score (120.54) isbetween the 50th and 75th percentile for women between the ages of 65 and 69.(Exact percentile calculated to be 69%; this means 68% of the population has lower calcium score and 31% of the population has a higher calcium score than you.)

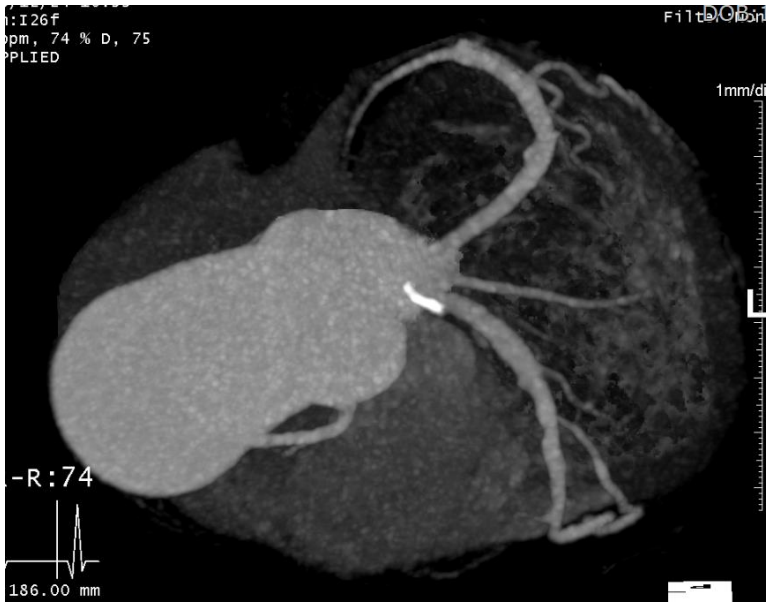
Case 2. Axial image



Case 2. CCTA


I SUK
1812245371
SOMATOM D
10:33
% D, 75
4
onaryCTA (Adult)
(0.0 f/s)
1 / 18
50pt


I26f
, 74 % D, 75
IED
1mm/div
R:74
6.00 mm
1018


:I26f
pm, 74 % D, 75
PPLIED
1mm/di
-R:74
186.00 mm

Case 2. F/66

Study summary

CCTA (18.12.24)
Codominant coronary artery.

-LM: N-S
-LAD: discrete moderate stenosis(40%) at LAD os due to calcific plaque.
discrte mild stenosis(30%) at mLAD due to non-calcific plaque.
-LCx: tubular mild stenosis(15%) at pLCx due to non-calcific plaque.
-RCA: N-S

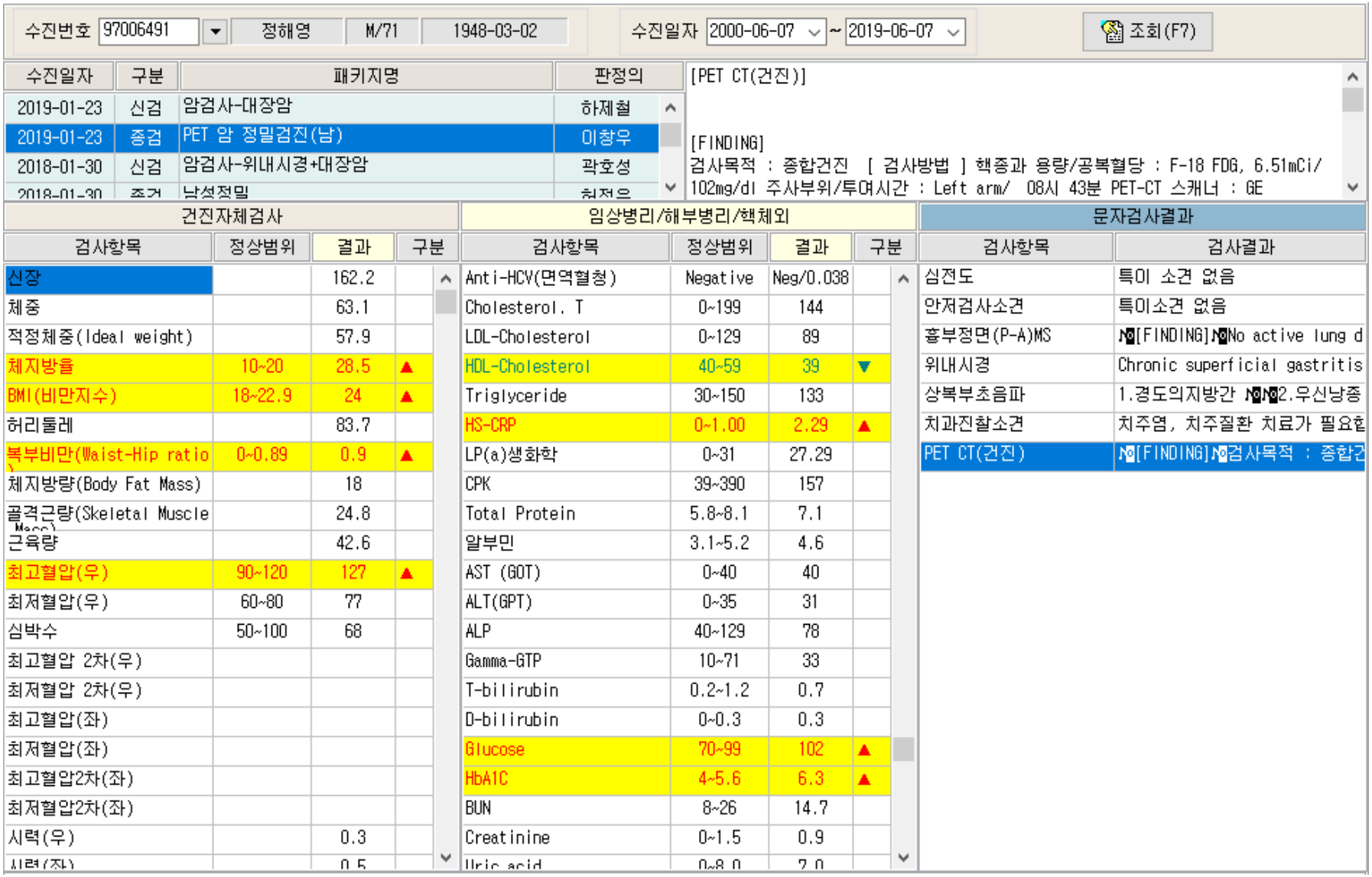
other cardiac finding:
-EF:61.21%(ED vol:139.02ml, ES vol:53.92ml)
LVIDd: 5.7cm , LVIDs: 4.3cm, LAAPd:3.7cm
IVSd:0.9cm LVPWd: 0.9cm, Ascending aorta: 4.0cm

2019-01-02 14:48 TREADMILL TEST(GXT) (G)
Negative GXT (BRUCE)
No symptom, Stage4 ,9 분10초,12.00 METS

2019-01-02 15:04 심장초음파(정밀)
Eccentric LVH
Diastolic dysfunction grade 2 with LA enlargement
Dilated ascending aorta

Treatment : Statin

Case 3. M/71



수진번호 97006491 | 정해영 | M/71 | 1948-03-02 | 수진일자 2000-06-07 ~ 2019-06-07 | 조회(F7)

수진일자	구분	패키지명	판정의
2019-01-23	신검	암검사-대장암	하제철
2019-01-23	종검	PET 암 정밀검진(남)	이창우
2018-01-30	신검	암검사-위내시경+대장암	곽호성
2018-01-30	종검	남성정밀	천정은

[PET CT(건진)]

[FINDING]
검사목적 : 종합건진 [검사방법] 핵종과 용량/공복혈당 : F-18 FDG, 6.51mCi/ 102mg/dl 주사부위/투여시간 : Left arm/ 08시 43분 PET-CT 스캐너 : GE

건진자체검사

검사항목	정상범위	결과	구분
신장		162.2	
체중		63.1	
적정체중(Ideal weight)		57.9	
체지방율	10~20	28.5	▲
BMI(비만지수)	18~22.9	24	▲
허리둘레		83.7	
복부비만(Waist-Hip ratio)	0~0.89	0.9	▲
체지방량(Body Fat Mass)		18	
골격근량(Skeletal Muscle Mass)		24.8	
근육량		42.6	
최고혈압(우)	90~120	127	▲
최저혈압(우)	60~80	77	
심박수	50~100	68	
최고혈압 2차(우)			
최저혈압 2차(우)			
최고혈압(좌)			
최저혈압(좌)			
최고혈압2차(좌)			
최저혈압2차(좌)			
시력(우)		0.3	
시력(좌)		0.5	

임상병리/해부병리/핵체외

검사항목	정상범위	결과	구분
Anti-HCV(면역혈청)	Negative	Neg/0.038	
Cholesterol, T	0~199	144	
LDL-Cholesterol	0~129	89	
HDL-Cholesterol	40~59	39	▼
Triglyceride	30~150	133	
HS-CRP	0~1.00	2.29	▲
LP(a)생화학	0~31	27.29	
CPK	39~390	157	
Total Protein	5.8~8.1	7.1	
알부민	3.1~5.2	4.6	
AST (GOT)	0~40	40	
ALT(GPT)	0~35	31	
ALP	40~129	78	
Gamma-GTP	10~71	33	
T-bilirubin	0.2~1.2	0.7	
D-bilirubin	0~0.3	0.3	
Glucose	70~99	102	▲
HbA1C	4~5.6	6.3	▲
BUN	8~26	14.7	
Creatinine	0~1.5	0.9	
Uric acid	0~8.0	7.0	

문자검사결과

검사항목	검사결과
심전도	특이 소견 없음
안저검사소견	특이소견 없음
흉부정면(P-A)MS	[FINDING]No active lung d
위내시경	Chronic superficial gastritis
상복부초음파	1.경도의지방간 2.우신낭종
치과진찰소견	치주염, 치주질환 치료가 필요합
PET CT(건진)	[FINDING]검사목적 : 종합건

Case 3. M/71

PET CT(건진)
[FINDING]
검사목적 : 종합건진

[소 견]

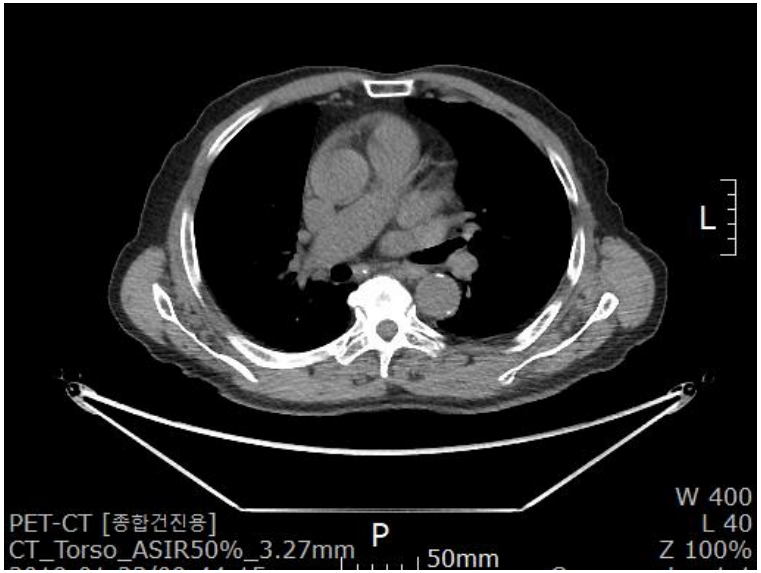
1) Brain, head & neck, chest & breast, abdomen, pelvis, extremities에 malignancy를 suggestion하는 abnormal hypermetabolic lesion은 관찰되지 않음.
2) Both shoulder joints에서 round FDG uptake (3.6/2.7) 관찰되며 arthritis 의심됨.
3) Left neck level II area (4.5) 및 mediastinum, 4R (3.0), 7 (3.9), 10L (4.1), 11L (3.7)에서 FDG uptake 관찰되며 reactive LNs 가능성이 높음.
4) Coronary artery에 calcifications 관찰됨.
5) Mild fatty liver 소견 보임. Liver S3에 small cyst 있음.
6) Right kidney에 two small stones 및 cyst 관찰됨.
7) Prostate gland가 커져 있으며 calcifications 동반됨.

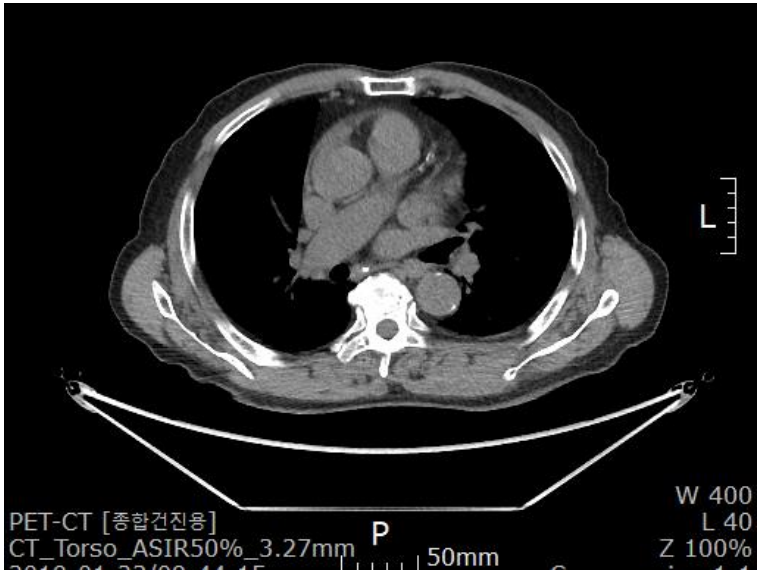
[CONCOLUSION]
1. r/o Arthritis, both shoulder joints
2. Reactive LNs, left neck level II area and 4R, 7, 10L, 11L, more likely
3. Coronary calcifications
4. Mild fatty liver
5. Two small stones and cyst, right kidney
6. Prostate hyperplasia

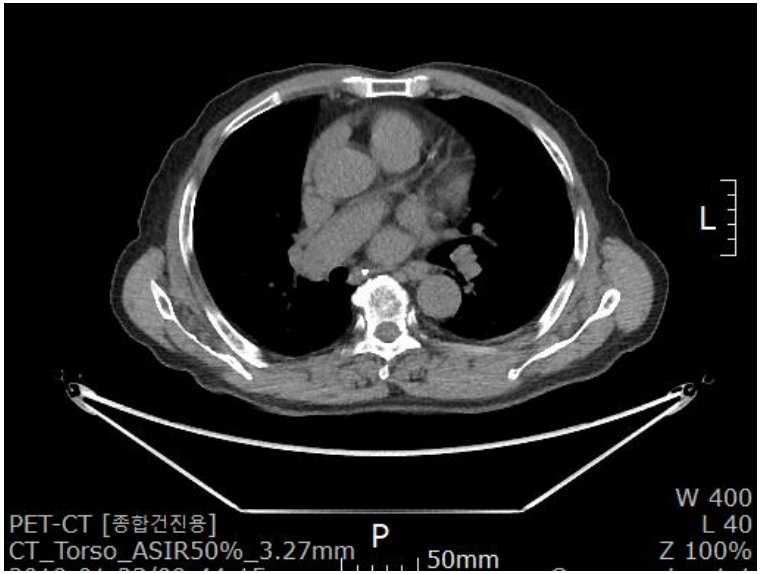
*병변의 크기가 작거나 (4~5 mm 이하), 종양의 종류에 따라 병변이 보이지 않을 수 있고 (위음성 결과), 위암과 간세포암을 찾는 데는 위내시경과 간초음파가 동반되어야 합니다.

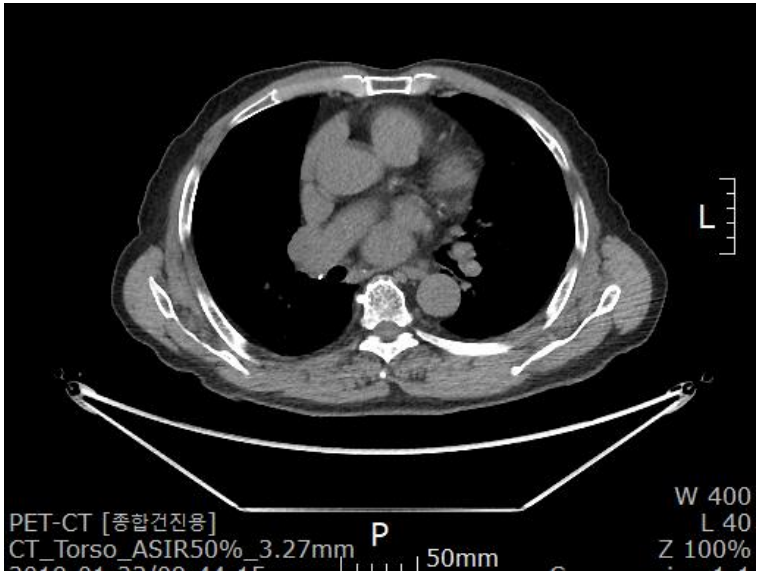
자세한 상담 및 관상동맥에 대한 정밀검사를 위해 순환기내과 진료를 받으시기 바랍니다.("44.PET-CT (전신)" 항목을 참조하세요.)

Case 3. M/71


L
PET-CT [종합건진용]
CT_Torso_ASIR50%_3.27mm
P
50mm
W 400
L 40
Z 100%


L
PET-CT [종합건진용]
CT_Torso_ASIR50%_3.27mm
P
50mm
W 400
L 40
Z 100%


L
PET-CT [종합건진용]
CT_Torso_ASIR50%_3.27mm
P
50mm
W 400
L 40
Z 100%


L
PET-CT [종합건진용]
CT_Torso_ASIR50%_3.27mm
P
50mm
W 400
L 40
Z 100%

Case 4. M/62

CT검사

검사항목	금회결과	
	결과	기준범위
관상동맥석회수치측정-CT	유소견	

▣ 관상동맥석회수치측정-CT

- 관상동맥석회화 수치 측정 CT -

Heart rate(심박동수): 80

-LM(좌주관상동맥) : 0 (석회화관찰되지않음)

-LAD(좌전하행동맥) : 850.38 (significant)

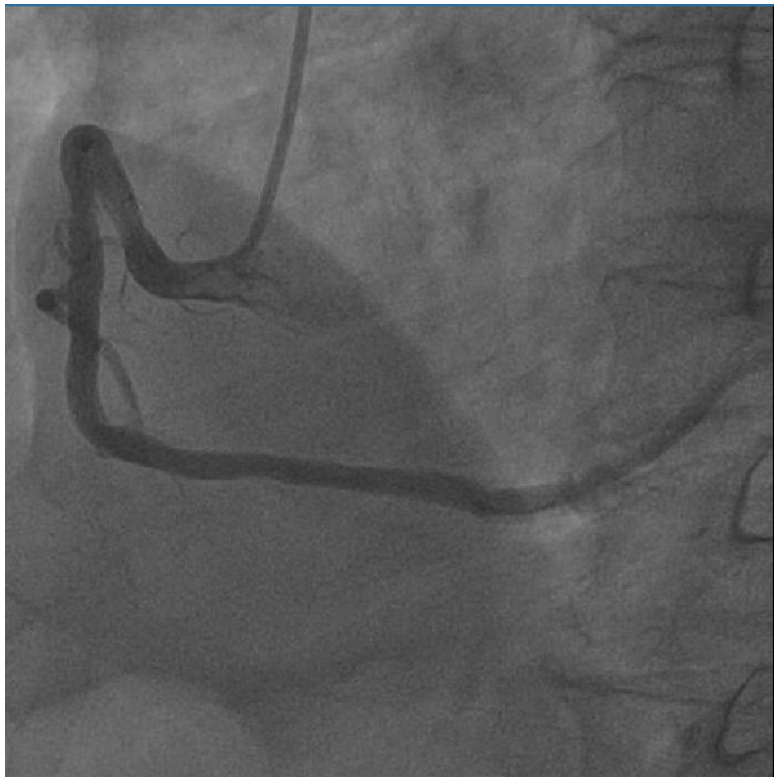
-LCX(회선동맥) : 0 (석회화관찰되지않음)

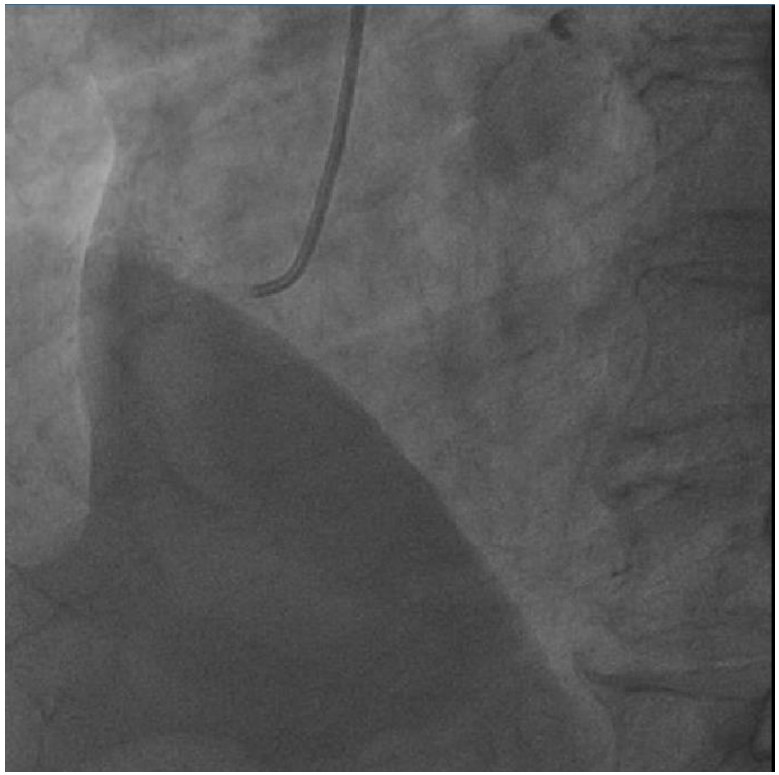
-RCA(우관상동맥) : 1636.09 (significant)

CONCLUSION(결론)

석회화 관찰되며 총석회화수치는 2486.47 (Significant evidence of CAD)
전문의의 상담을 받으시기 바랍니다.

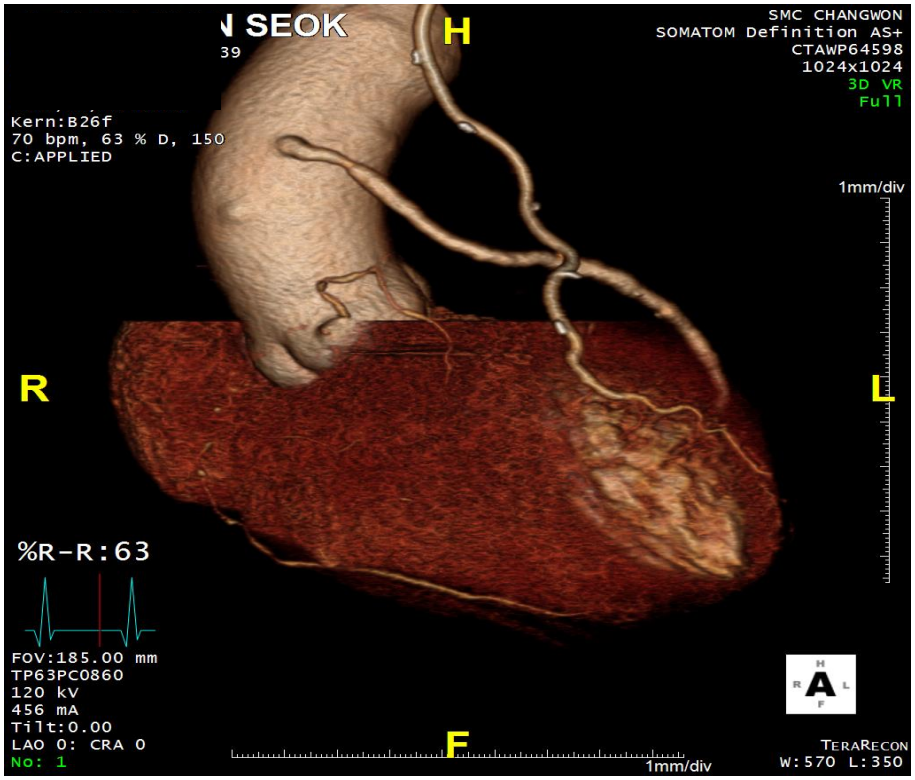
Case 4. M/62



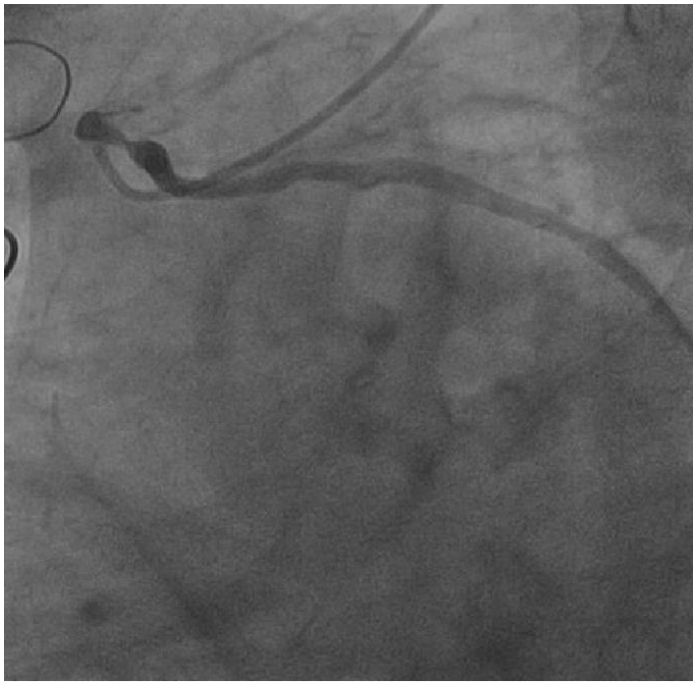


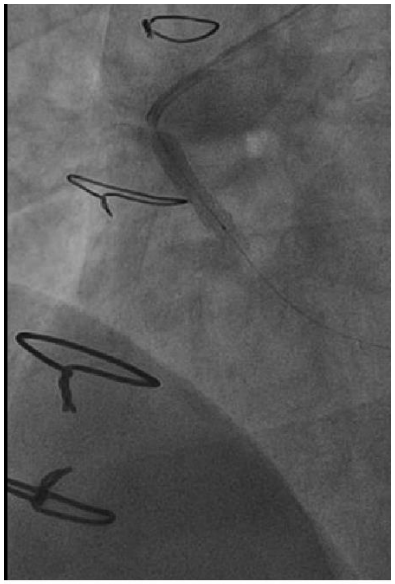
Case 4. M/62

Case 5. M/71, s/p CABG



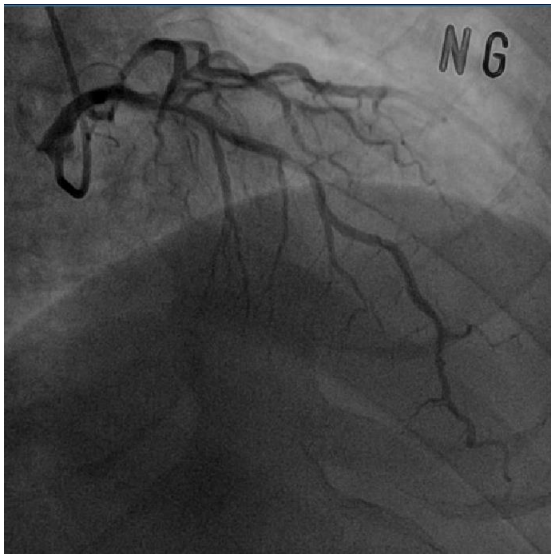
Case 5. PCI for SVG

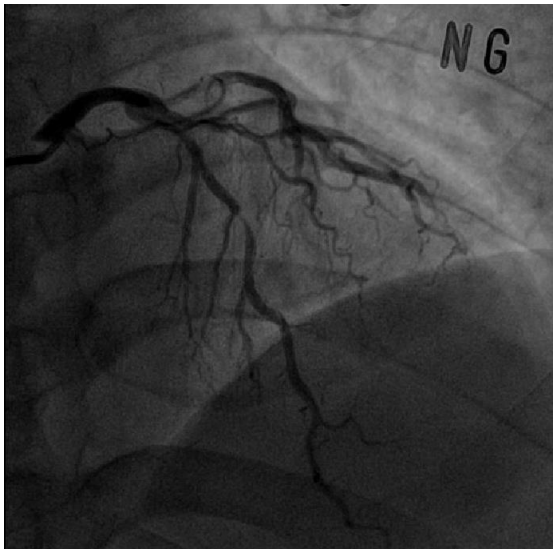




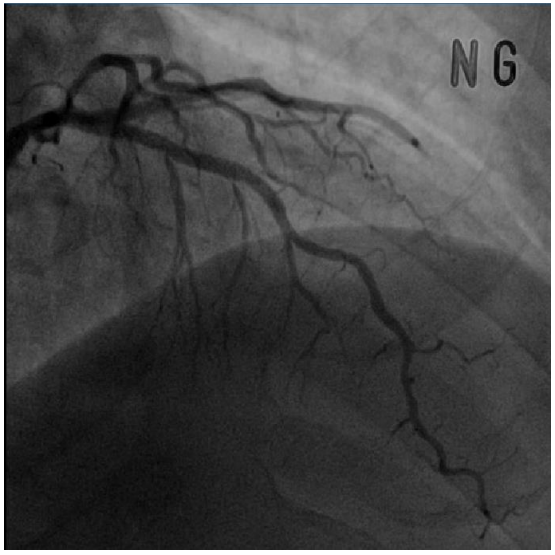
Case 5. M/40, s/p PCI

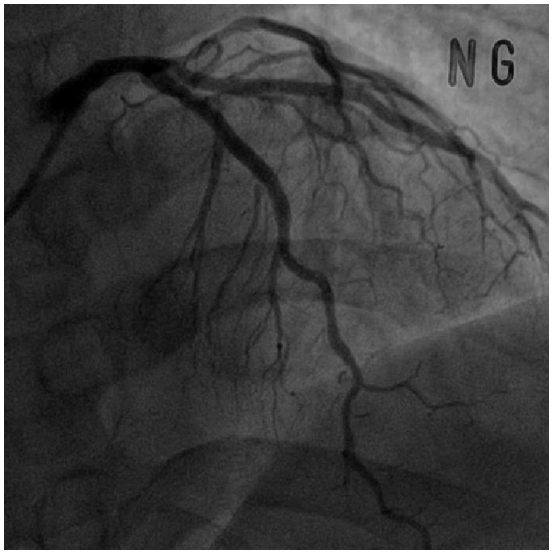
시술 전





시술 전





Case 5. M/40, CCTA, 5 yr later

128 CT with NTG (#1) , RR: 1140 . poor quality , CTA DLP 571.3 , total DLP 628.

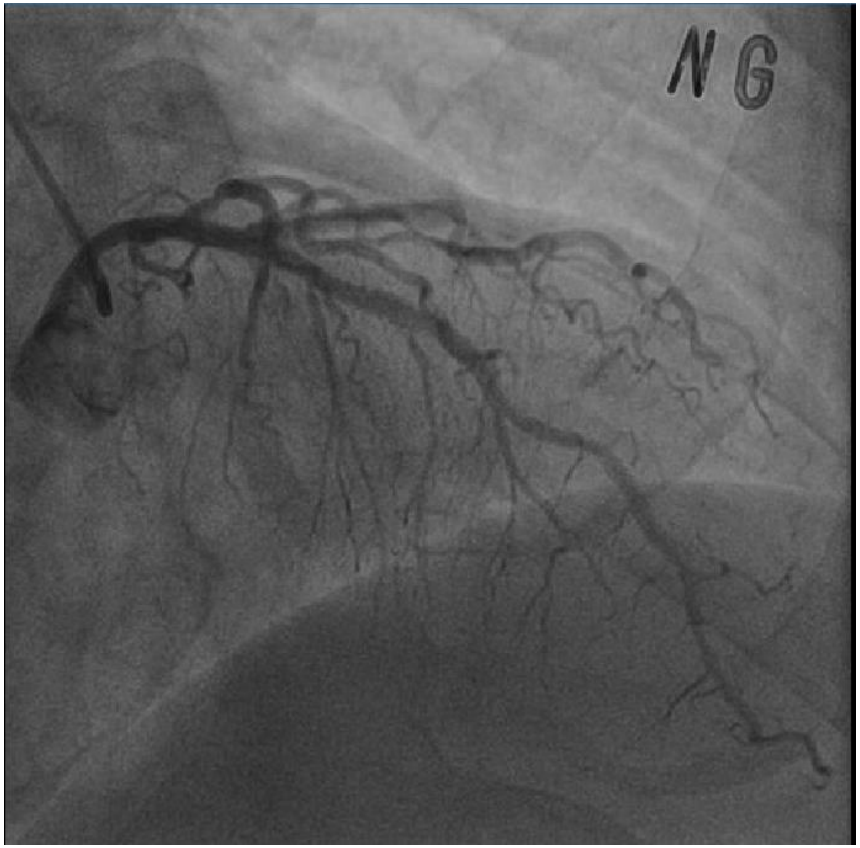
*** p- to mLAD stent: R/O discrete ISR (50-60%).
OM1 stent: maybe good patency.

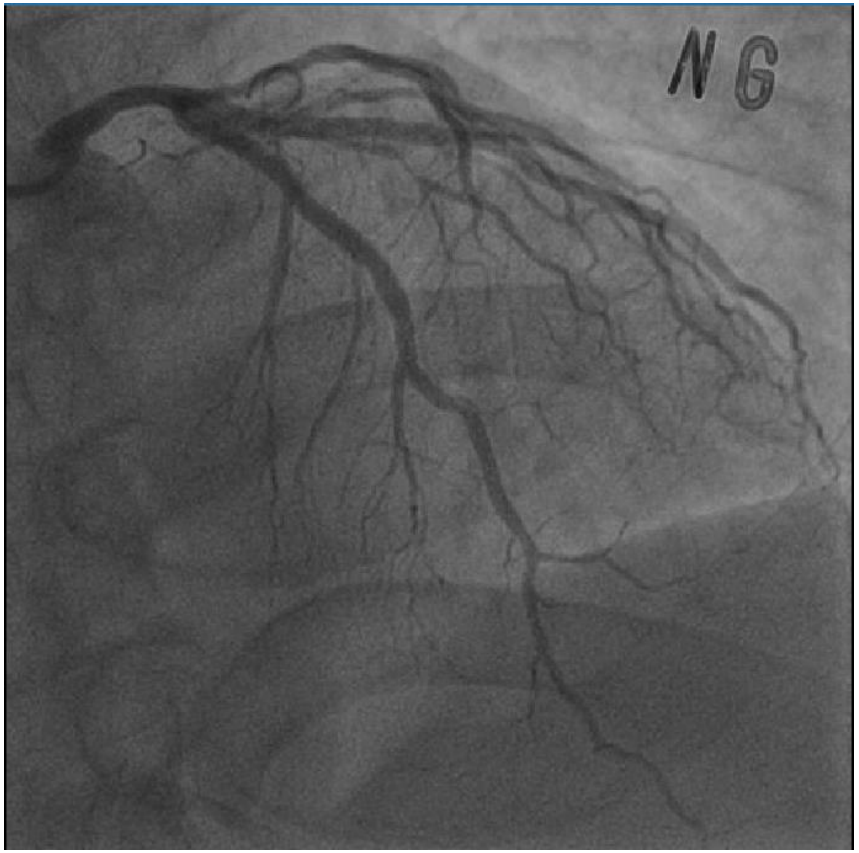
LCA:
-LM: discrete mild stenosis(20-30%) at LM due to calcific plaque.
-LAD: R/O discrete ISR (50-60%) at p-to mLAD stent.
discrete moderate stenosis(40%) at D1 os due to calcific plaque.
-LCx: maybe good patency at OM1 stent.

RCA: tubular mild stenosis(10%) at pRCA due to calcific plaque.
discrete mild stenosis(10%) at mRCA due to calcific plaque.
discrete mild stenosis(15-20%) at mRCA due to calcific plaque.
discrete severe stenosis(70-80%) at PDA os due to non-calcific plaque.

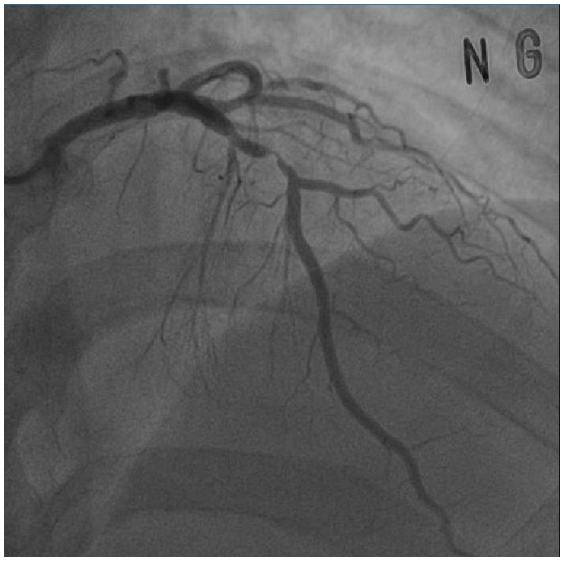
other cardiac finding:
-EF:63.91%(ED vol:82.23ml, ES vol:29.68ml)
LVIDd: 4.7cm , LVIDs: 3.3cm, LAAPd:3.3cm
IVSd:1.0cm LVPWd: 1.0cm,
Ascending aorta: 3.0cm

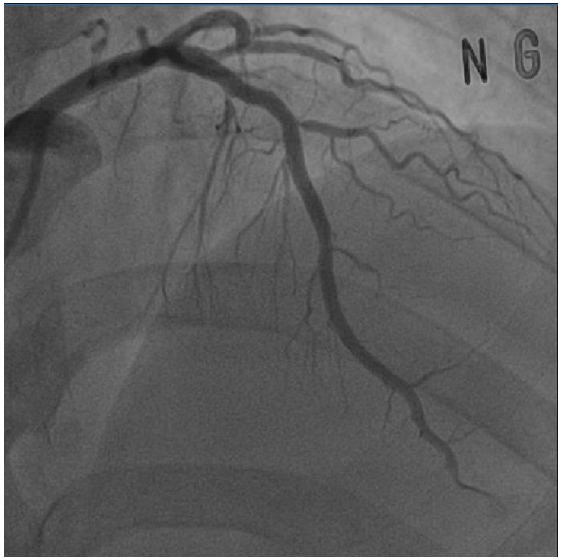
Case 5. M/40, CAG

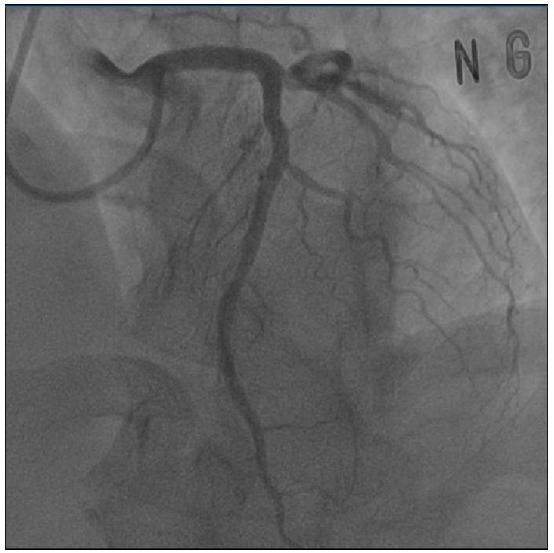




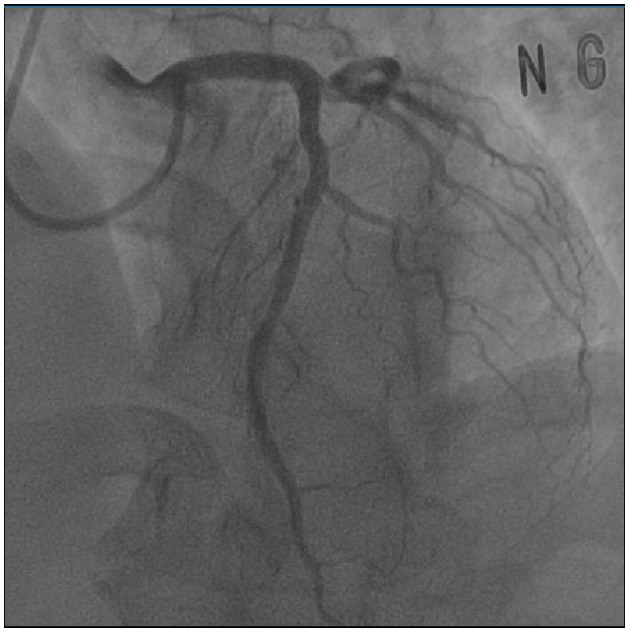
Case 7. M/44, PCI for LAD







Case 7. CCTA F/U, 2 year later



경청해 주셔서 감사 드립니다