



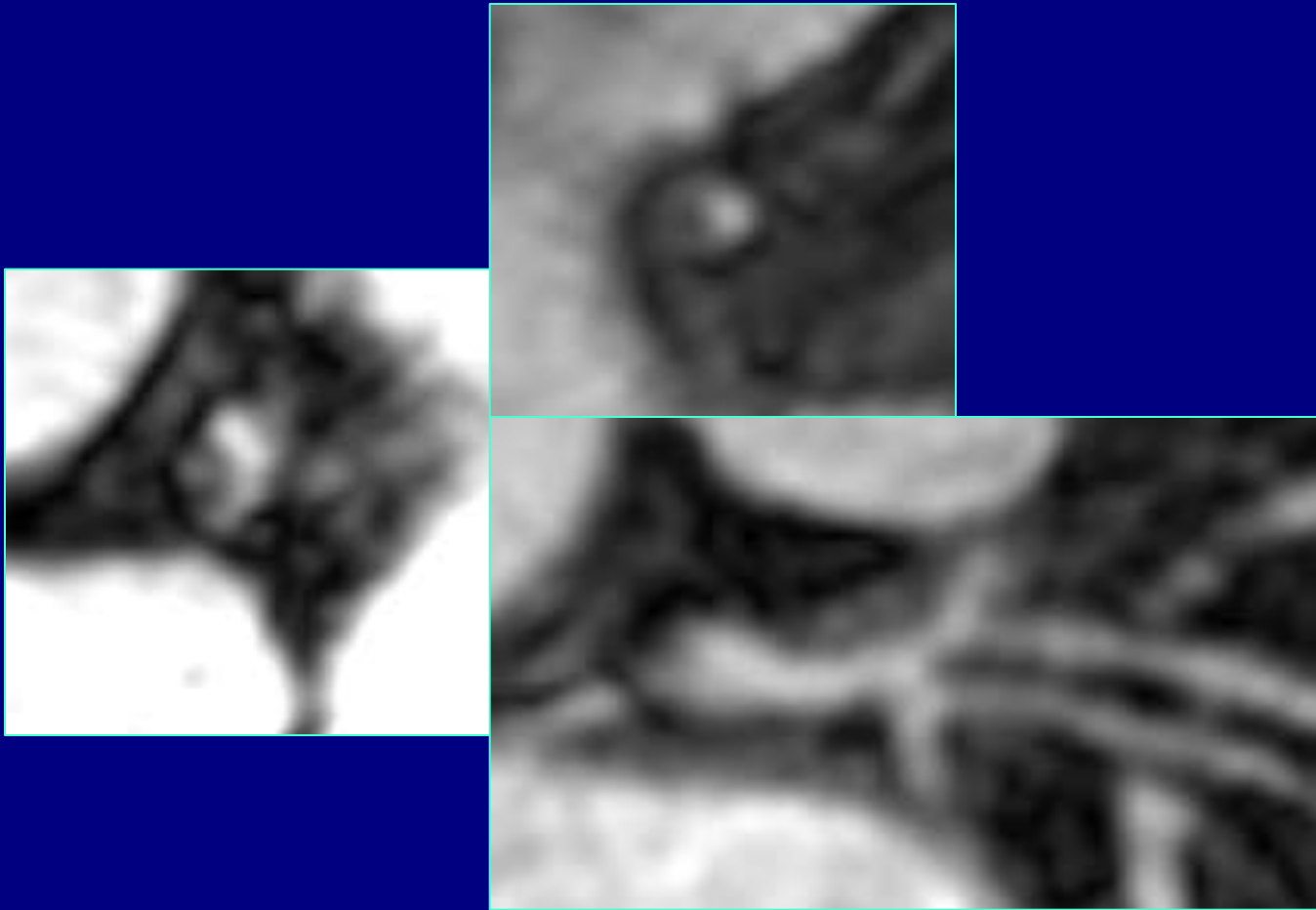
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# Coronary MRA predicts PCI Success Better

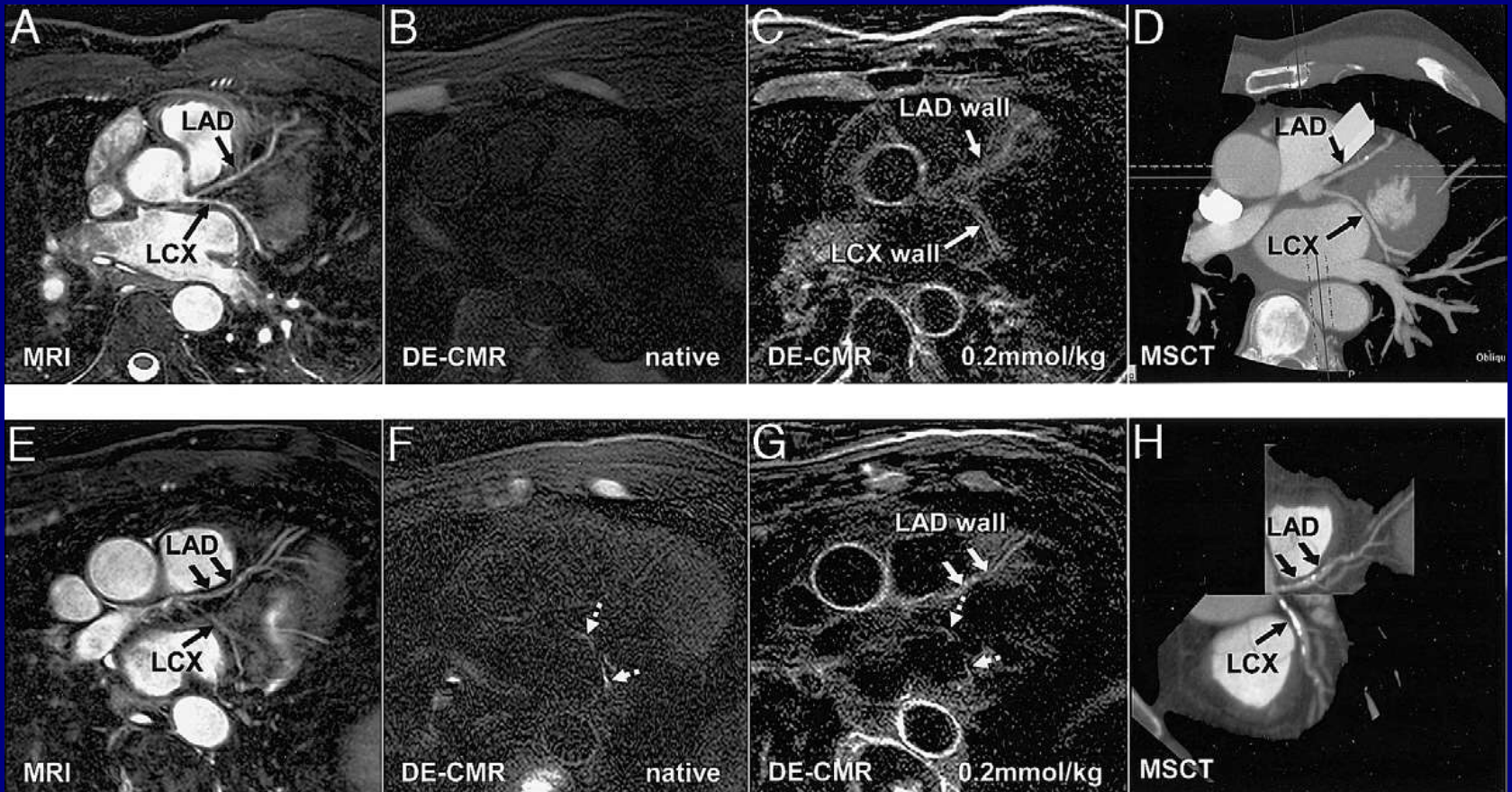
Yeon Hyeon Choe, MD

Department of Radiology and  
HvSI Imaging Center,  
Samsung Medical Center,  
Sungkyunkwan University School of Medicine  
Seoul, Korea

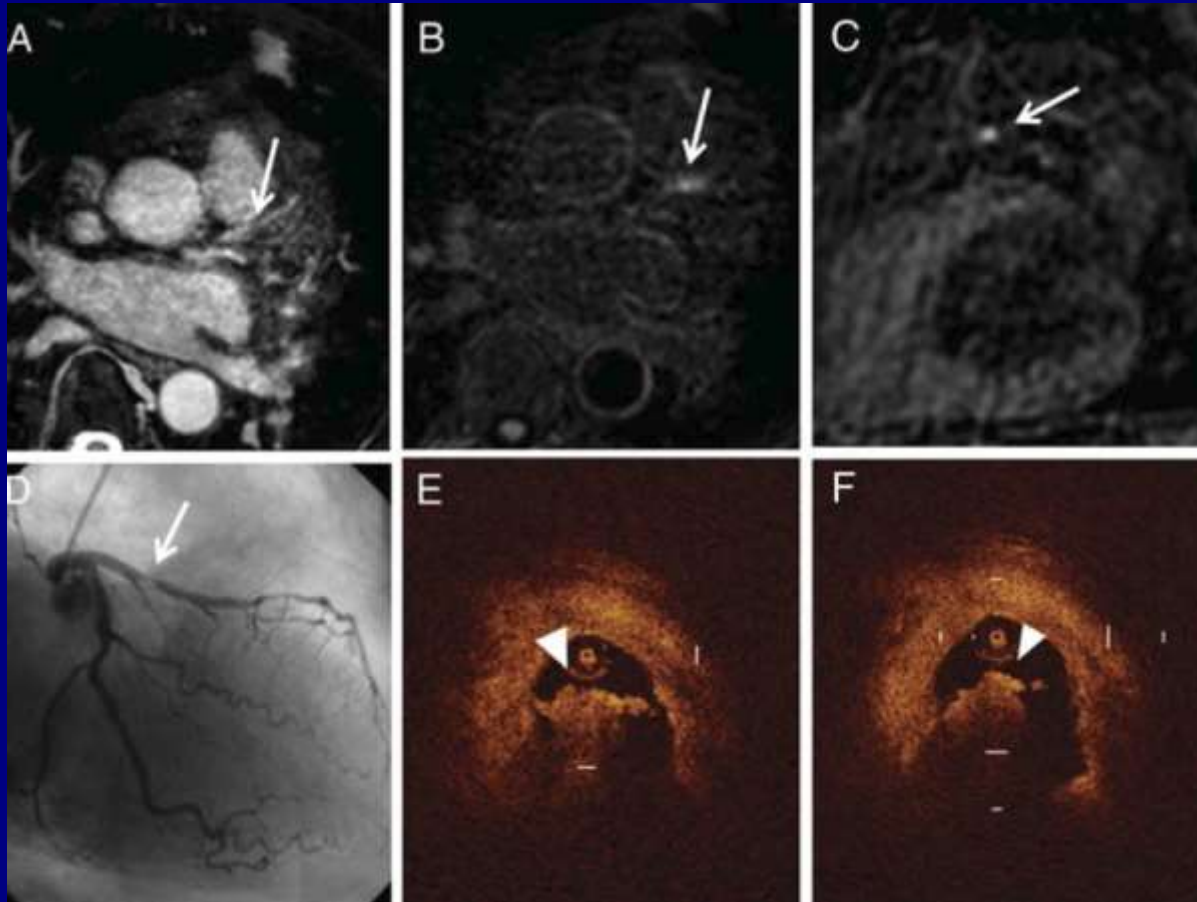
# Coronary MRA with Gd



# Delayed-Enhancement Cardiovascular Magnetic Resonance Coronary Artery Wall Imaging



Hyperintense plaque identified by MRI relates to intracoronary thrombus as detected by OCT in patients with angina pectoris

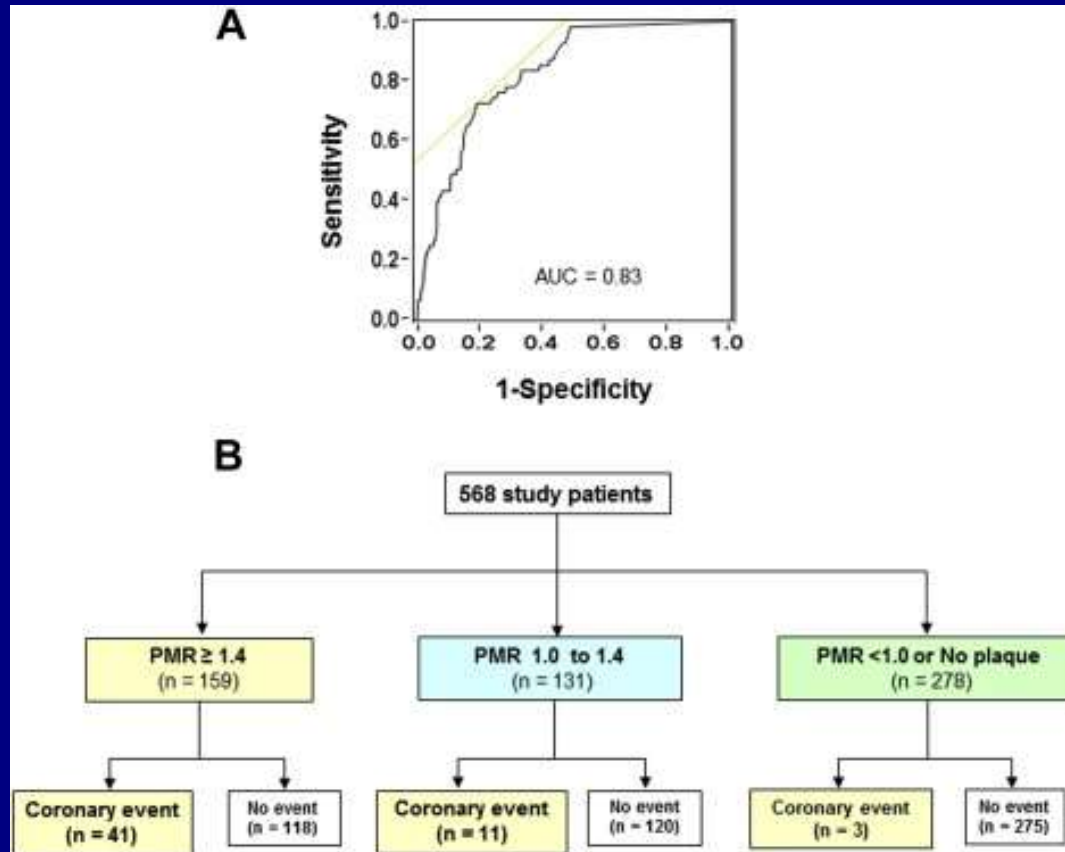




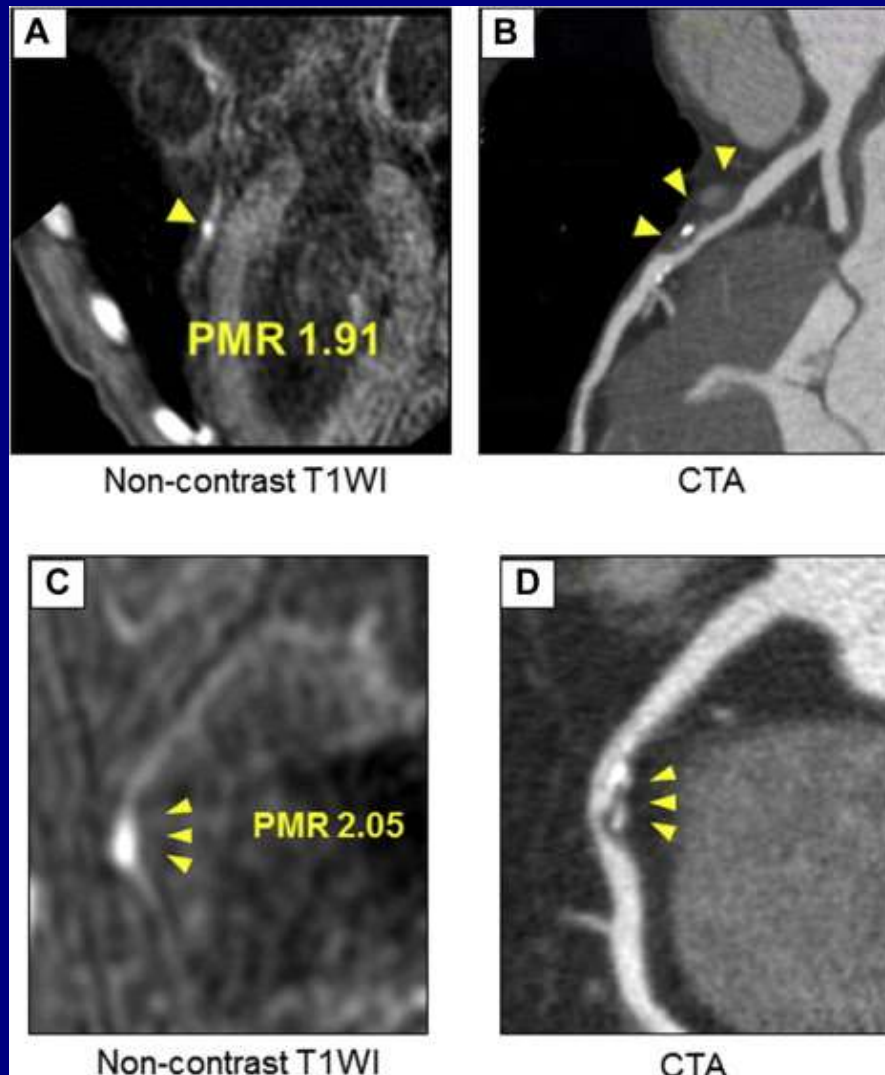
# OCT findings in hyperintense and non-hyperintense plaque

	HIP (n = 16)	Non-HIP (n = 10)	P-value
Lipid-rich plaque	12 (75%)	5 (50%)	0.234
TCFA	6 (38%)	2 (20%)	0.420
Plaque rupture	7 (44%)	3 (30%)	0.683
Calcification	9 (56%)	7 (70%)	0.683
Thrombus	12 (75%)	1 (10%)	0.004
Red thrombus	7 (58%)	0 (0%)	
White thrombus	5 (42%)	1 (100%)	

# High-intensity signals in coronary plaques on noncontrast T1-weighted magnetic resonance imaging as a novel determinant of coronary events

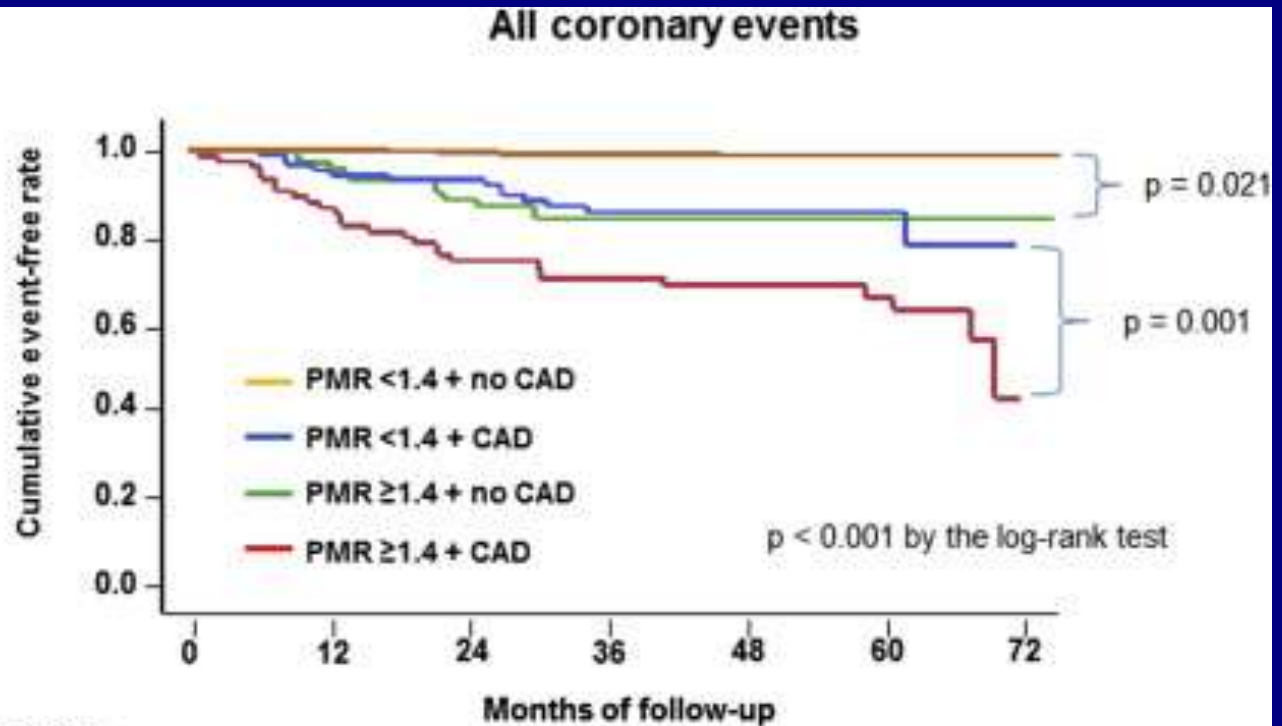


Noguchi et al. J Am Coll Cardiol. 2014; 63(10):989-99



Noguchi et al. J Am Coll Cardiol. 2014; 63(10):989-99

# Kaplan-Meier Curves of Coronary Event-free Survival



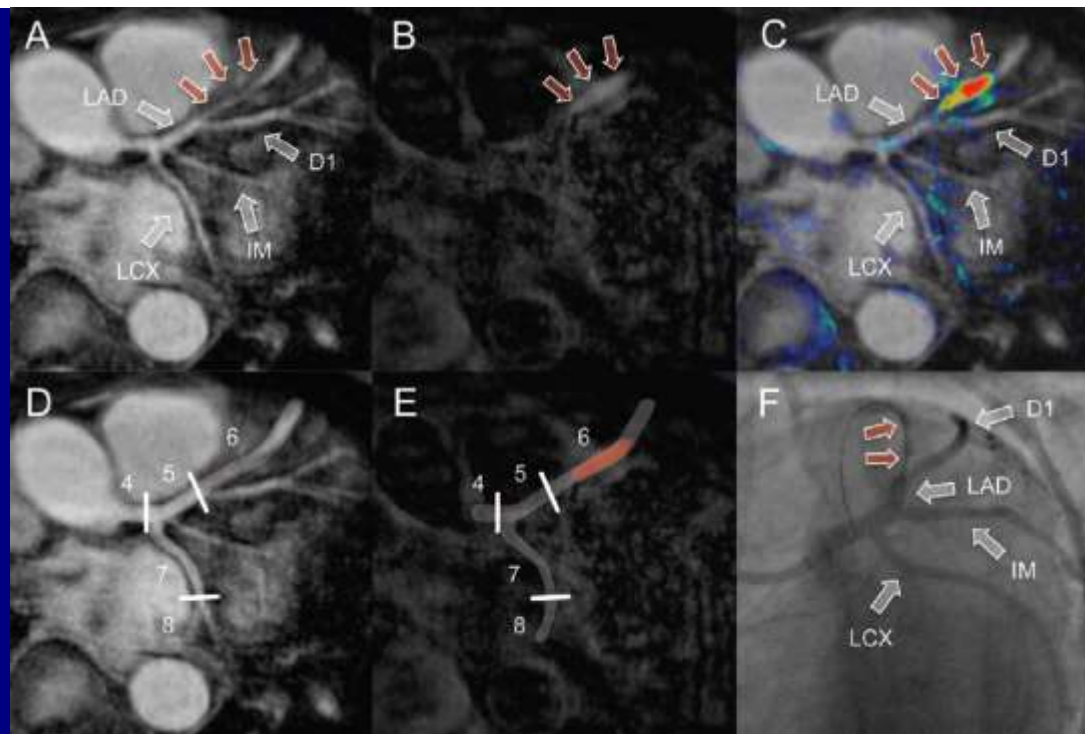
## Number of patients at risk

	0	12	24	36	48	60	72
PMR <1.4 + no CAD	340	340	327				145
PMR <1.4 + CAD	69	67	50				21
PMR ≥1.4 + no CAD	85	81	60				20
PMR ≥1.4 + CAD	74	60	51				24



# Detection of Intracoronary Thrombus by Magnetic Resonance Imaging in Patients With Acute Myocardial Infarction

C.H.P. Jansen, MD; D. Perera, MRCP, MD; M.R. Makowski, MD, PhD; A.J. Wiethoff, PhD;  
A. Phinikaridou, PhD; R.M. Razavi, MD; M.S. Marber, MD, PhD; G.F. Greil, MD;  
E. Nagel, MD, PhD; D. Maintz, MD; S. Redwood, MD; R.M. Botnar, PhD



***Circulation. 2011;124:416-424***



# Coronary MRA of Coronary Artery Total Occlusion: CMR Findings and Success Rates of PCI According to Intraluminal Signal Intensity Patterns

Sung Mok Kim, Jin-Ho Choi , Yeon Hyeon Choe

Department of Radiology and Cardiovascular Imaging Center  
Division of Cardiology (JHC)

Samsung Medical Center, Sungkyunkwan  
University School of Medicine, Seoul, Korea

Radiology. 2016 Apr;279(1):84-92

# Background

We hypothesized that intraluminal signal intensity (SI) of coronary total occlusion (CTO) lesions at coronary MR angiography (CMRA) may reflect the degree of the softness of the lesion with or without the presence of microvessels.

# Purpose

The purpose of this study were to evaluate the coronary MR angiography (CMRA) findings of coronary artery total occlusion lesions and to compare success rates of percutaneous coronary intervention (PCI) for CTO lesions according to different signal intensity patterns at CMRA.

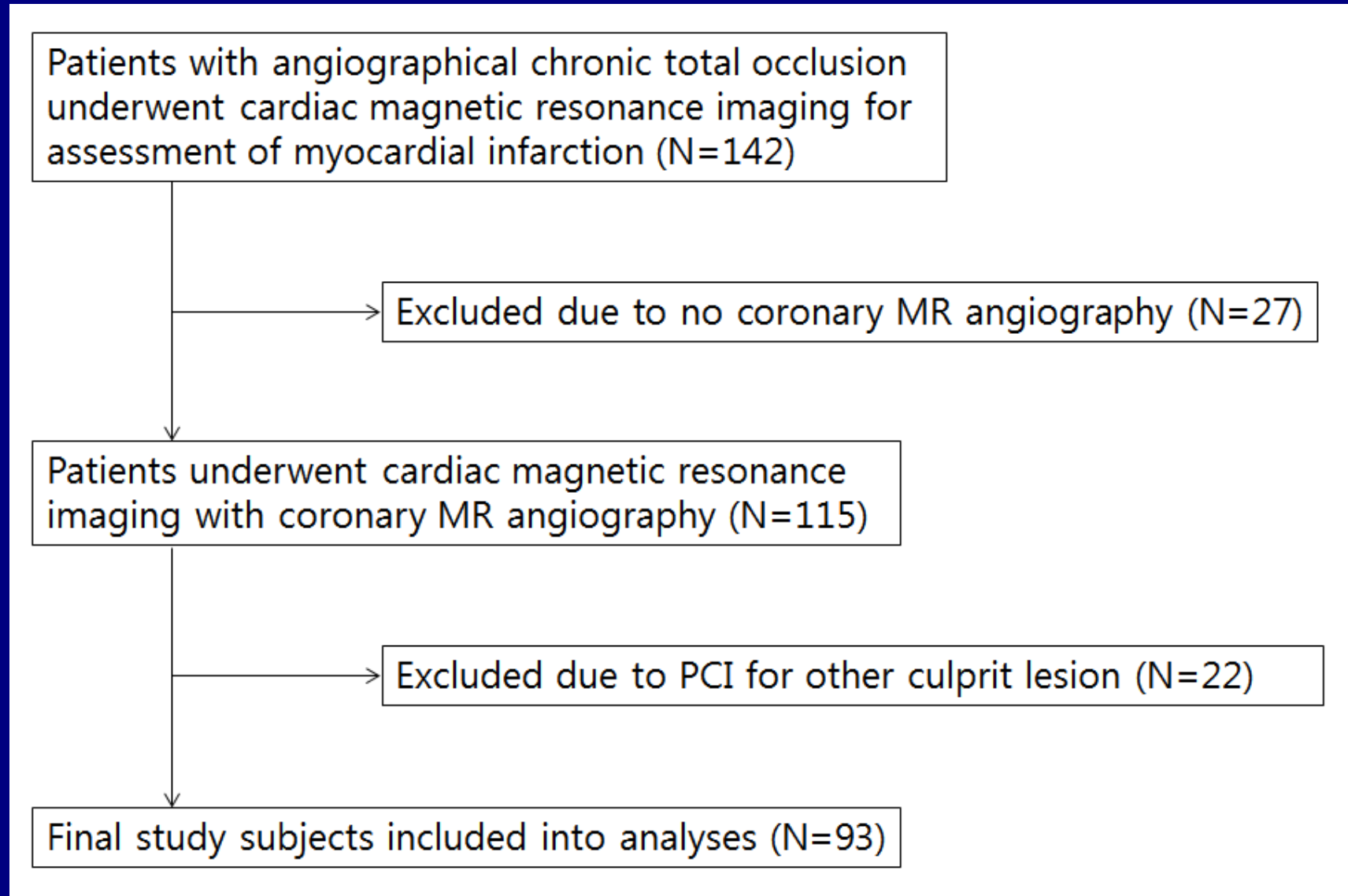
Patients with angiographical chronic total occlusion underwent cardiac magnetic resonance imaging for assessment of myocardial infarction (N=142)

Excluded due to no coronary MR angiography (N=27)

Patients underwent cardiac magnetic resonance imaging with coronary MR angiography (N=115)

Excluded due to PCI for other culprit lesion (N=22)

Final study subjects included into analyses (N=93)

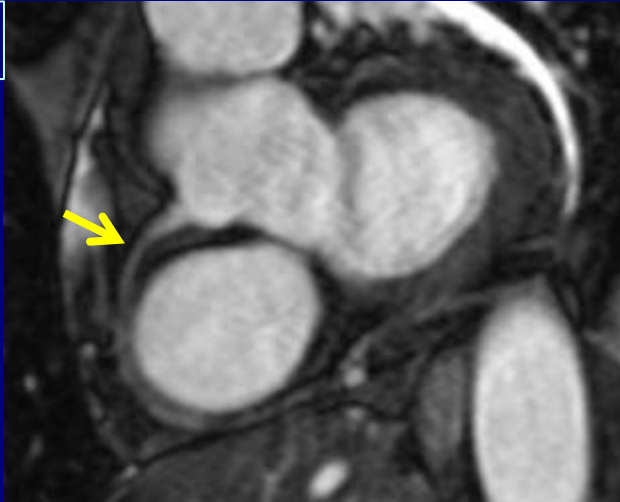




# Materials and Methods

## CMRA grading of CTO lesions

Gr I



Gr II



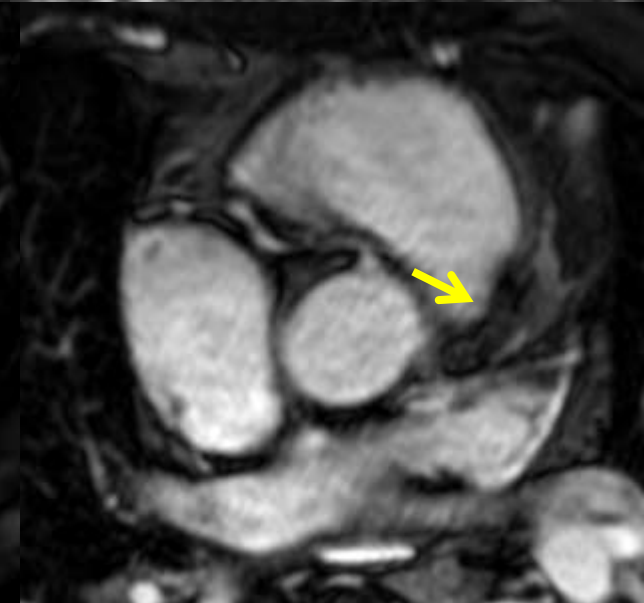
II

Gr III



III

Gr IV



IV



Rod-like continuous HSI areas



Continuous HSI areas with moderate irregularity



Interrupted HSI areas

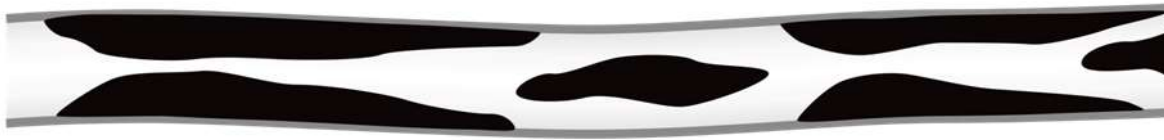


Absent HSI areas

# CMRA Signal Intensity Patterns of CTO Lesions



Rod-like continuous HSI areas



Continuous HSI areas with moderate irregularity

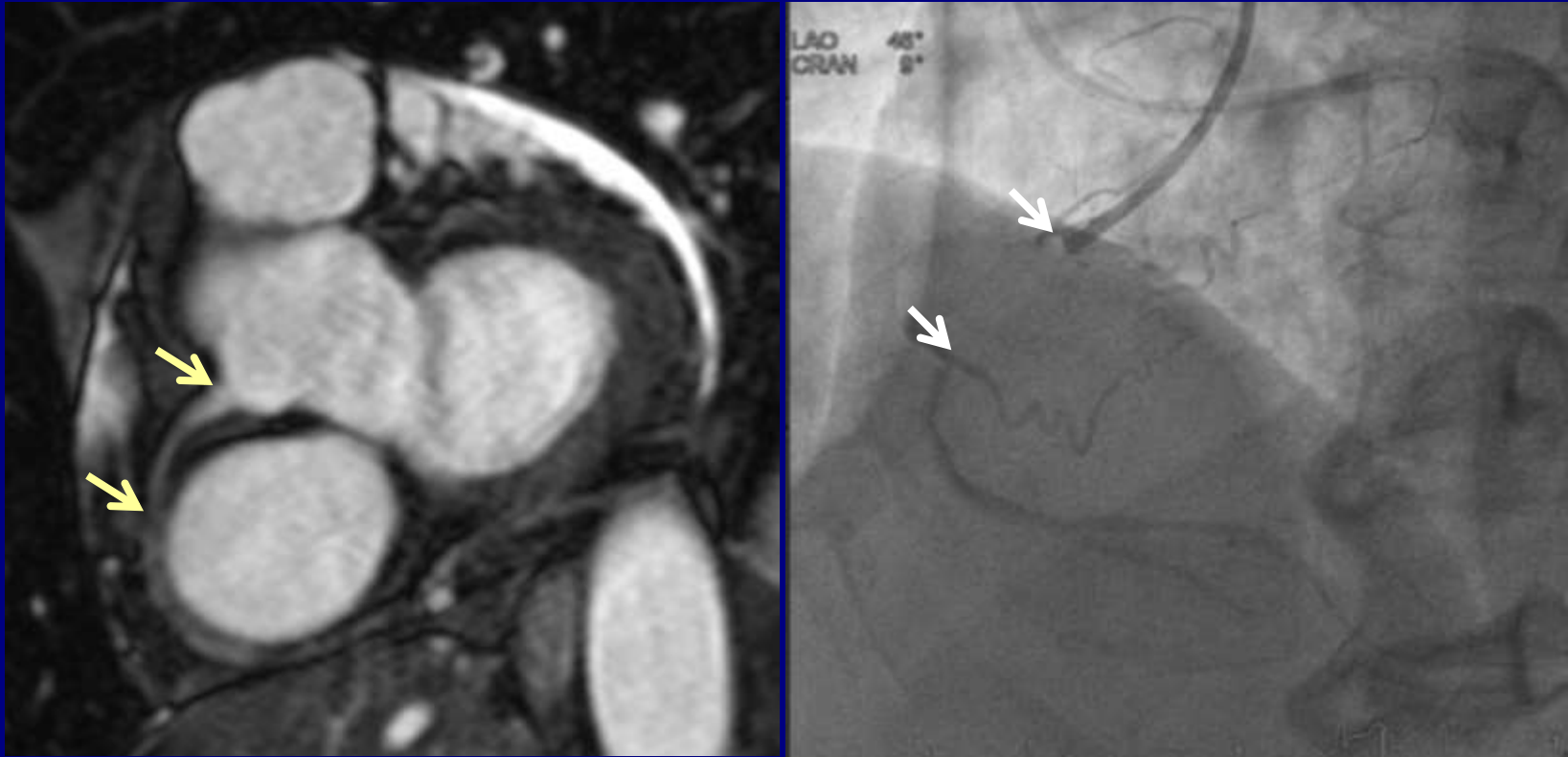


Interrupted HSI areas



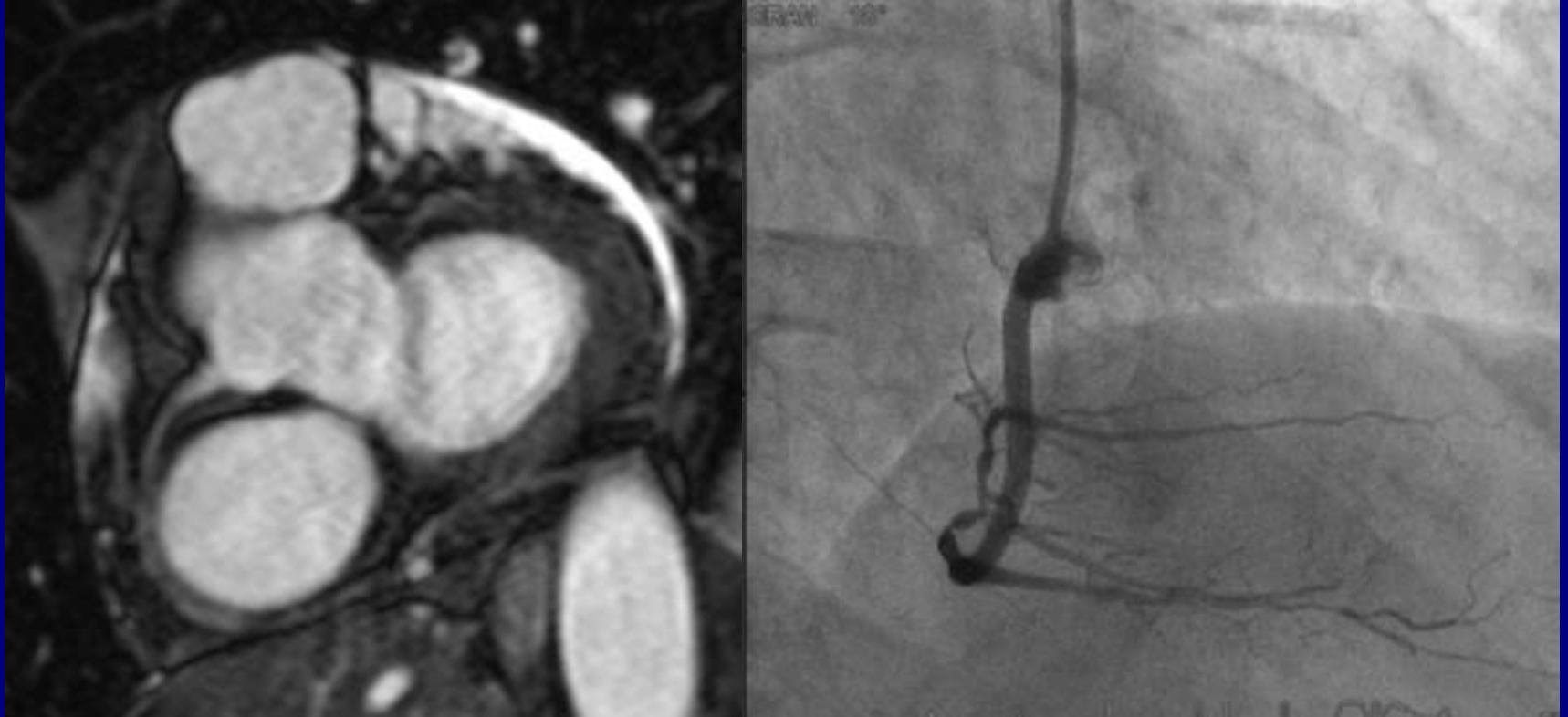
Absent HSI areas

# A 64/M with pRCA Chronic Total Occlusion



CMRA shows continuity of High SI in CTO segment.  
Invasive coronary angiogram shows CTO of pRCA.

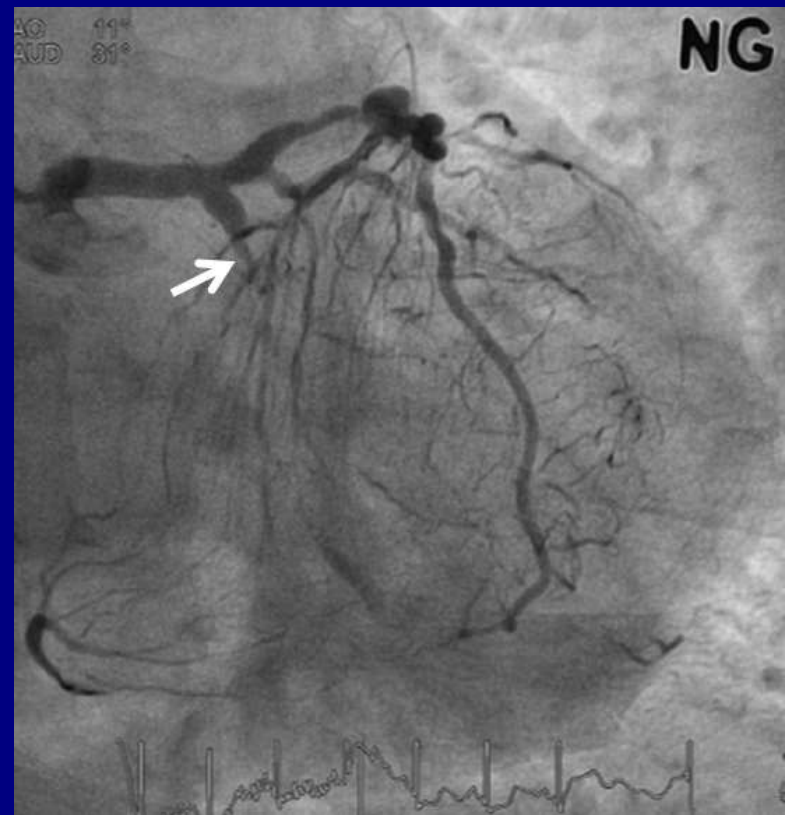
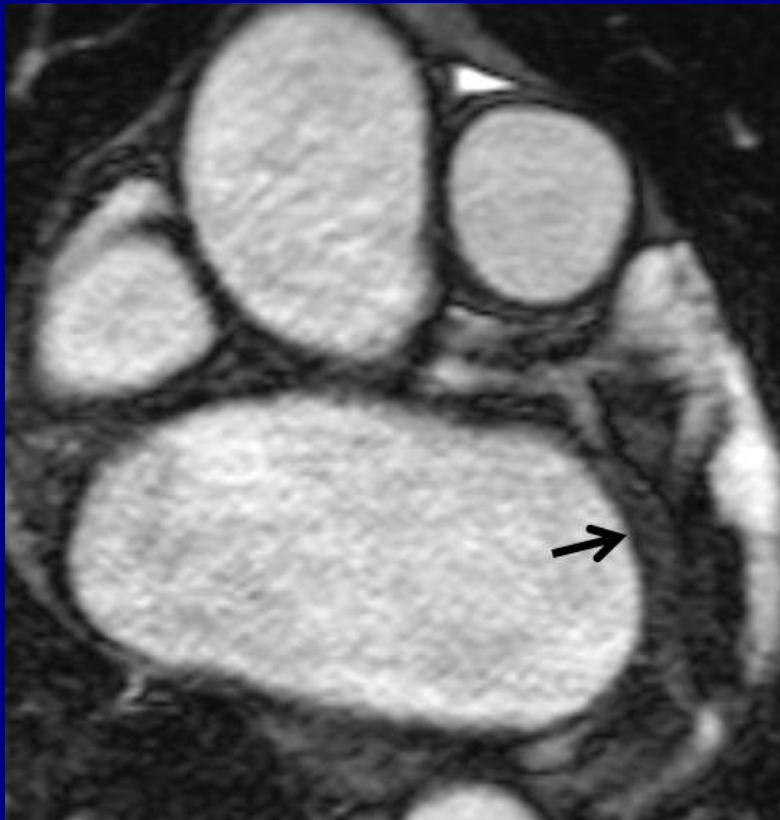
Kim SM, Choe YH. Radiology. 2016 Apr;279(1):84-92



This lesion was successfully treated with PCI.



# Chronic Fibrotic CTO with Dark SI on CMRA → Failure of PCI



# Univariable Analysis of CMRA and Invasive Angio Findings according to PCI Results (n = 95)

Parameter	PCI Success (n = 78)	PCI Failure (n = 17)	P-value
Lesion length (mm)	20.0±14.7	28.0±19.8	0.141
Blunt stump	21 (27%)	6 (35%)	0.490
Calcification	17 (22%)	6 (35%)	0.244
Bending (>45°)	12 (15%)	3 (12%)	0.817
<b>TIMI I</b>	<b>27 (35%)</b>	<b>1 (6%)</b>	<b>0.043</b>
Bridging collateral	15 (19%)	4 (24%)	0.689
Retrograde approach	8 (10%)	1 (6%)	0.582
<b>Presence of continuity of HSI</b>	<b>40 (51%)</b>	<b>2 (12%)</b>	<b>0.009</b>

## Results

# Multivariate Analysis of Predictors of PCI Success

Parameter	Odds Ratio	95% Confidence Interval	<i>P</i> -value
TIMI I	7.097	0.864, 58.305	0.068
Presence of continuity of High SI	6.971	1.463, 33.220	0.015

# Conclusion:

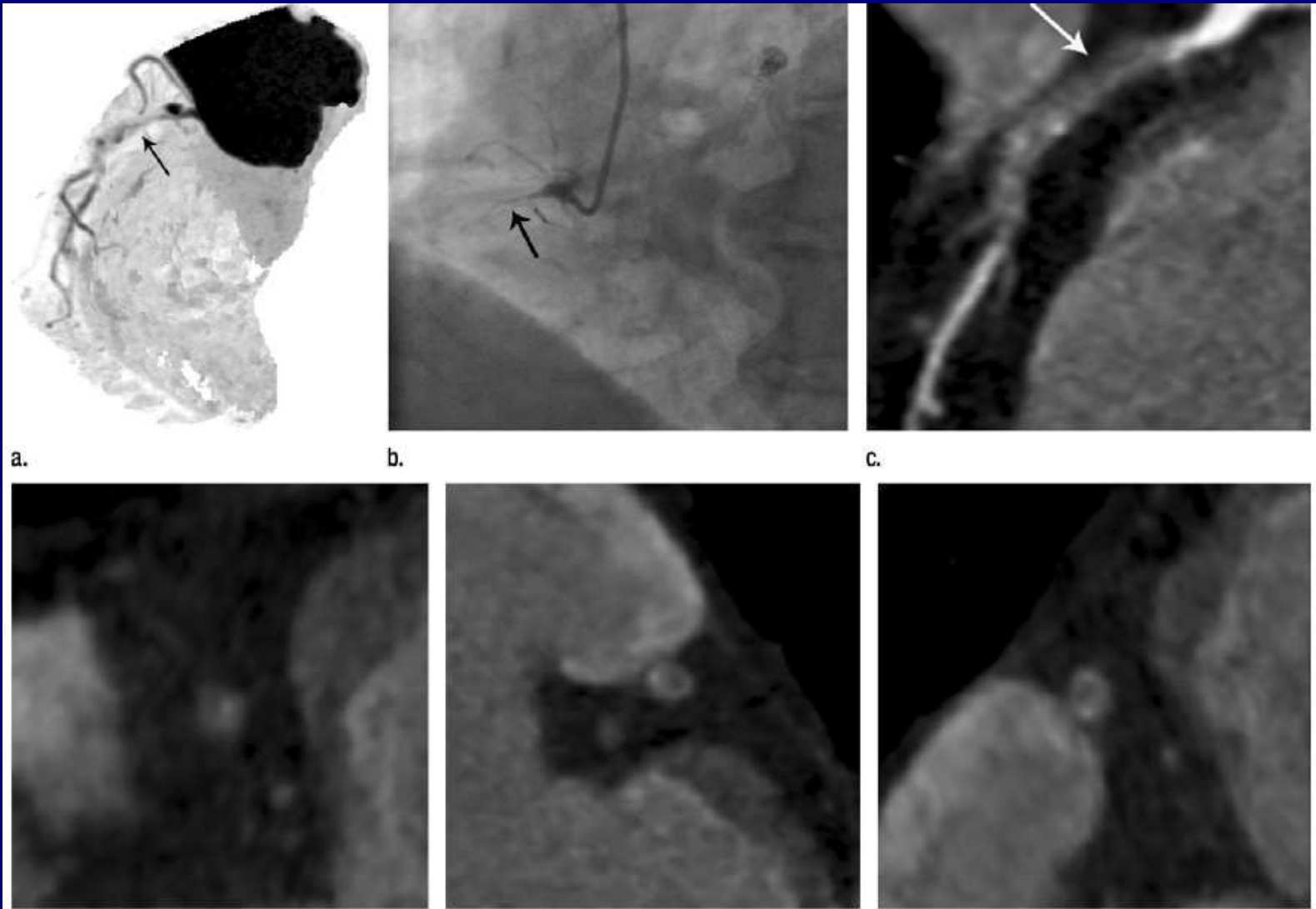
## CTO MRA for PCI Planning

The CTO lesions with predominantly bright intraluminal SIs and continuity of HSI on CMRA shows better success rates of PCI compared with those with predominantly low or dark SIs on CMRA.

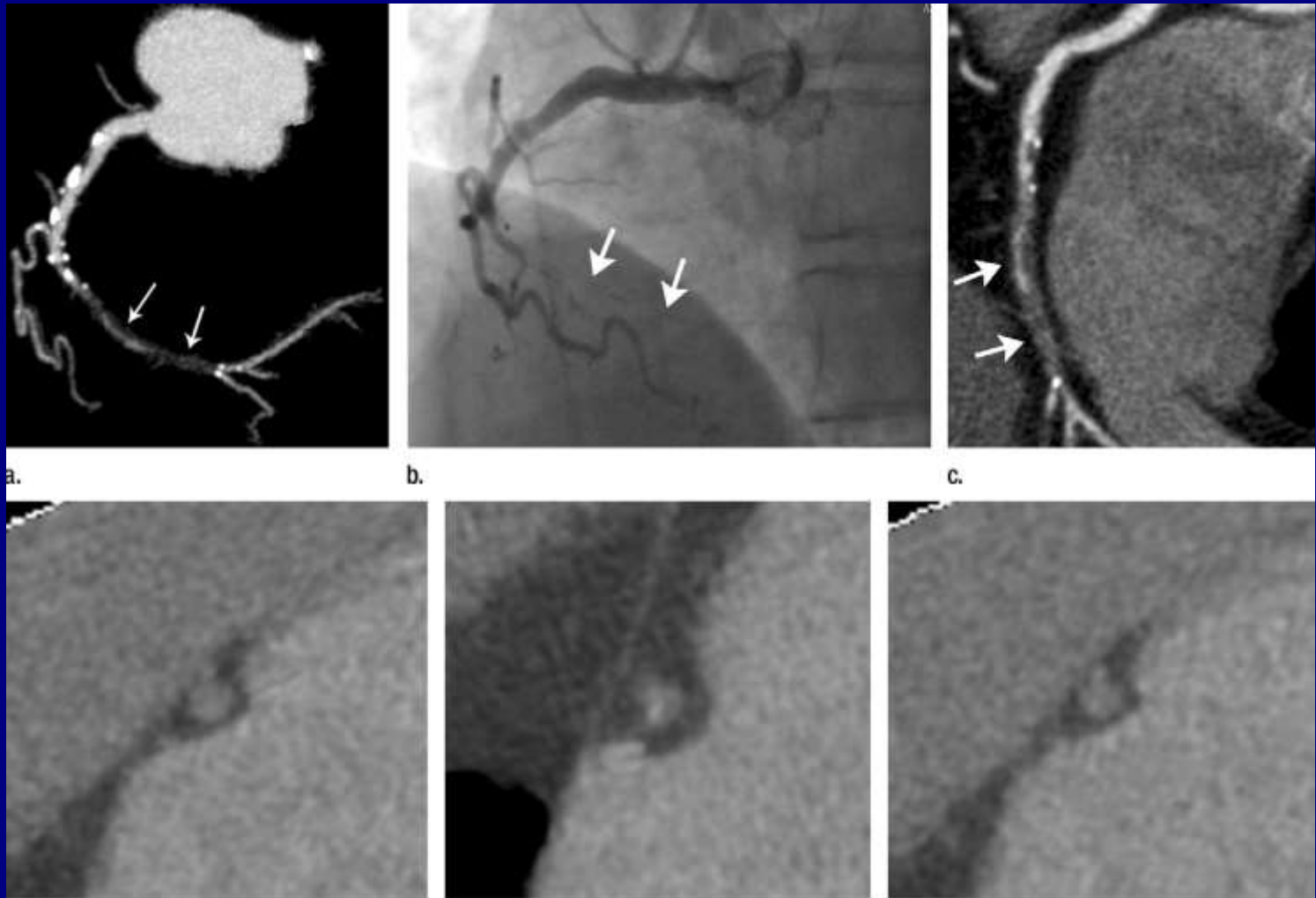
## Coronary Total Occlusion Lesions: Linear Intrathrombus Enhancement at CT Predicts Better Outcome of Percutaneous Coronary Intervention

- 88 CTO of 80 patients.
- 51 with PCI success
- Linear intrathrombus enhancement in 59% of success cases
- The presence of linear intrathrombus enhancement proved at multivariate analysis to be the only independent predictor of PCI success (odds ratio: 4.926; 95% confidence interval: 1.646, 14.74;  $P = .004$ )



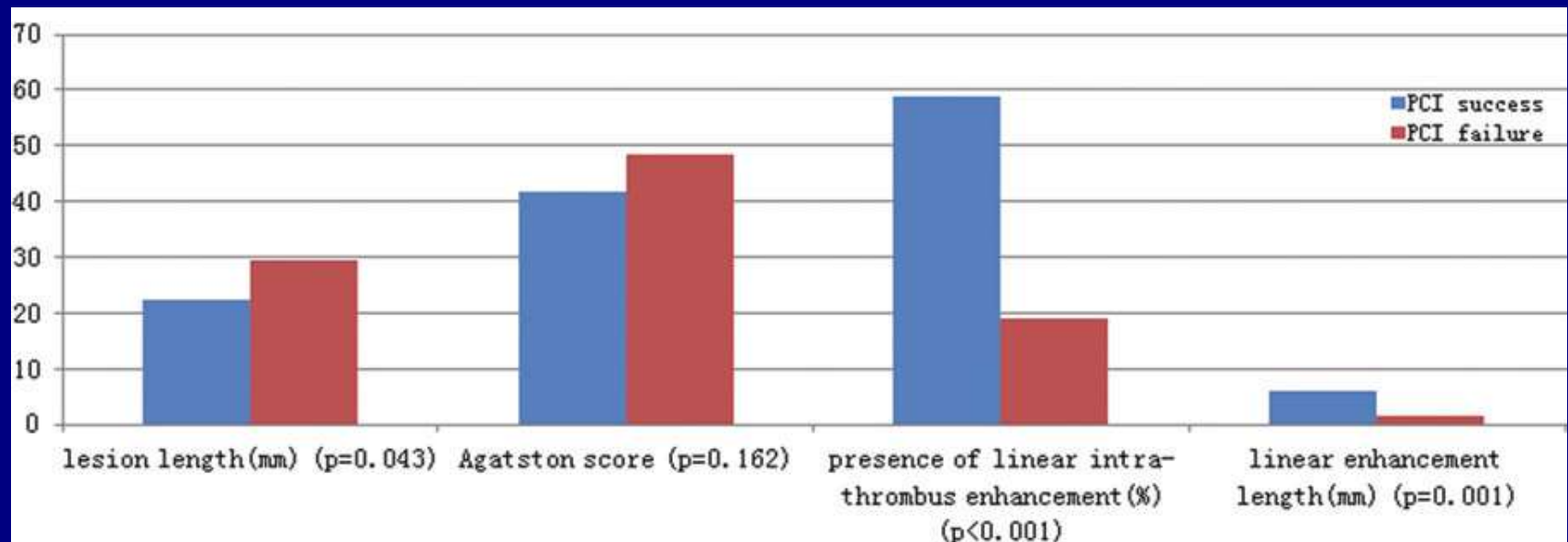


CTO lesion with linear intrathrombus enhancement



CTO lesion with  
small-caliber linear intrathrombus enhancement

# Graph shows comparison of coronary CT angiography characteristics of CTO lesions between PCI success and PCI failure groups



# Predictors of PCI Success

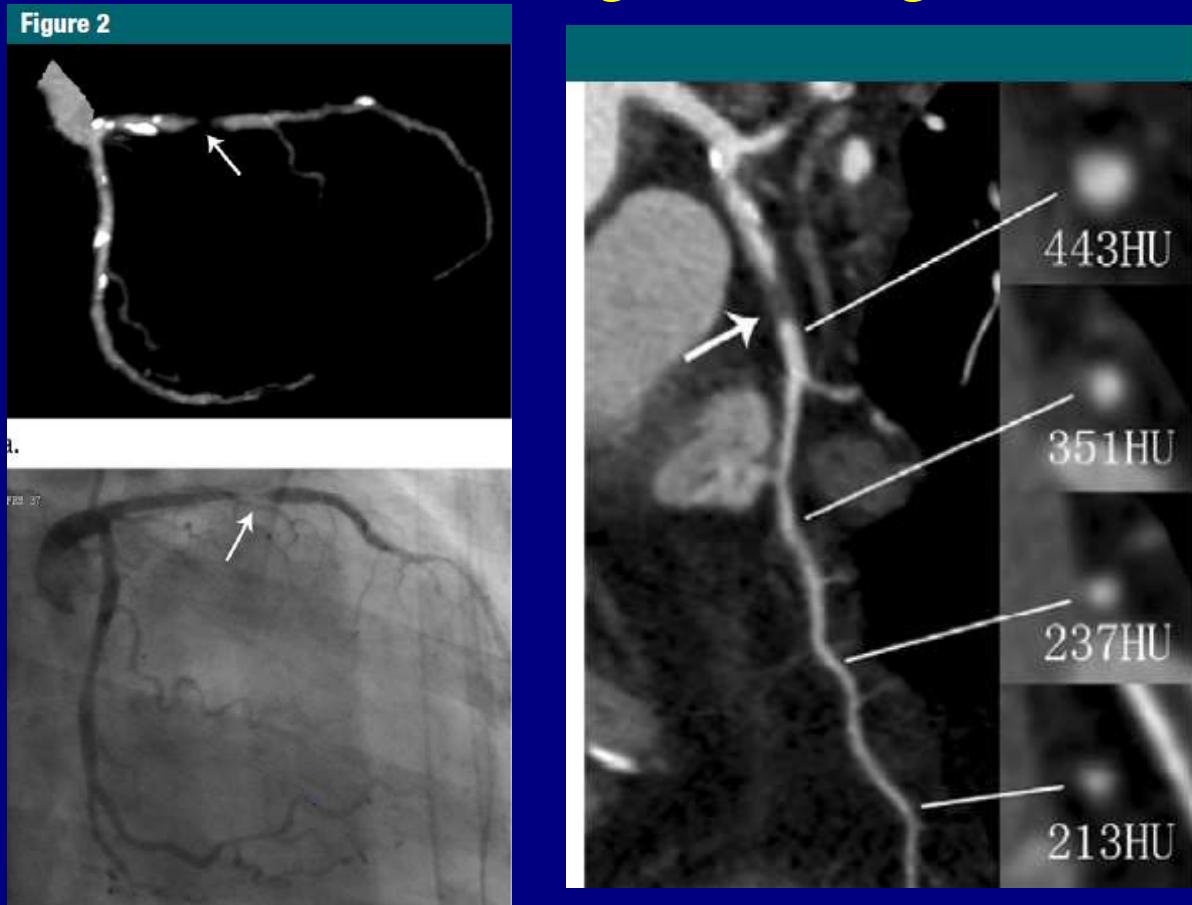
## Multivariate Analysis: Predictors of PCI Success

Variable	Odds Ratio	95% Confidence Interval	<i>P</i> Value
Lesion length at coronary CT angiography > 18.2 mm	0.496	0.166, 1.482	.209
Presence of linear intrathrombus enhancement at coronary CT angiography	4.926	1.646, 14.74	.004
Agatston score of lesions at coronary CT angiography > 44.5	0.348	0.079, 1.531	.163
Presence of tortuous course at conventional coronary angiography (angle, >45°)	0.438	0.112, 1.717	.237
CTO duration > 16.5 months	0.108	0.011, 1.02	.052

# Conclusion

- On the basis of the current finding in this study, the presence of coronary CT angiography–visible linear intrathrombus enhancement within the occluded segment may represent intravascular microvessel formation or recanalized lumen and predicts better outcome of PCI of CTO lesions.

# Coronary CT angiographic evaluation of subtotal occlusion with absence of reverse attenuation gradient sign



# Diagnostic Performance of Coronary CT Angiography for Differentiation of CTO from Subtotal Occlusion

Parameter	Sensitivity (%)	Specificity (%)	Diagnostic Accuracy (%)
Presence of RAG	65 (32/49)	93 (42/45)	79 (74/94)
Lesion length $\geq$ 14.3 mm	71 (35/49)	100 (45/45)	85 (80/94)
Presence of bridging collateral vessels	8 (4/49)	100 (45/45)	52 (49/94)
Combination of all three parameters	90 (44/49)	93 (42/45)	92 (86/94)



# Summary

- CT and MRI guide PCI of CTO lesions.
- Bright intraluminal SIs and continuity of high SI on Coronary MRA suggest softness of the lesion and shows better success rates of PCI.
- Linear intrathrombus enhancement within the occluded segment on coronary CTA may represent intravascular microvessel formation or recanalized lumen and predicts better outcome of PCI.