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MAINZ

„Take home message“ - aktuelle kardiologische Leitlinien

Akutes Koronarsyndrom

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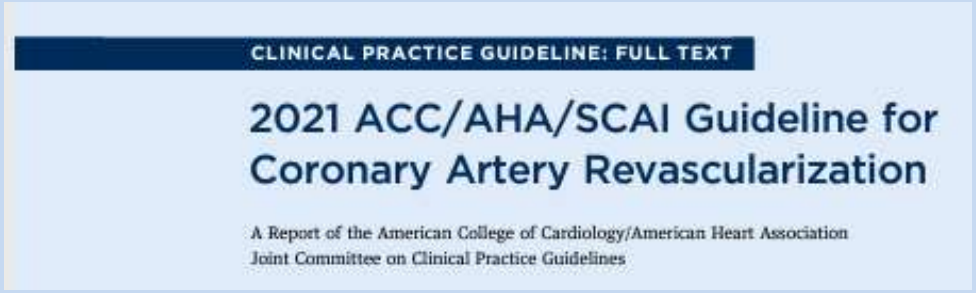
Leitlinien

AHA/ACC CLINICAL PRACTICE GUIDELINE

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



2020 ESC Guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation

2018 ESC/EACTS Guidelines on myocardial revascularization

The Task Force on myocardial revascularization of the European Society of Cardiology (ESC) and European Association for Cardio-Thoracic Surgery (EACTS)

2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation

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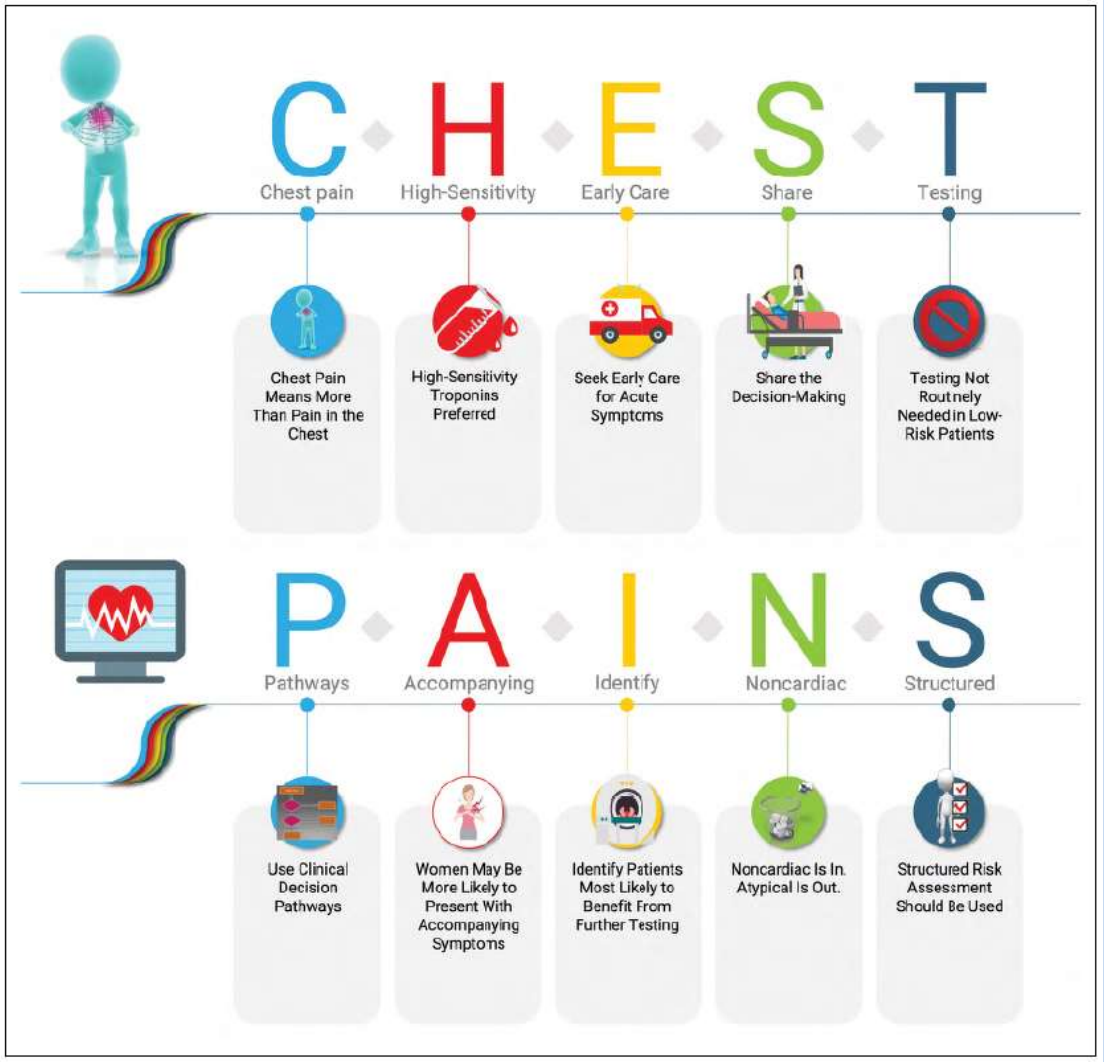
Leitlinien



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Chest Pain Means More Than Pain in the Chest

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Recommendations for Defining Chest Pain
Referenced studies that support the recommendations are summarized in Online Data Supplements 1 and 2.

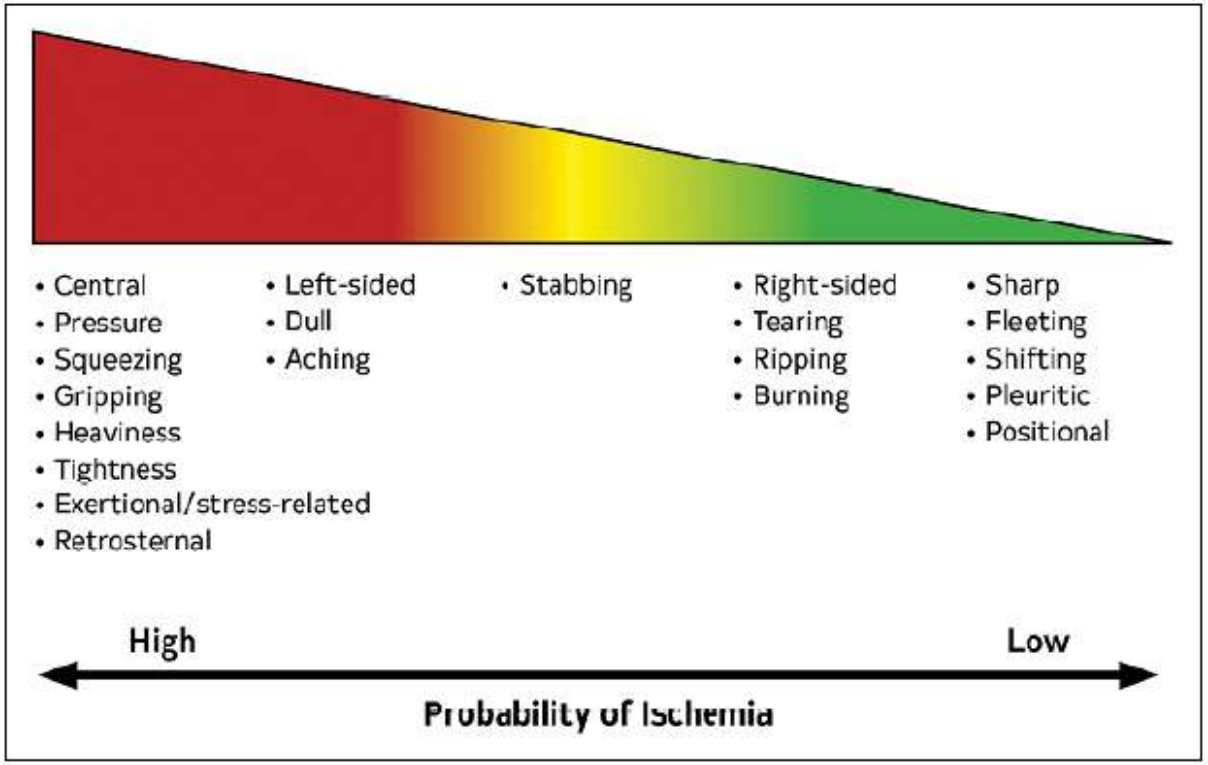
COR	LOE	Recommendations
1	C-LD	2. Chest pain should not be described as atypical, because it is not helpful in determining the cause and can be misinterpreted as benign in nature. Instead, chest pain should be described as cardiac, possibly cardiac, or noncardiac because these terms are more specific to the potential underlying diagnosis.

Recommendations for a Focus on the Uniqueness of Chest Pain in Women
Referenced studies that support the recommendations are summarized in Online Data Supplements 3 and 4.

COR	LOE	Recommendations
1	B-NR	1. Women who present with chest pain are at risk for underdiagnosis, and potential cardiac causes should always be considered.[1-7]
1	B-NR	2. In women presenting with chest pain, it is recommended to obtain a history that emphasizes accompanying symptoms that are more common in women with ACS.[1-7]

Recommendation for Considerations for Older Patients With Chest Pain

COR	LOE	Recommendation
1	C-LD	1. In patients with chest pain who are >75 years of age, ACS should be considered when accompanying symptoms such as shortness of breath, syncope, or acute delirium are present, or when an unexplained fall has occurred.[1]



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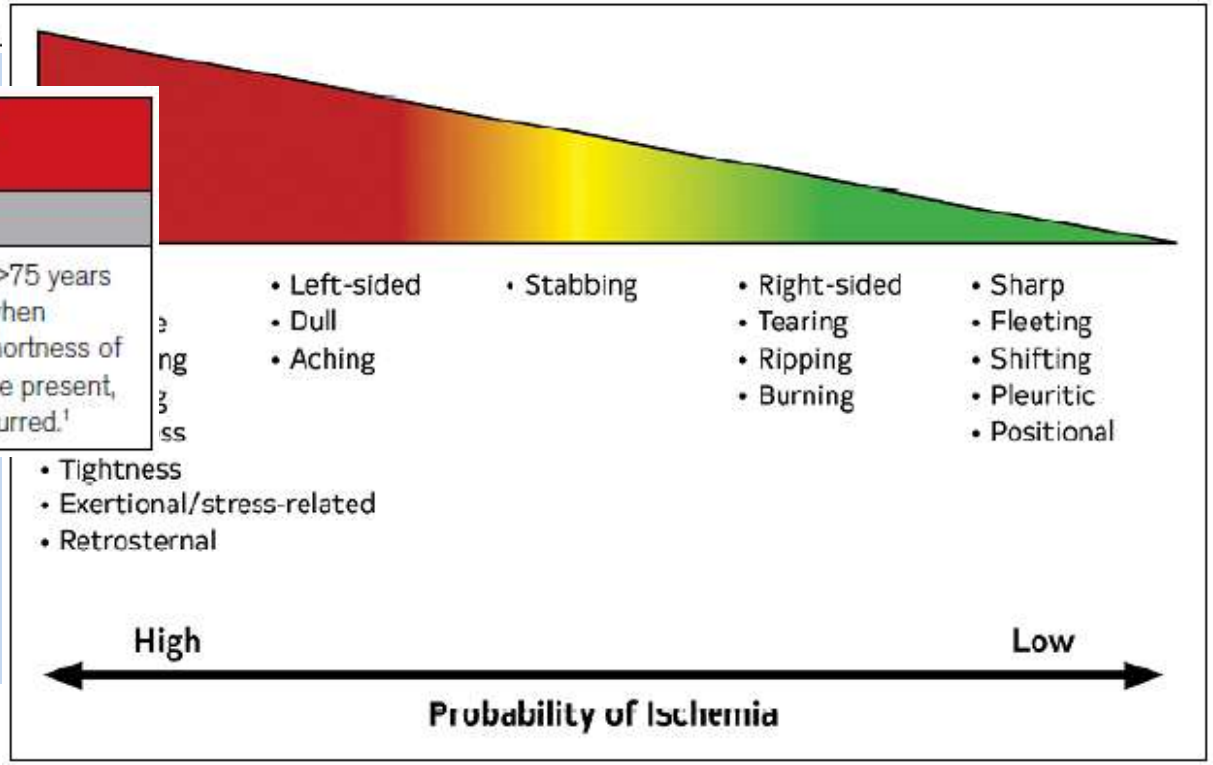

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Delay: COR III!!!

Recommendations for Setting Considerations
Referenced studies that support the recommendations are summarized in Online Data Supplement 8.

COR	LOE	Recommendations
1	B-NR	1. Unless a noncardiac cause is evident, an ECG should be performed for patients seen in the office setting with stable chest pain; if an ECG is unavailable the patient should be referred to the ED so one can be obtained.[1-5]
1	C-LD	2. Patients with clinical evidence of ACS or other life-threatening causes of acute chest pain seen in the office setting should be transported urgently to the ED, ideally by EMS.[1-9]
1	C-LD	3. In all patients who present with acute chest pain regardless of the setting, an ECG should be acquired and reviewed for STEMI within 10 minutes of arrival.[1-3,6,7,10]
1	C-LD	4. In all patients presenting to the ED with acute chest pain and suspected ACS, cTn should be measured as soon as possible after presentation.[8,9]
3: Harm	C-LD	5. For patients with acute chest pain and suspected ACS initially evaluated in the office setting, delayed transfer to the ED for cTn or other diagnostic testing should be avoided.

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Was passiert in der CPU?

	HEART Pathway[31]	EDACS[44]	ADAPT (mADAPT)[45]	NOTR[34]	2020 ESC/hs-cTn[4,46,47]	2016 ESC/GRACE[11,38]
Target population	Suspected ACS	Suspected ACS, CP >5 min, planned serial troponin	Suspected ACS, CP >5 min, planned observation	Suspected ACS, ECG, troponin ordered	Suspected ACS, stable	Suspected ACS, planned serial troponin
Target outcome	↑ ED discharge without increasing missed 30-d or 1-y MACE	↑ ED discharge rate without increasing missed 30-d MACE	↑ ED discharge rate without increasing missed 30-d MACE	↑ Low-risk classification without increasing missed 30-d MACE	Early detection of AMI; 30-d MACE	Early detection of AMI
Patients with primary outcome in study population, %	6–22	12	15	5–8	9.8	10–17
Troponin	cTn, hs-cTn	hs-cTn	cTn, hs-cTn	cTn, hs-cTn	hs-cTn	cTn, hs-cTn
Variables used	History ECG Age Risk factors Troponin (0, 3 h)	Age Sex Risk factors History Troponin (0, 2 h)	TIMI score 0-1 No ischemic ECG changes Troponin (0, 2 h)	Age Risk factors Previous AMI or CAD Troponin (0, 2 h)	History ECG hs-cTn (0, 1 or 2 h)	Age HR, SBP Serum Cr Cardiac arrest ECG Cardiac biomarker Killip class
Risk thresholds:						
Low risk	HEART score <3 Neg 0, 3-h cTn Neg 0, 2-h hs-cTn	EDACS score <16 Neg 0, 2 h hs-cTn No ischemic ECG Δ	TIMI score 0 (or <1 for mADAPT) Neg 0, 2-h cTn or hs-cTn No ischemic ECG Δ	Age <50 y <3 risk factors Previous AMI or CAD Neg cTn or hs-cTn (0, 2 h)	Initial hs-cTn is "very low" and Sx onset >3 h ago **Or** Initial hs-cTn "low" and 1– or 2-h hs-cTn Δ is "low"	Chest pain free, GRACE <140 Sx <6 h - hs-cTn <ULN (0, 3 h) Sx >6 h - hs-cTn <ULN (arrival)
Intermediate risk	HEART score 4-6	NA	TIMI score 2-4	NA	Initial hs-cTn is between "low" and "high" **And/Or** 1- or 2-h hs-cTn Δ is between low and high thresholds	T0 hs-cTn = 12–52 ng/L or 1-h Δ = 3–5 ng/L
High risk	HEART score 7-10[48,49]	NA	TIMI score 5-7[49]	NA	Initial hs-cTn is "high" **Or** 1- or 2-h hs-cTn Δ is high	T0 hs-cTn >52 ng/L **Or** Δ 1 h >5 ng/L
Performance	↑ ED discharges by 21% (40% versus 18%) ↓ 30-d objective testing by 12% (69% versus 57%) ↓ length of stay by 12 h (9.9 versus 21.9 h)	More patients identified as low risk versus ADAPT (42% versus 31%)	ADAPT: More discharged ≤6 h (19% versus 11%)	30-d MACE sensitivity =100% 28% eligible for ED discharge	AMI sensitivity >99% 62% Ruled out (0.2% 30-d MACE) 25% Observe 13% Rule in	AMI sensitivity >99% 30-d MACE not studied
AMI sensitivity, %	100	100	100	100	>99	96.7
cTn accuracy: 30-d MACE sensitivity, %	100	100	100	100	NA	NA
hs-cTn accuracy: 30-d MACE sensitivity, %	95	92	93	99	99	--
ED discharge, %	40	49	19 (ADAPT) 39 (mADAPT)	28	--	--

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Variables used	History ECG Age Risk factors Troponin (0, 3 h)	Age Sex Risk factors History Troponin (0, 2 h)	TIMI score 0-1 No ischemic ECG changes Troponin (0, 2 h)	Age Risk factors Previous AMI or CAD Troponin (0, 2 h)	History ECG hs-cTn (0, 1 or 2 h)	Age HR, SBP Serum Cr Cardiac arrest ECG Cardiac biomarker Killip class
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High risk	HEART score 7-10[43,49]	NA	TIMI score 5-7[49]	NA	Initial hs-cTn is "high"	T0 hs-cTn >52 ng/L

	HEART Pathway[31]	EDACS[44]	ADAPT (mADAPT)[45]	NOTR[34]	2020 ESC/hs-cTn[4,46,47]	2016 ESC/ GRACE[11,38]
AMI sensitivity, %	100	100	100	100	>99	96.7
cTn accuracy: 30-d MACE sensitivity, %	100	100	100	100	NA	NA
hs-cTn accuracy: 30-d MACE sensitivity, %	95	92	93	99	99	--
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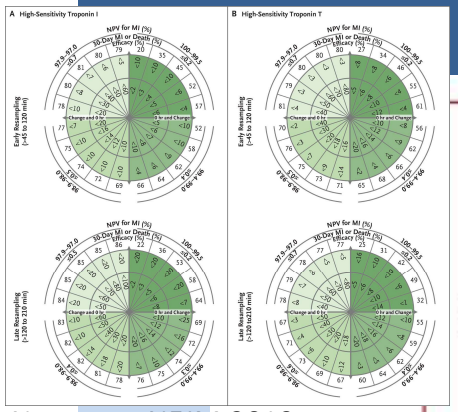
Rule-in rule-out



Neumann NEJM 2019

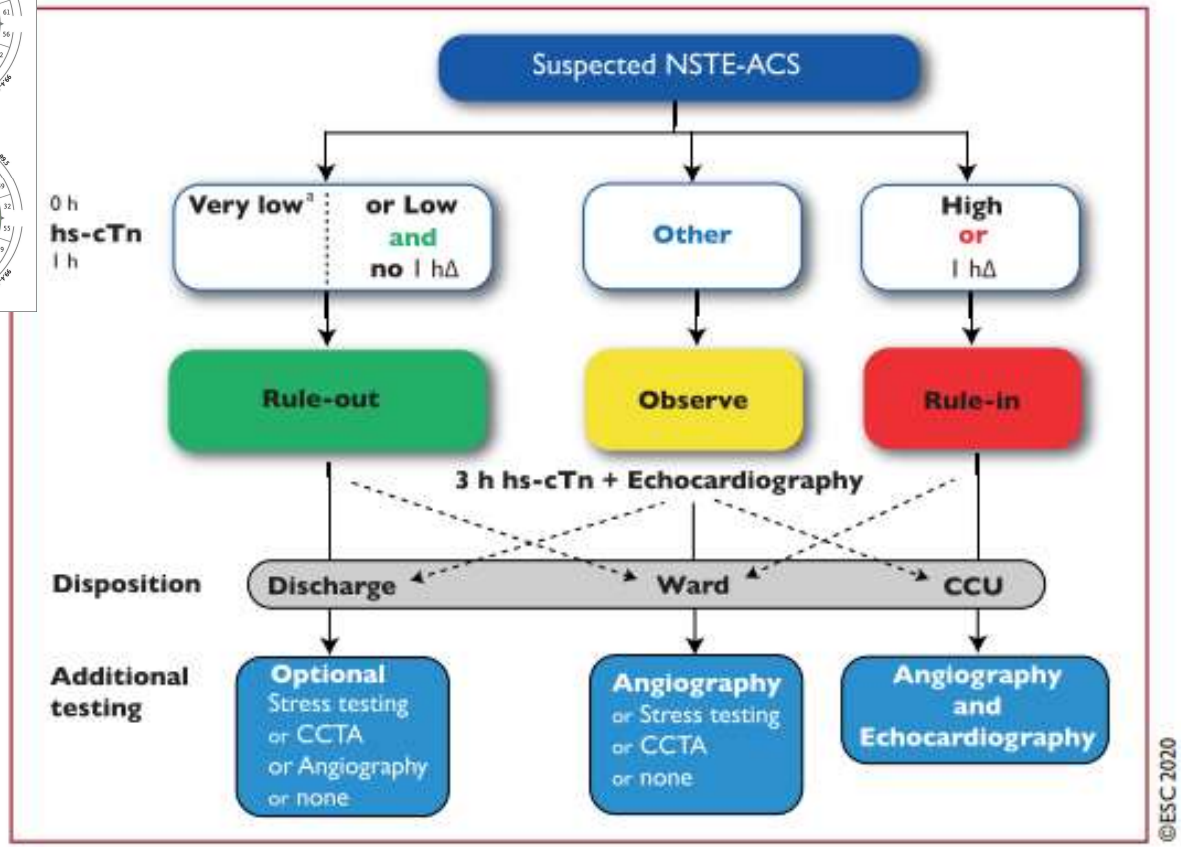


Figure 3 0 h/1 h rule-out and rule-in algorithm using high-sensitivity cardiac troponin assays in haemodynamically stable patients presenting with suspected non-ST-segment elevation acute coronary syndrome to the emergency department. 0 h and 1 h refer to the time from first blood test. NSTEMI can be ruled out at presentation if the hs-cTn concentration is very low. NSTEMI can also be ruled out by the combination of low baseline levels and the lack of a relevant increase within 1 h (no 1hΔ). Patients have a high likelihood of NSTEMI if the hs-cTn concentration at presentation is at least moderately elevated or hs-cTn concentrations show a clear rise within the first hour (1hΔ).[1,6–8,10–13,29–31,33] Cut-offs are assay specific (see *Table 3*) and derived to meet predefined criteria for sensitivity and specificity for NSTEMI. CCU = coronary care unit; CCTA = coronary computed tomography angiography; CPO = chest pain onset; hs-cTn = high-sensitivity cardiac troponin; NSTE-ACS = non-ST-segment elevation acute coronary syndrome; NSTEMI = non-ST-segment elevation myocardial infarction. [a]Only applicable if CPO >3 h. *Listen to the audio guide of this figure online.*

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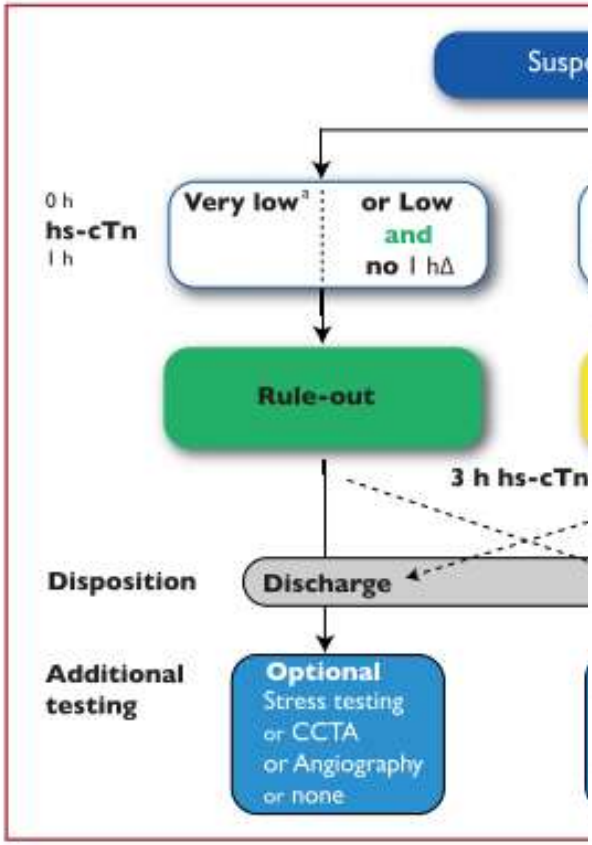

0 h/1 h algorithm	Very low	Low	No 1hΔ	High	1hΔ
hs-cTn T (Elecsys; Roche)	<5	<12	<3	≥52	≥5
hs-cTn I (Architect; Abbott)	<4	<5	<2	≥64	≥6
hs-cTn I (Centaur; Siemens)	<3	<6	<3	≥120	≥12
hs-cTn I (Access; Beckman Coulter)	<4	<5	<4	≥50	≥15
hs-cTn I (Clarity; Singulex)	<1	<2	<1	≥30	≥6
hs-cTn I (Vitros; Clinical Diagnostics)	<1	<2	<1	≥40	≥4
hs-cTn I (Pathfast; LSI Medience)	<3	<4	<3	≥90	≥20
hs-cTn I (TriageTrue; Quidel)	<4	<5	<3	≥60	≥8
0 h/2 h algorithm	**Very low**	**Low**	**No 2hΔ**	**High**	**2hΔ**
hs-cTn T (Elecsys; Roche)	<5	<14	<4	≥52	≥10
hs-cTn I (Architect; Abbott)	<4	<6	<2	≥64	≥15
hs-cTn I (Centaur; Siemens)	<3	<8	<7	≥120	≥20
hs-cTn I (Access; Beckman Coulter)	<4	<5	<5	≥50	≥20
hs-cTn I (Clarity; Singulex)	<1	TBD	TBD	≥30	TBD
hs-cTn I (Vitros; Clinical Diagnostics)	<1	TBD	TBD	≥40	TBD
hs-cTn I (Pathfast; LSI Medience)	<3	TBD	TBD	≥90	TBD
hs-cTn I (TriageTrue; Quidel)	<4	TBD	TBD	≥60	TBD

Figure 3 0 h/1 h rule-out and rule-in algorithm using high-sensitivity card… pected non-ST-segment elevation acute coronary syndrome to the emerge… can be ruled out at presentation if the hs-cTn concentration is very low. NS… lack of a relevant increase within 1 h (no 1hΔ). Patients have a high likelihood… elevated or hs-cTn concentrations show a clear rise within the first hour (1h… meet predefined criteria for sensitivity and specificity for NSTEMI. CCU = … CPO = chest pain onset; hs-cTn = high-sensitivity cardiac troponin; NSTE-A… ST-segment elevation myocardial infarction. [a]Only applicable if CPO >3 h. *Listen to the audio guide of this figure online.*

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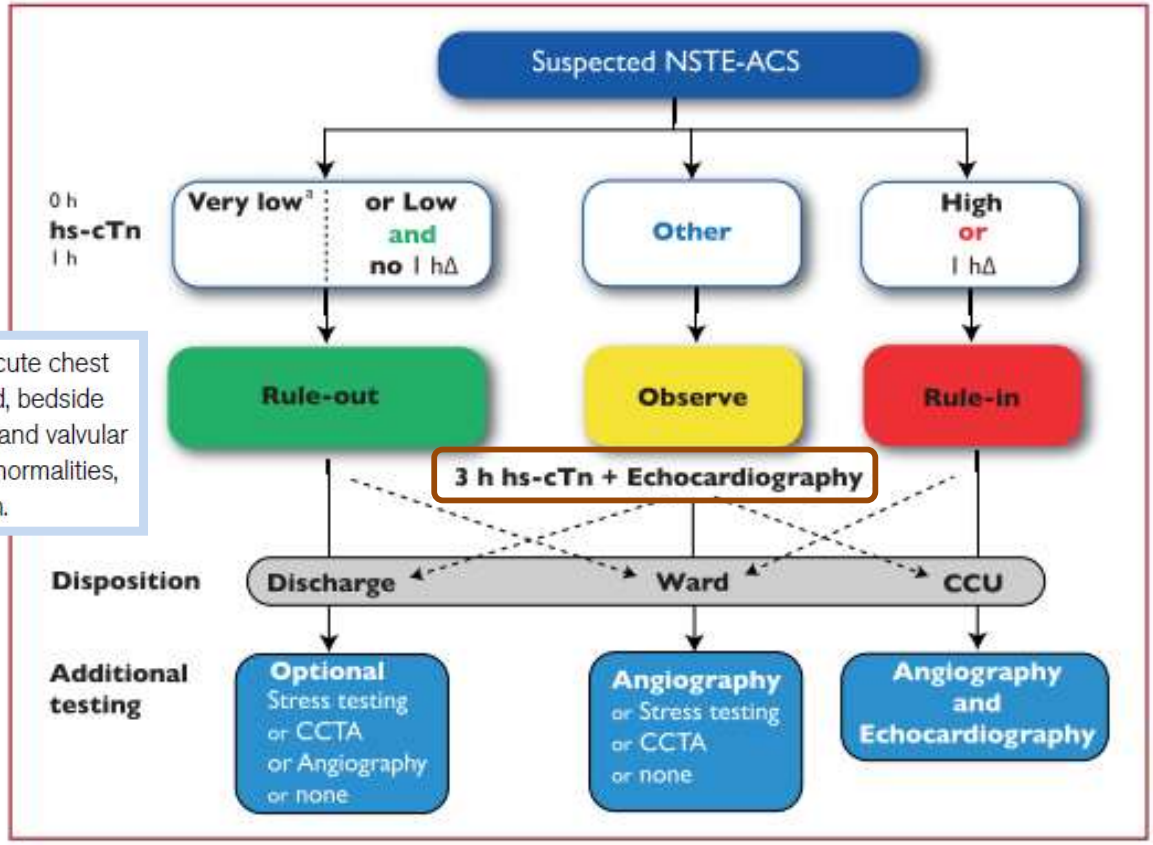
Rule-in rule-out

1. For intermediate-risk patients with acute chest pain, TTE is recommended as a rapid, bedside test to establish baseline ventricular and valvular function, evaluate for wall motion abnormalities, and to assess for pericardial effusion.



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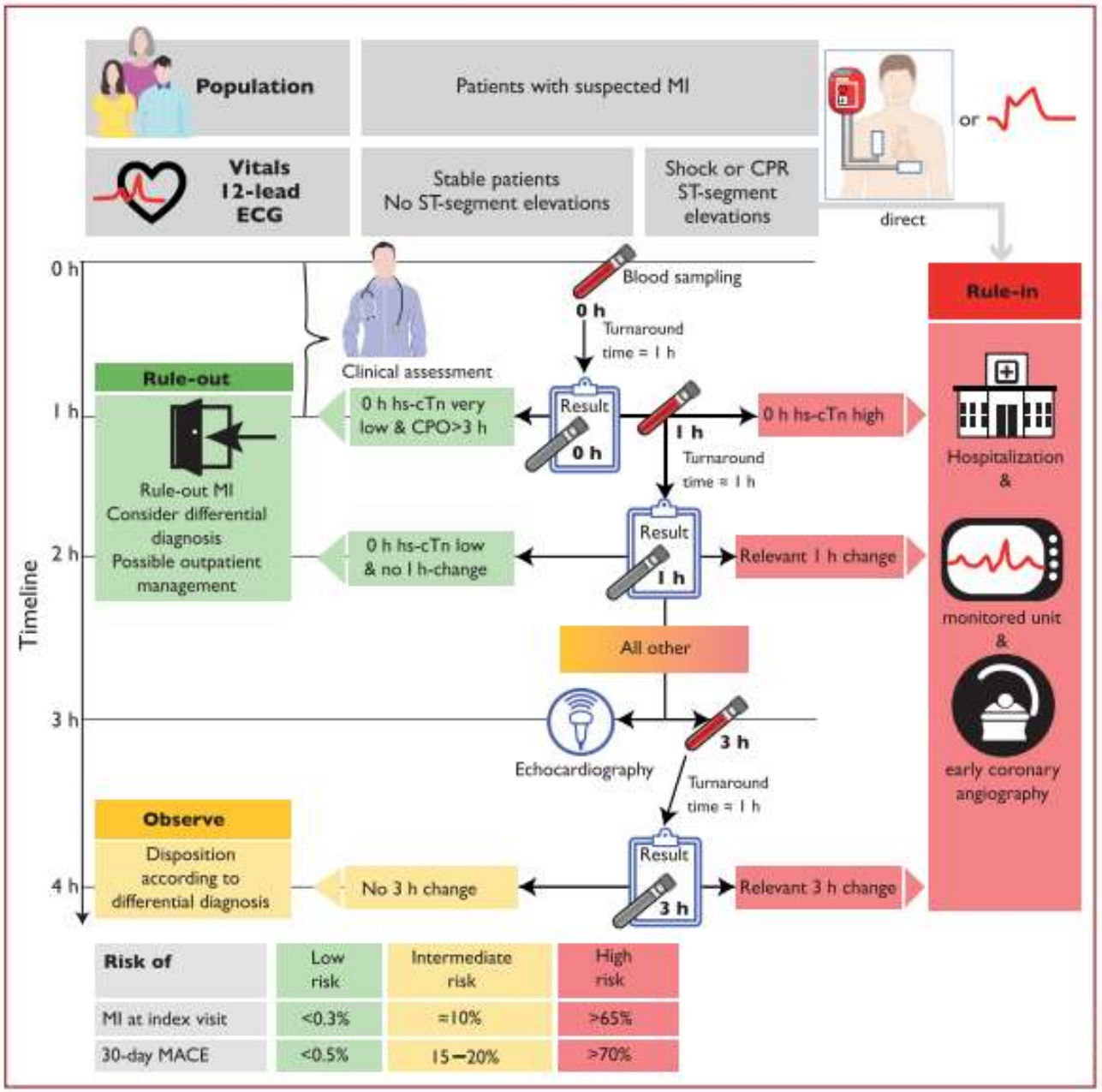

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Target outcome	↑ ED discharge without increasing missed 30-d or 1-y MACE	↑ ED dis-charge rate without increasing missed 30-d MACE	↑ ED discharge rate without in-creasing missed 30-d MACE	↑ Low-risk clas-sification with-out increasing missed 30-d MACE	Early detection of AMI; 30-d MACE	Early detection of AMI
Patients with primary outcome in study popu-	6–22	12	15	5–8	9.8	10–17

Recommendations for Low-Risk Patients With Acute Chest Pain
Referenced studies that support the recommendations are summarized in Online Data Supplements 10 and 11.

COR	LOE	Recommendations
1	B-NR	1. Patients with acute chest pain and a 30-day risk of death or MACE <1% should be designated as low risk.[1-11]
2a	B-R	2. In patients with acute chest pain and suspected ACS who are deemed low-risk (<1% 30-day risk of death or MACE), it is reasonable to discharge home without admission or urgent cardiac testing.[12-16]

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Identify Patients Most Likely to Benefit From Further Testing. Patients with acute or stable chest pain who are at intermediate risk or intermediate to high pre-test risk of obstructive coronary artery disease, respectively, will benefit the most from cardiac imaging and testing.

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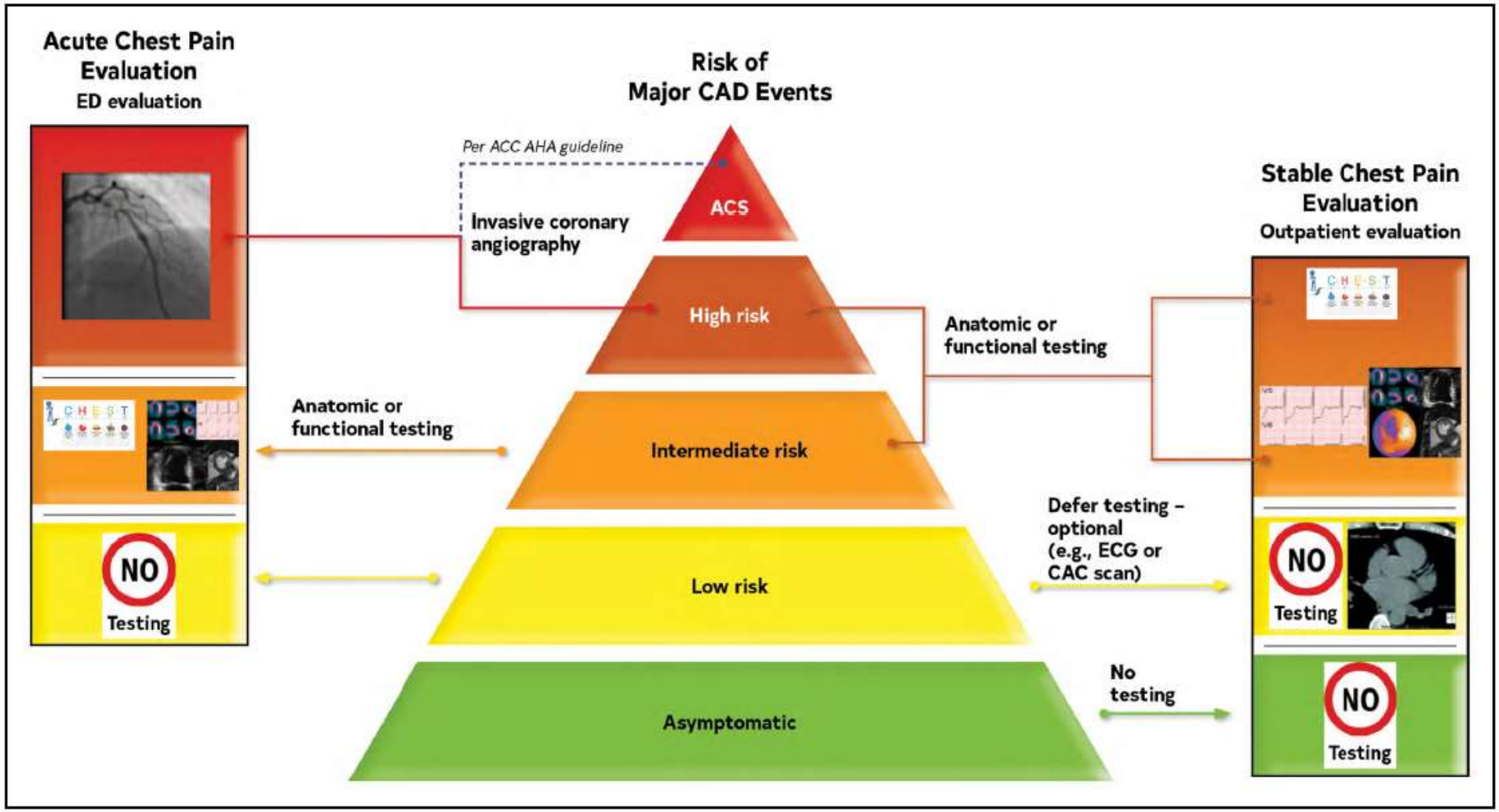

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Recommendations for Intermediate-Risk Patients With No Known CAD
Referenced studies that support the recommendations are summarized in Online Data Supplements 14 and 15.

COR	LOE	Recommendations
		Index Diagnostic Testing
		Anatomic Testing
1	A	1. For intermediate-risk patients with acute chest pain and no known CAD eligible for diagnostic testing after a negative or inconclusive evaluation for ACS, CCTA is useful for exclusion of atherosclerotic plaque and obstructive CAD.[1-11]
1	C-EO	2. For intermediate-risk patients with acute chest pain, moderate-severe ischemia on current or prior (≤1 year) stress testing, and no known CAD established by prior anatomic testing, ICA is recommended.
2a	C-LD	3. For intermediate-risk patients with acute chest pain with evidence of previous mildly abnormal stress test results (≤1 year), CCTA is reasonable for diagnosing obstructive CAD.[12,13]
		Stress Testing
1	B-NR	4. For intermediate-risk patients with acute chest pain and no known CAD who are eligible for cardiac testing, either exercise ECG, stress echocardiography, stress PET/SPECT MPI, or stress CMR is useful for the diagnosis of myocardial ischemia.[1,4,10,14-36]

		Sequential or Add-on Diagnostic Testing
2a	B-NR	5. For intermediate-risk patients with acute chest pain and no known CAD, with a coronary artery stenosis of 40% to 90% in a proximal or middle coronary artery on CCTA, FFR-CT can be useful for the diagnosis of vessel-specific ischemia and to guide decision-making regarding the use of coronary revascularization.[37-43]
2a	C-EO	6. For intermediate-risk patients with acute chest pain and no known CAD, as well as an inconclusive prior stress test, CCTA can be useful for excluding the presence of atherosclerotic plaque and obstructive CAD.
2a	C-EO	7. For intermediate-risk patients with acute chest pain and no known CAD, with an inconclusive CCTA, stress imaging (with echocardiography, PET/SPECT MPI, or CMR) can be useful for the diagnosis of myocardial ischemia.

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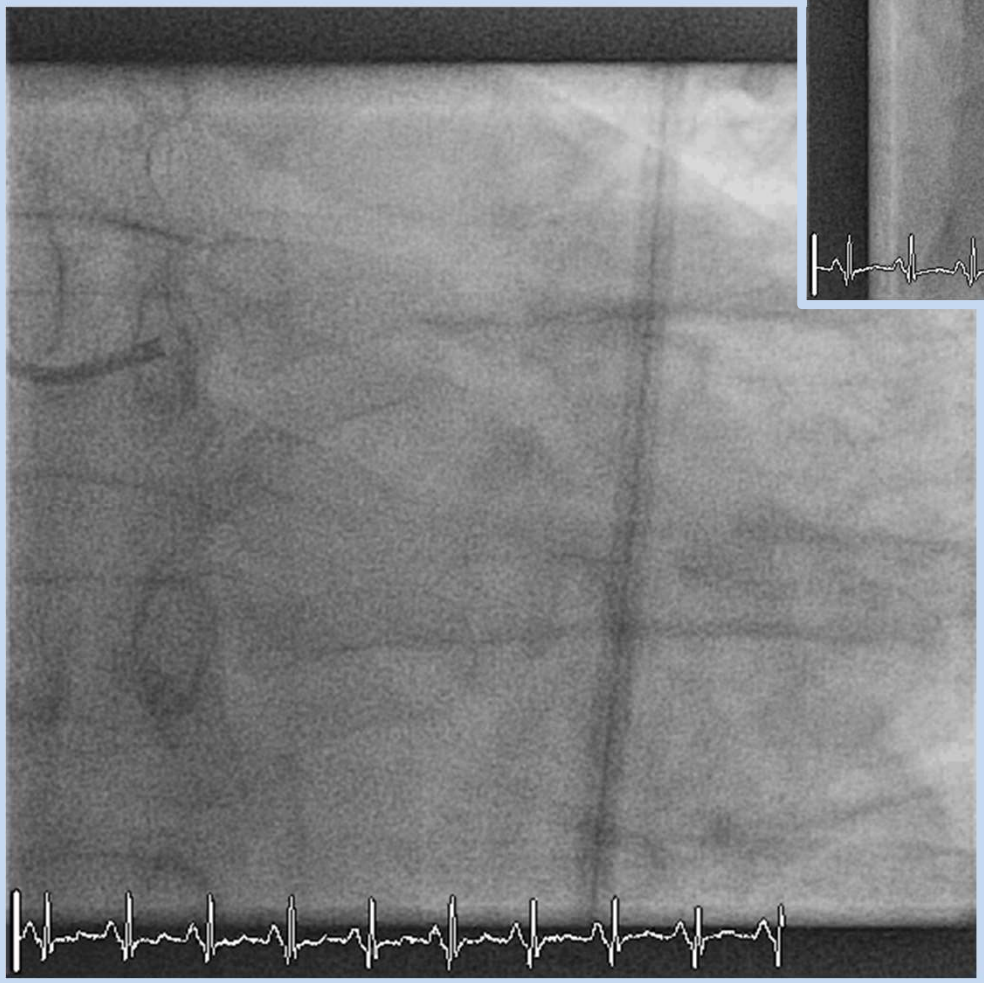
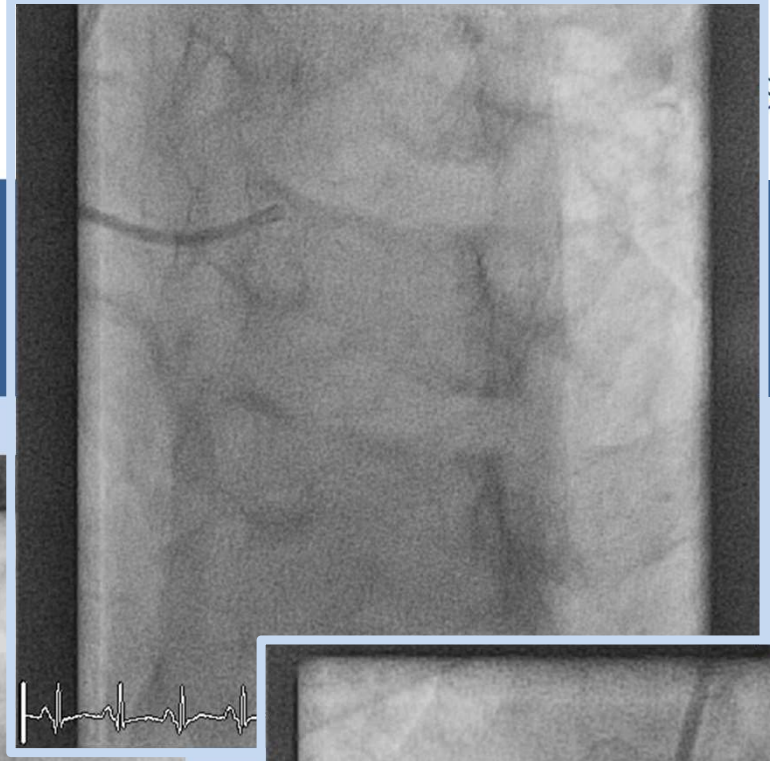
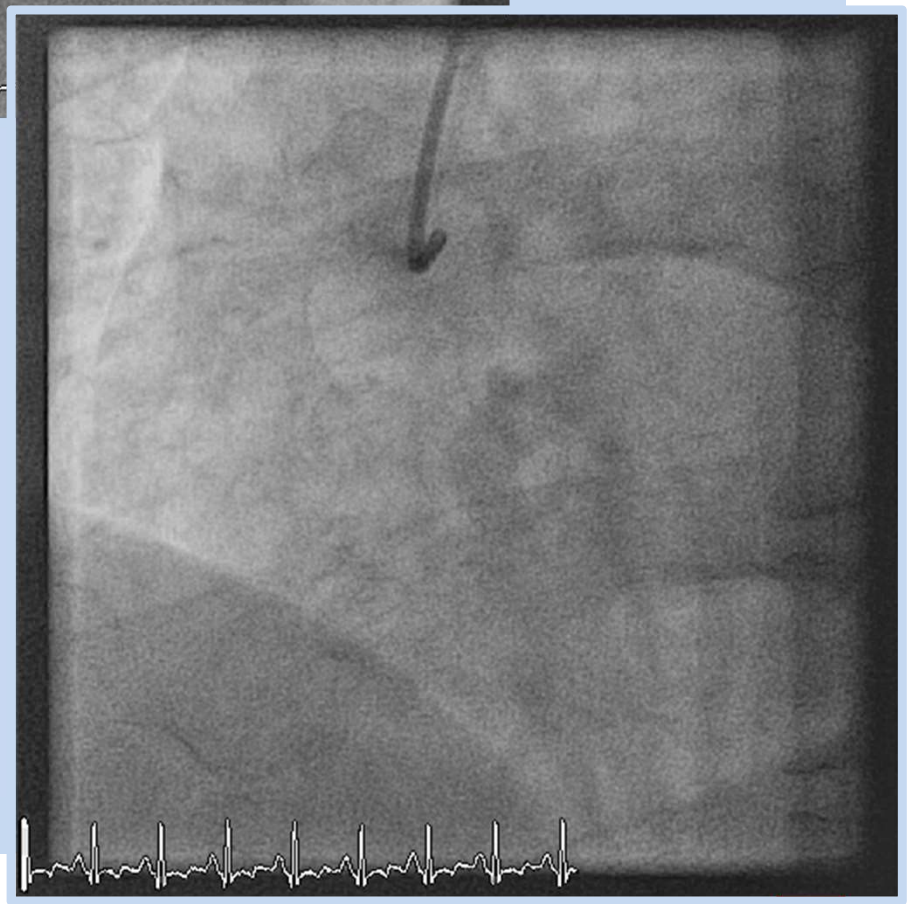
Recommendations for Shared Decision-Making in Patients With Acute Chest Pain
Referenced studies that support the recommendations are summarized in Online Data Supplement 22.

COR	LOE	Recommendations
1	B-R	1. For patients with acute chest pain and suspected ACS who are deemed low risk by a CDP, patient decision aids are beneficial to improve understanding and effectively facilitate risk communication.[1,2]
1	B-R	2. For patients with acute chest pain and suspected ACS who are deemed intermediate risk by a CDP, shared decision-making between the clinician and patient regarding the need for admission, for observation, discharge, or further evaluation in an outpatient setting is recommended for improving patient understanding and reducing low-value testing.[1,2]

Culprit and “non-”







Culprit and “non-”

A coronary lesion should be considered culprit if it fulfills at least two:
- Intraluminal filing defect
- Plaque ulceration
- Plaque irregularity, dissection or impaired flow

350 patients Vanqwish trial
54% NSTEMIs
39% STEMIs

	n (%)
Patients	350
Culprit lesion identified	221 (63)
Single culprit lesion	173 (49)
Single incomplete occlusion	127 (36)
Single complete occlusion	46 (13)
Multiple culprit lesions	48 (14)
No culprit lesion identified	129 (37)

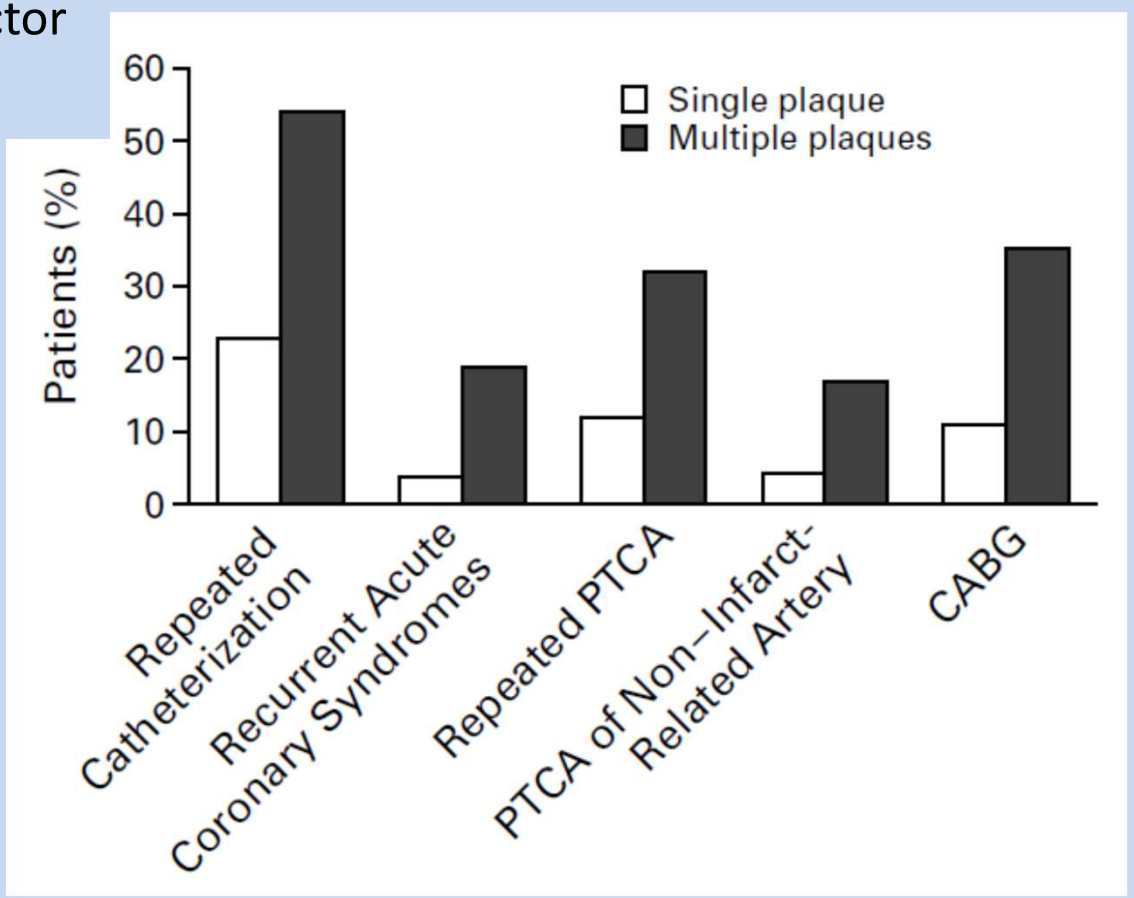
MI = myocardial infarction; n = number of patients.

Up to 40% of NSTE-ACS patients with obstructive CAD present with multiple complex plaques[159–162] and 25% with an acute occluded coronary artery,[163] so that identification of the culprit lesion may be challenging.

Kerensky JACC 2002

“Non-culprit” as cause of events

In NSTEMI, the presence of multiple lesions
- is frequent (25-40%)
- is the most potent predictor factor
- is responsible for ~50% of the subsequent events



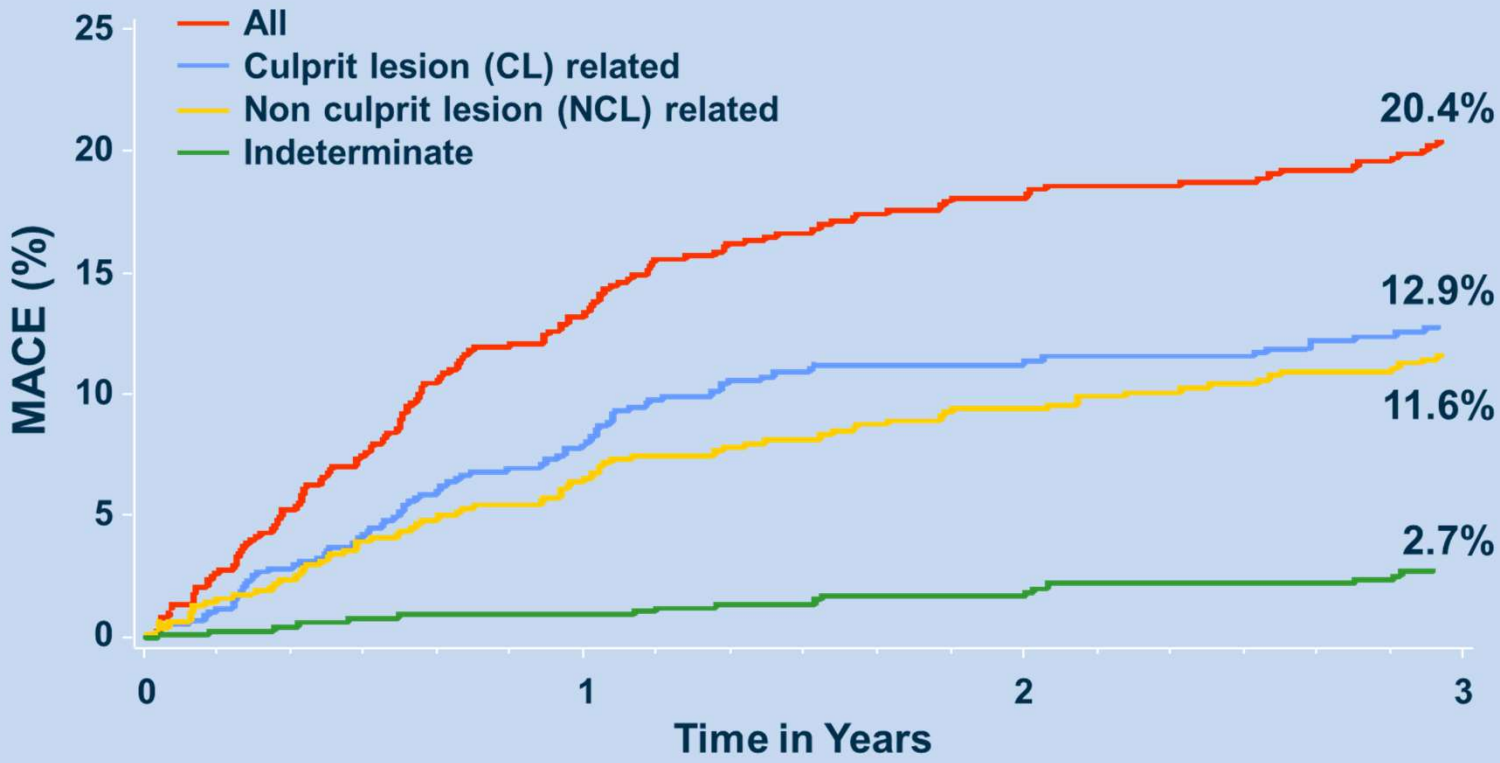
MULTIPLE COMPLEX CORONARY PLAQUES IN PATIENTS WITH ACUTE MYOCARDIAL INFARCTION

JAMES A. GOLDSTEIN, M.D., DEMETRIS DEMETRIOU, M.D., CINDY L. GRINES, M.D., MARK PICA, B.S., MAZEN SHOUKFEH, M.D., AND WILLIAM W. O'NEILL, M.D.

N=253 patients (153 MVD)

Stone, NEJM 2011

Prospect study



Although nonculprit lesions that were responsible for unanticipated events were frequently angiographically mild, most were thin-cap fibroatheromas or were characterized by a large plaque burden, a small luminal area, or some combination of these characteristics

MACE = cardiac death, cardiac arrest, MI, or rehospitalization for unstable or progressive angina

2018 ESC/EACTS Guidelines on myocardial revascularization

The Task Force on myocardial revascularization of the European Society of Cardiology (ESC) and European Association for Cardio-Thoracic Surgery (EACTS)

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What to do?

It is recommended to base the revasculari-

zation strategy (*ad hoc* culprit lesion PCI/

clinical status

ne disease

rization strategies and outcomes

culariza tion of significant lesions should be attempted

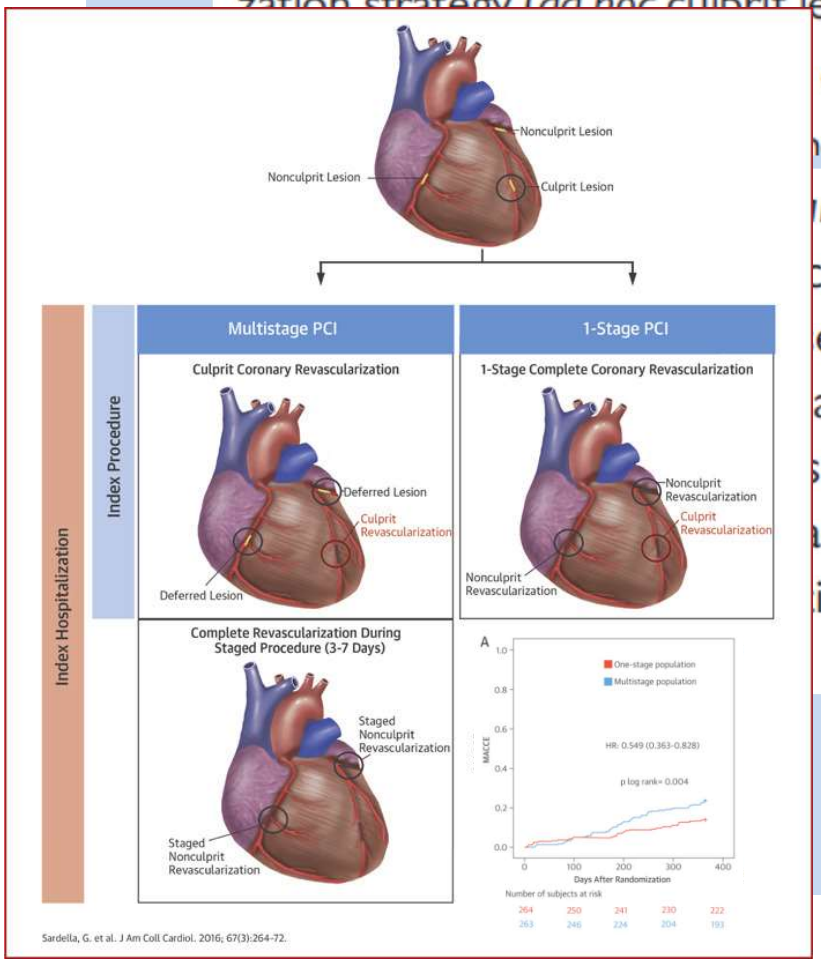
ease NSTE-ACS patients, given that it was mandated

arly vs. late intervention[171,182,183] and that the prog-

s with incomplete revascularization is known to be

ddition, it seems that complete one-stage revascula-

iated with better clinical outcome than multistage

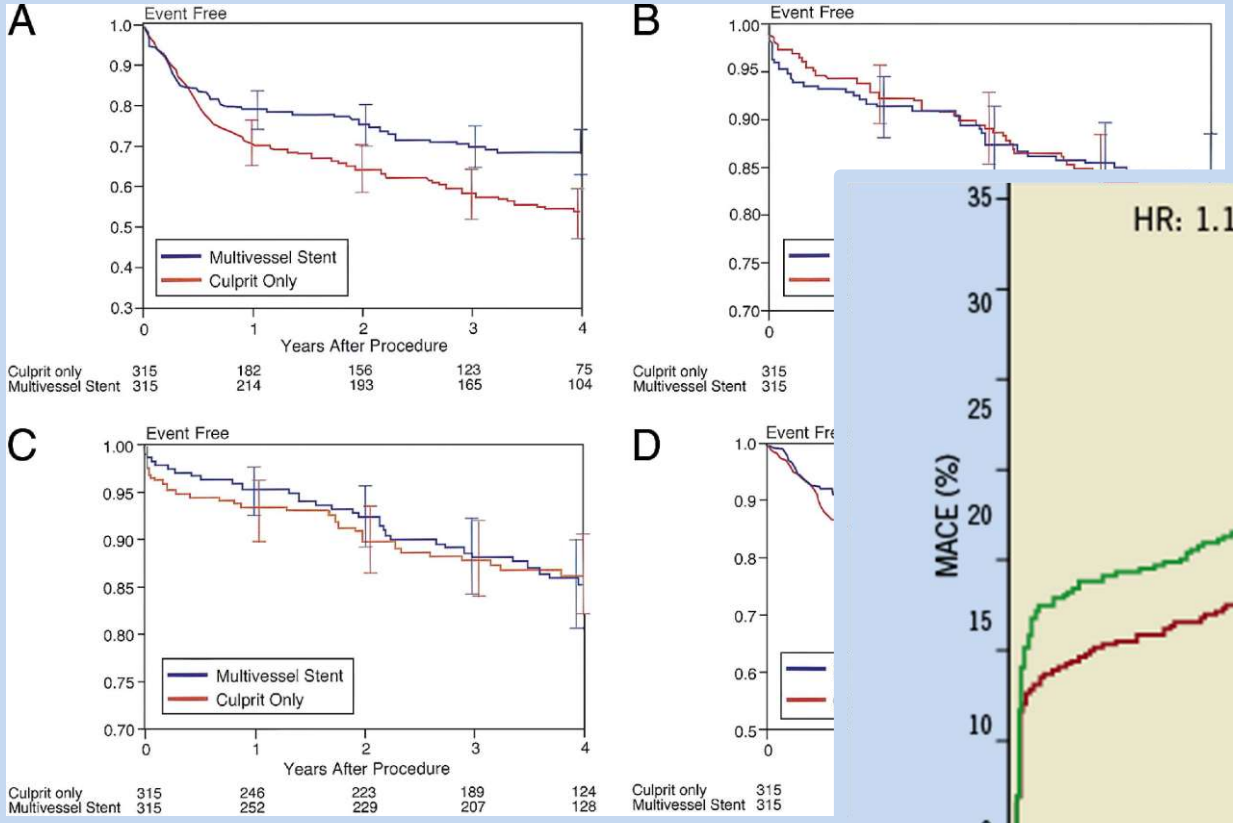


The 1-year rate of target vessel revascularization was significantly higher in the MS-PCI group (1S-PCI: n = 22 [8.33%] vs. MS-PCI: n = 40 [15.20%]; HR: 0.522 [95% CI: 0.310 to 0.878]; p = 0.01; p log-rank = 0.013)

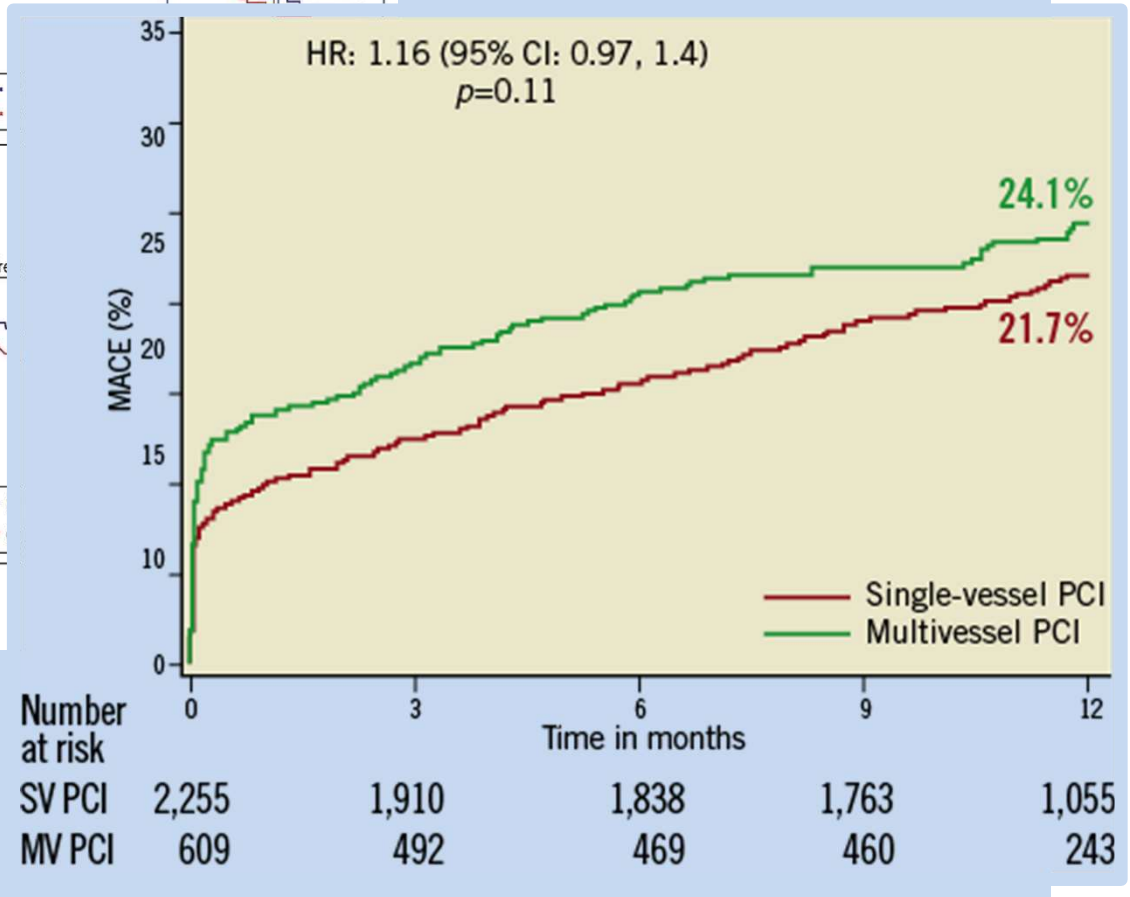
- "Multivessel"? - 584pts
- TVR, not nTVR

Sardella JACC 2016 (SMILE)

What to do? – conflict



1,240 patients, BMS



ACUITY

609 pts

death/MI higher in the MV PCI group

Shishehbor JACC 2007

Stone Eurointervention

CLINICAL PRACTICE GUIDELINE: FULL TEXT

2021 ACC/AHA/SCAI Guideline for Coronary Artery Revascularization

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

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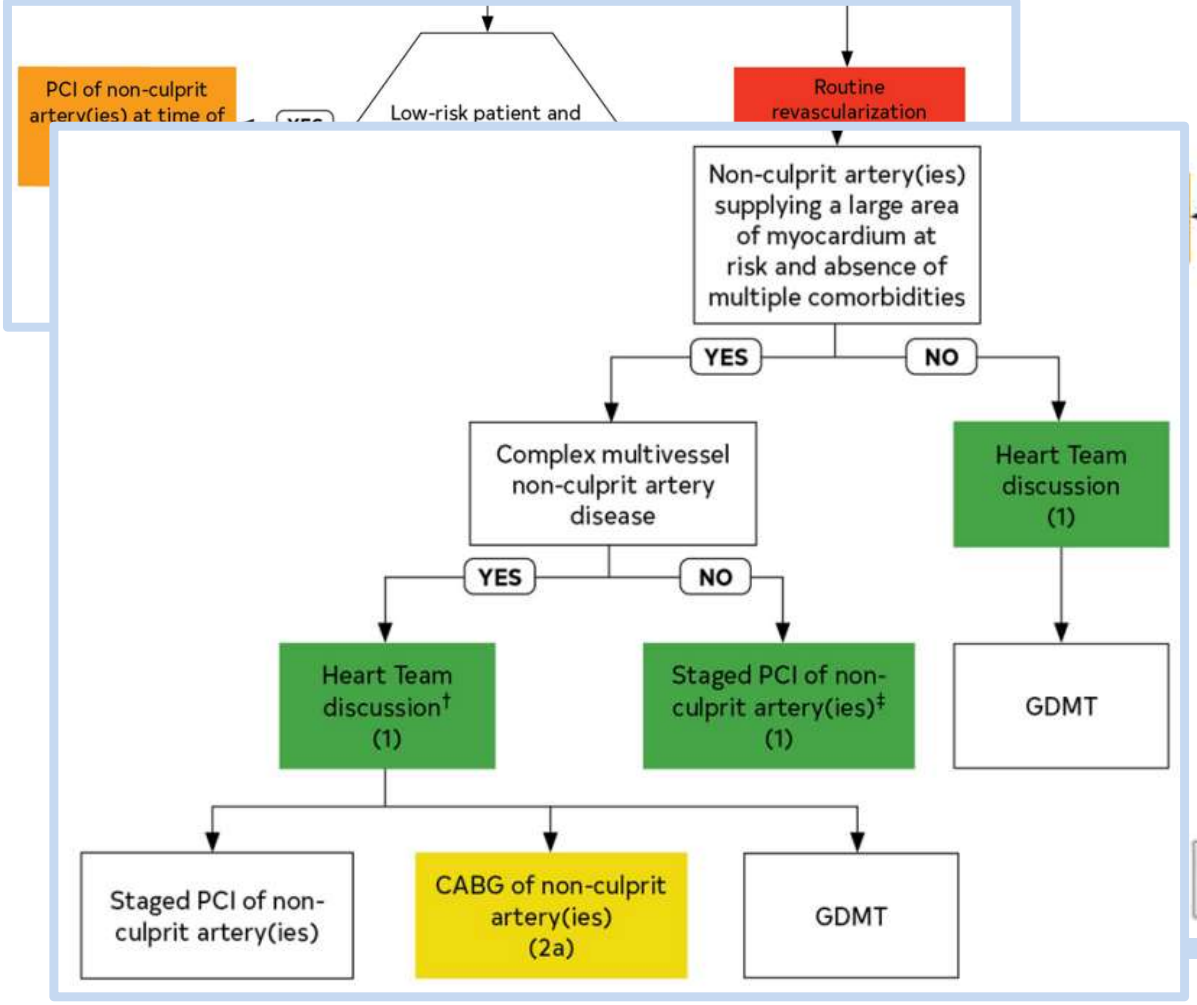
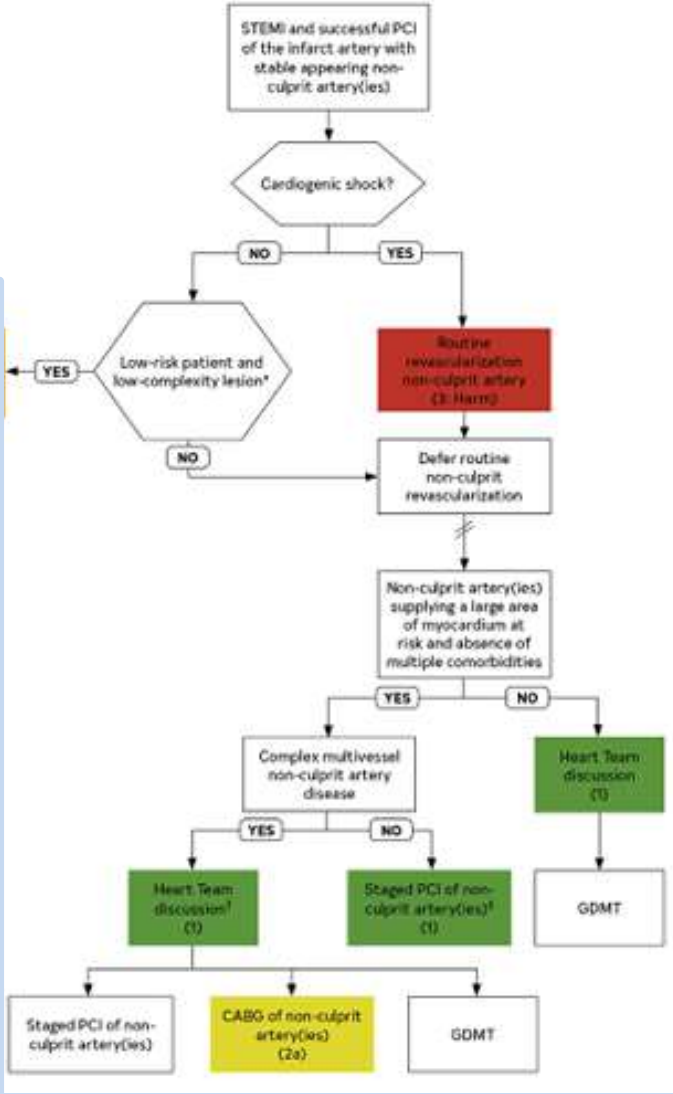
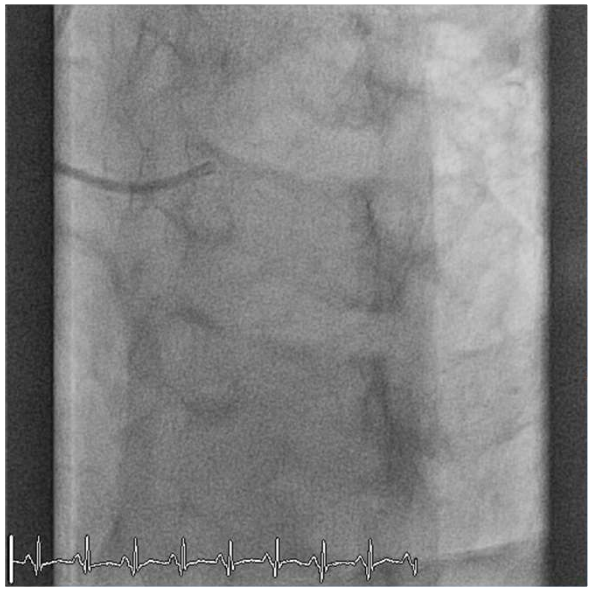
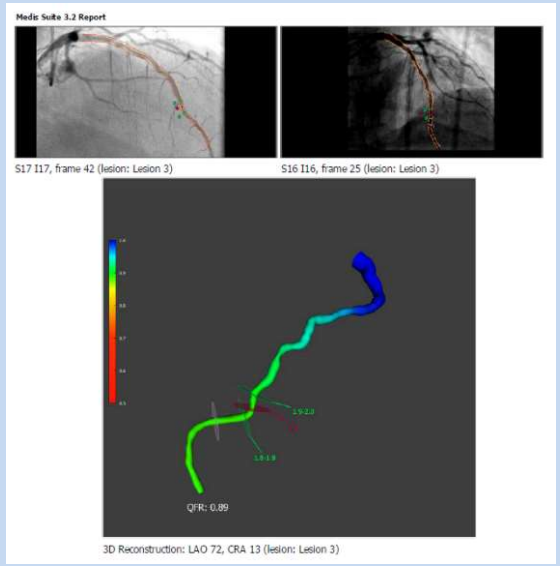
Culprit and "non-"







QUOMODO



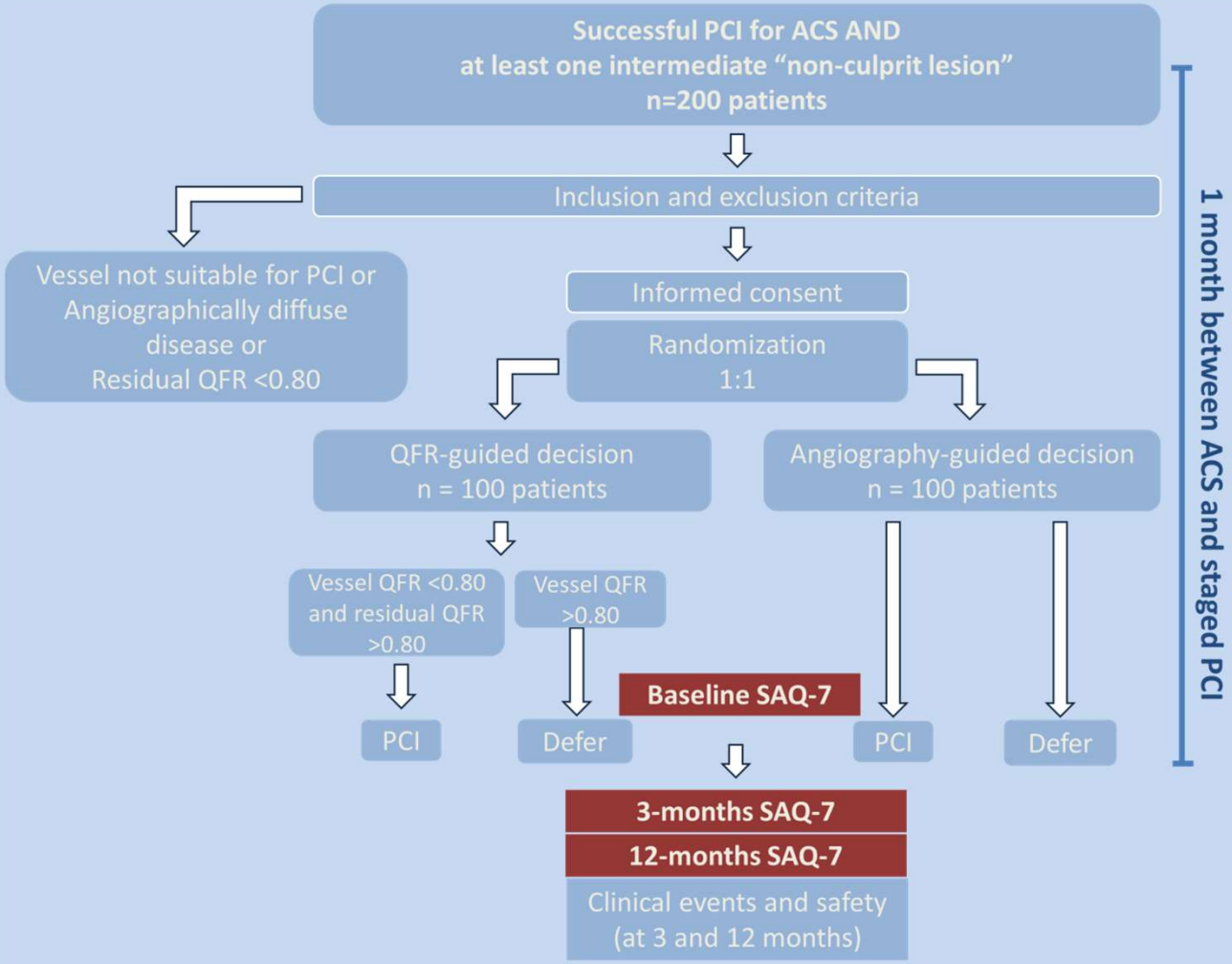
Medis Suite 3.2 Report

Vessel QFR Results

	Contrast	Fixed Flow	
Vessel QFR	**0.89**	0.87	
QFR at index	0.89	0.87	at 77.9 mm

Lesion QFR Results

	Lesion 1	Lesion 2	**Lesion 3**
Contrast			
Δ QFR	0.06	0.02	**0.01**
Lesion QFR	0.94	0.98	**0.99**
Residual Vessel QFR	0.95	0.91	**0.90**
Fixed Flow			
Δ QFR	0.07	0.03	**0.01**
Lesion QFR	0.93	0.97	**0.99**
Residual Vessel QFR	0.94	0.90	**0.88**



An EAPCI Expert Consensus Document on Ischaemia with Non-Obstructive Coronary Arteries in Collaboration with European Society of Cardiology Working Group on Coronary Pathophysiology & Microcirculation Endorsed by Coronary Vasomotor Disorders International Study Group

MINOCA

use of OCT in the 25% of NSTE-
graphically normal epicardial coronary arte
for identifying the culprit lesion, or rule ou
as dissection or haematomas [MI with r
arteries (MINOCA)].[167–169]

Spontaneous coronary artery dissection (SCAD) is a nonatherosclerotic, nontraumatic, or iatrogenic separation of the coronary arterial tunics secondary to vasa vasorum hemorrhage or intimal tear, and accounts for up to 4% of all ACS, but the incidence is reported to be much higher (22-35% of ACS) in women <60 years of age. Intracoronary imaging is very useful for the diagnosis and treatment orientation. Medical treatment is not well established.

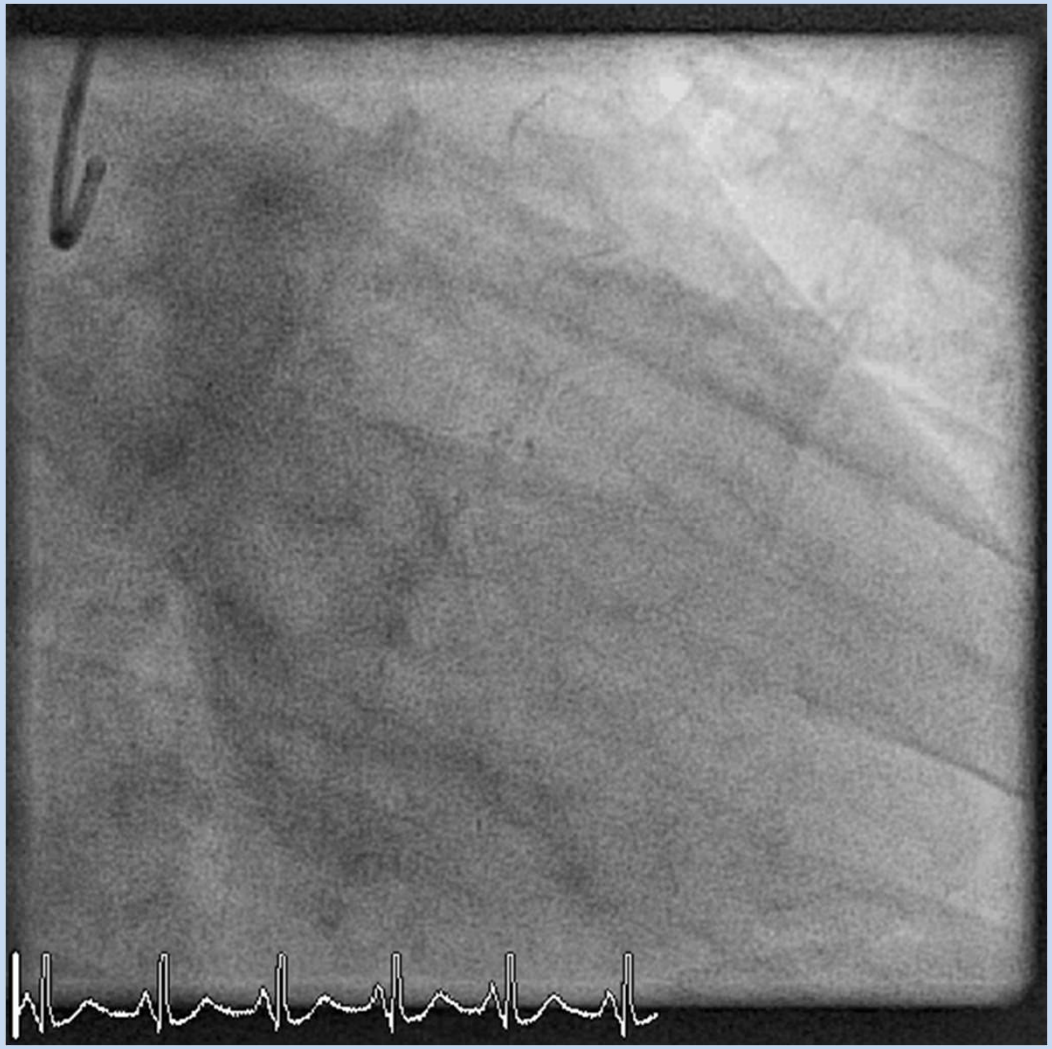
38 pts with MINOCA

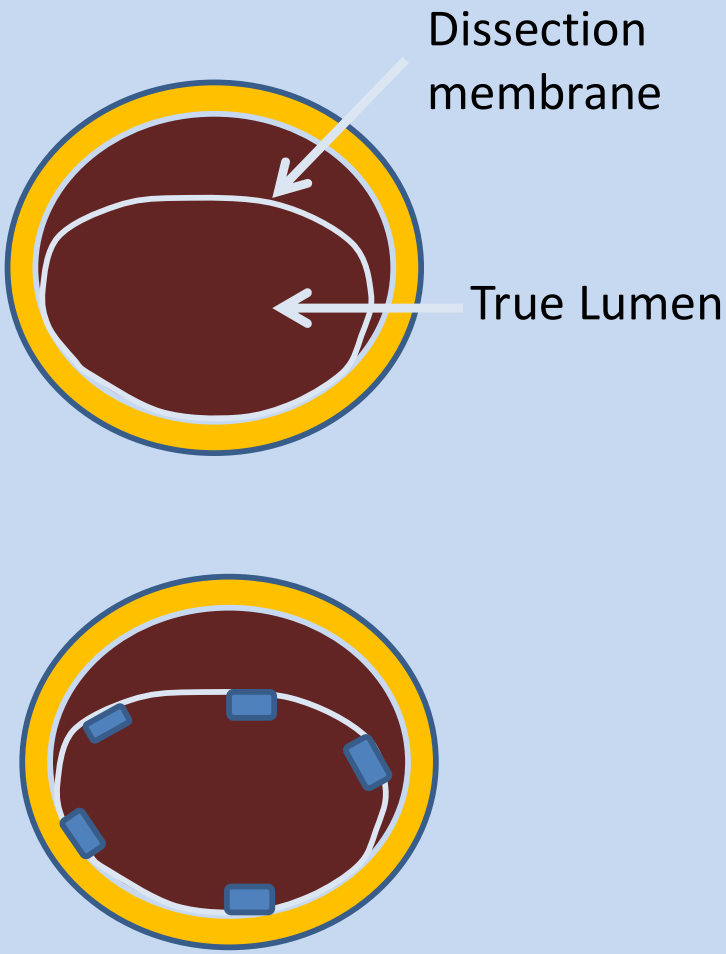
Plaque disruption and intracoronary thrombus were present in 24% and 18%

	All Lesions (n = 100)	Lesions in IRA (n = 10)	Lesions in non-IRA (n = 70)	p Value
Plaque disruption	14 (14)	4 (40)	4 (6)	0.020*
Plaque rupture	11 (11)	4 (40)	3 (4)	0.012*
Calcified nodule	4 (4)	0	1 (1)	0.051
Thrombus	10 (10)	5 (50)	3 (4)	0.014*
Red thrombus	9 (9)	5 (50)	2 (3)	0.001*
White thrombus	5 (5)	1 (10)	2 (3)	0.399
Plaque disruption with thrombus	6 (6)	3 (30)	1 (1)	0.005*
Plaque erosion	5 (5)	3 (30)	2 (3)	0.069
Plaque ulceration	2 (2)	0	2 (3)	0.051
Intramural hematoma	1 (1)	0	1 (1)	0.051

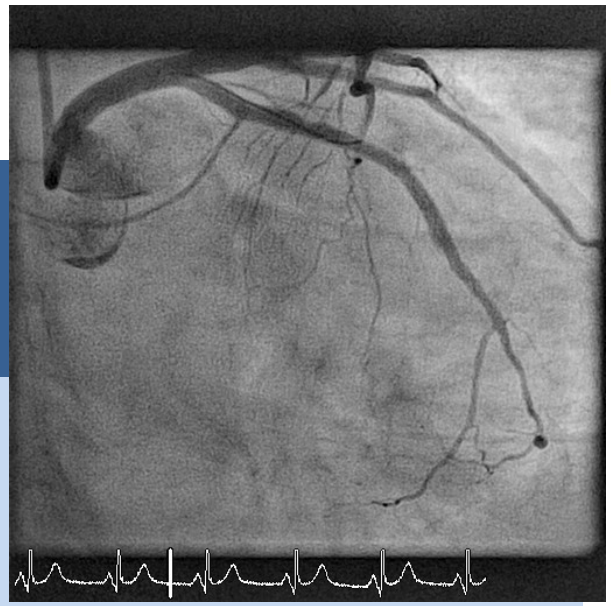
Opolsky JACC Imaging 2018

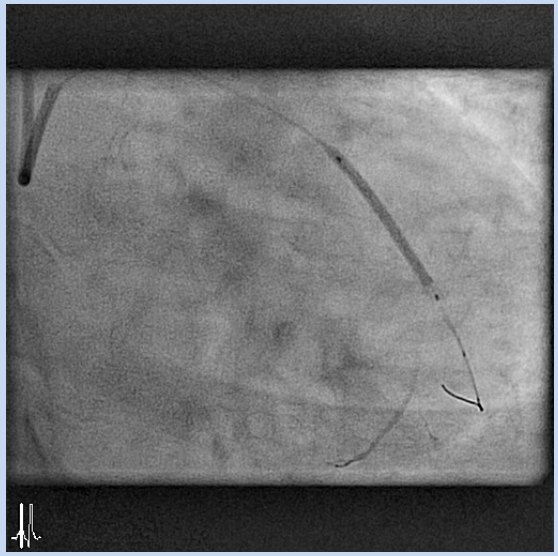
Spontaneous dissection

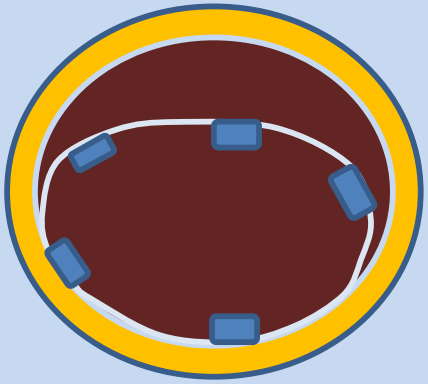


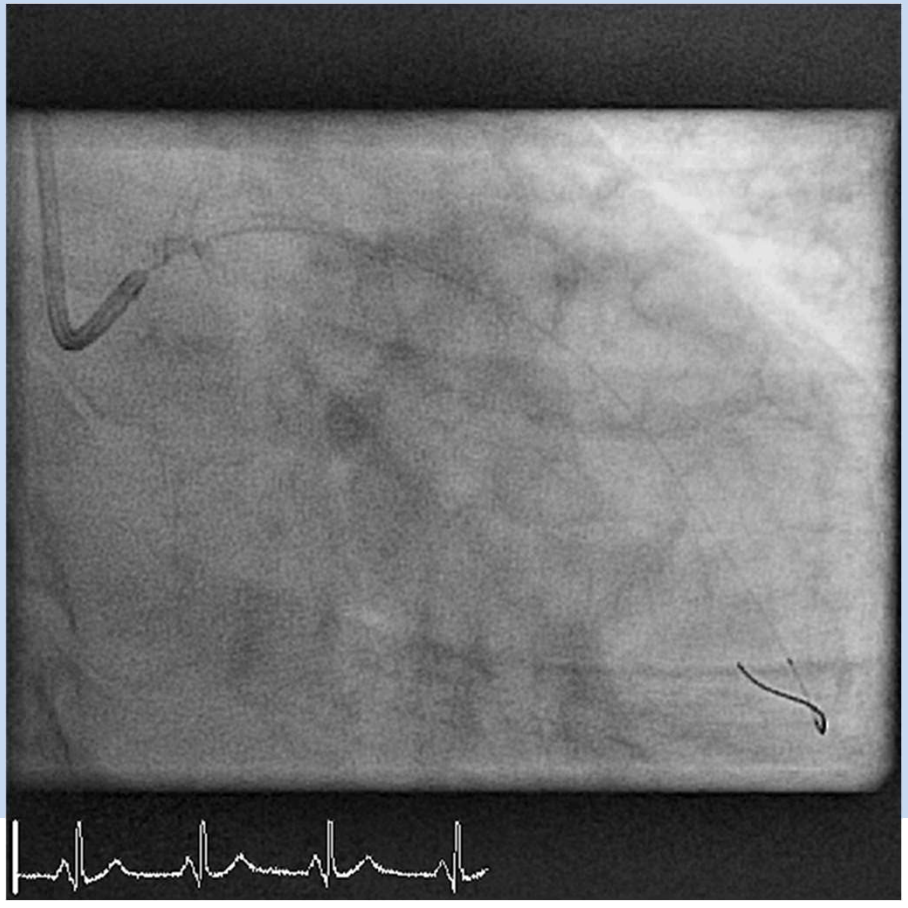


Spontaneous dissection

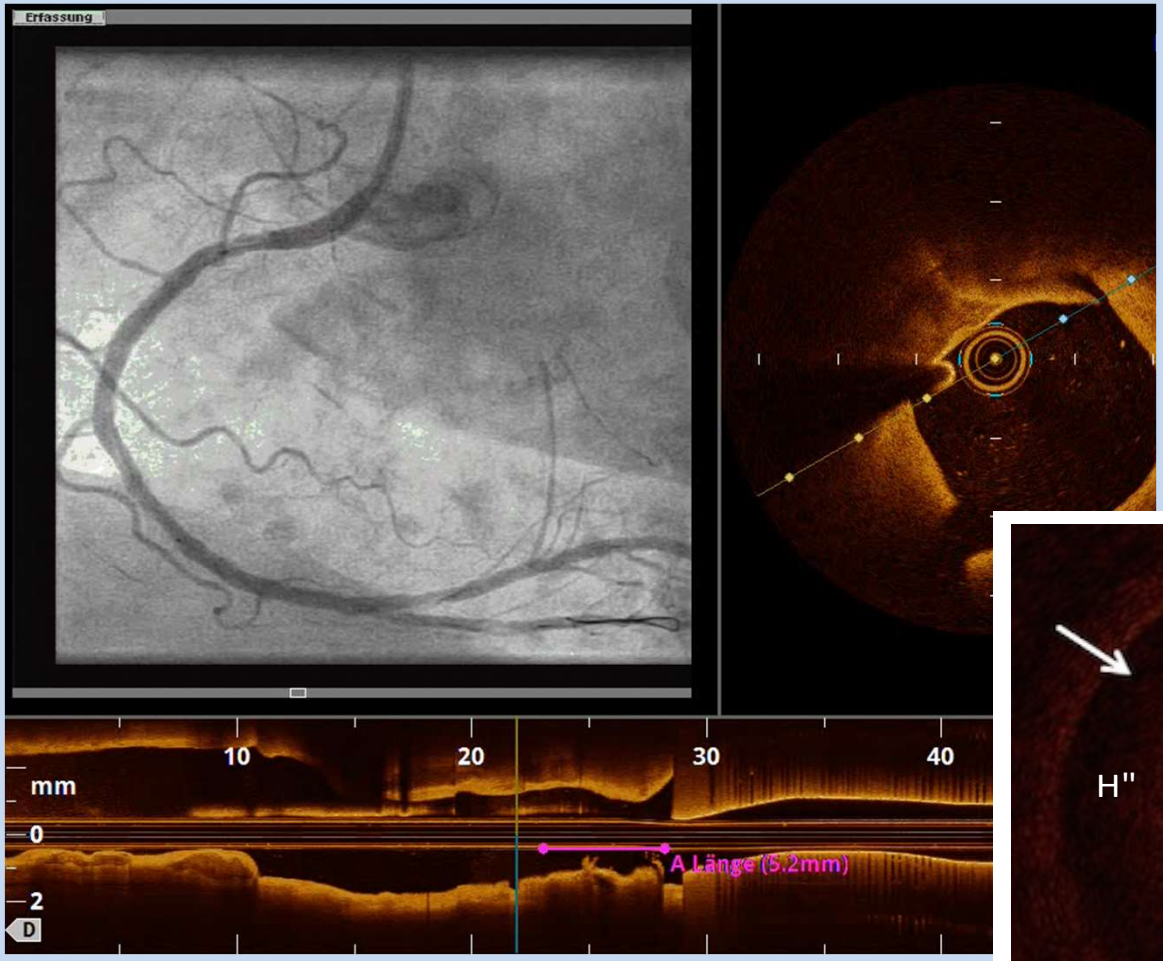


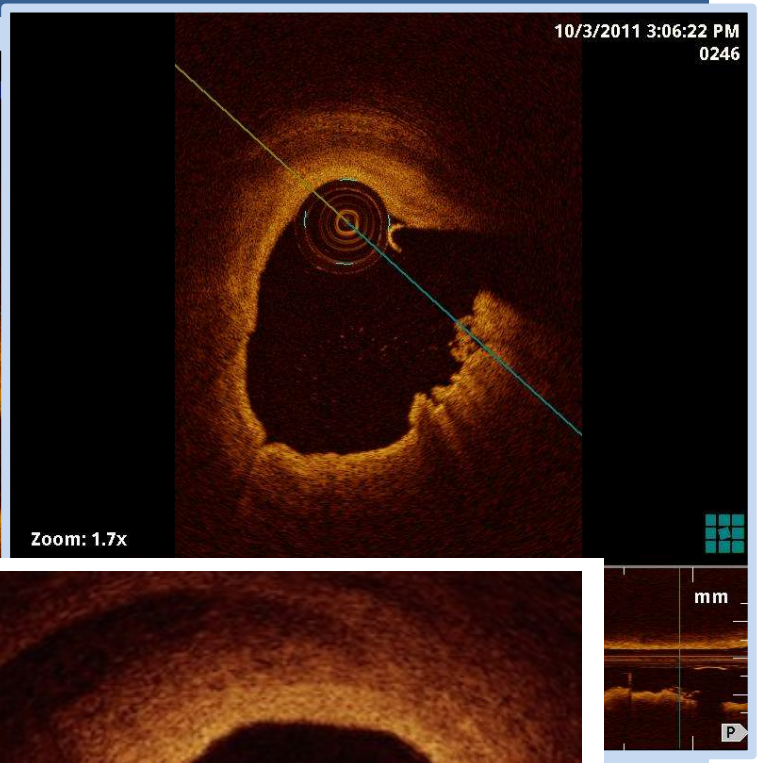


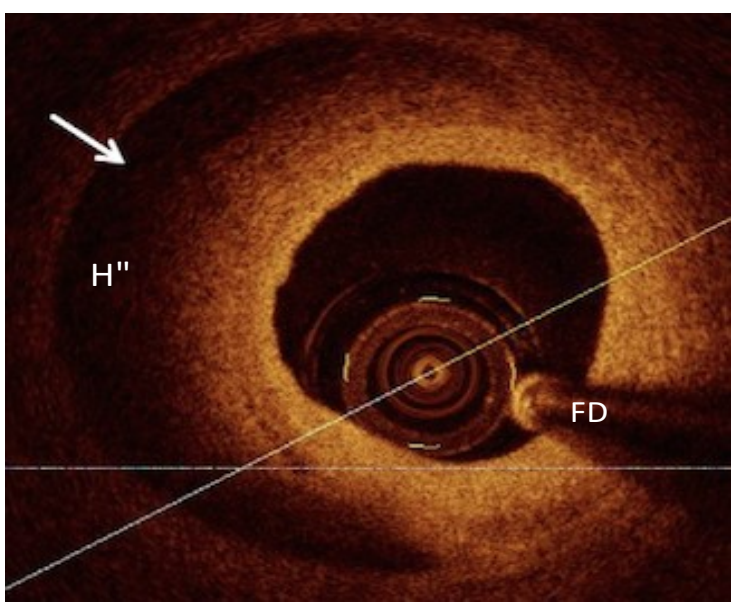




“not-so-MINOCA”







DZHK
DEUTSCHES ZENTRUM FÜR
HERZ-KREISLAUF-FORSCHUNG E.V.

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MAINZ

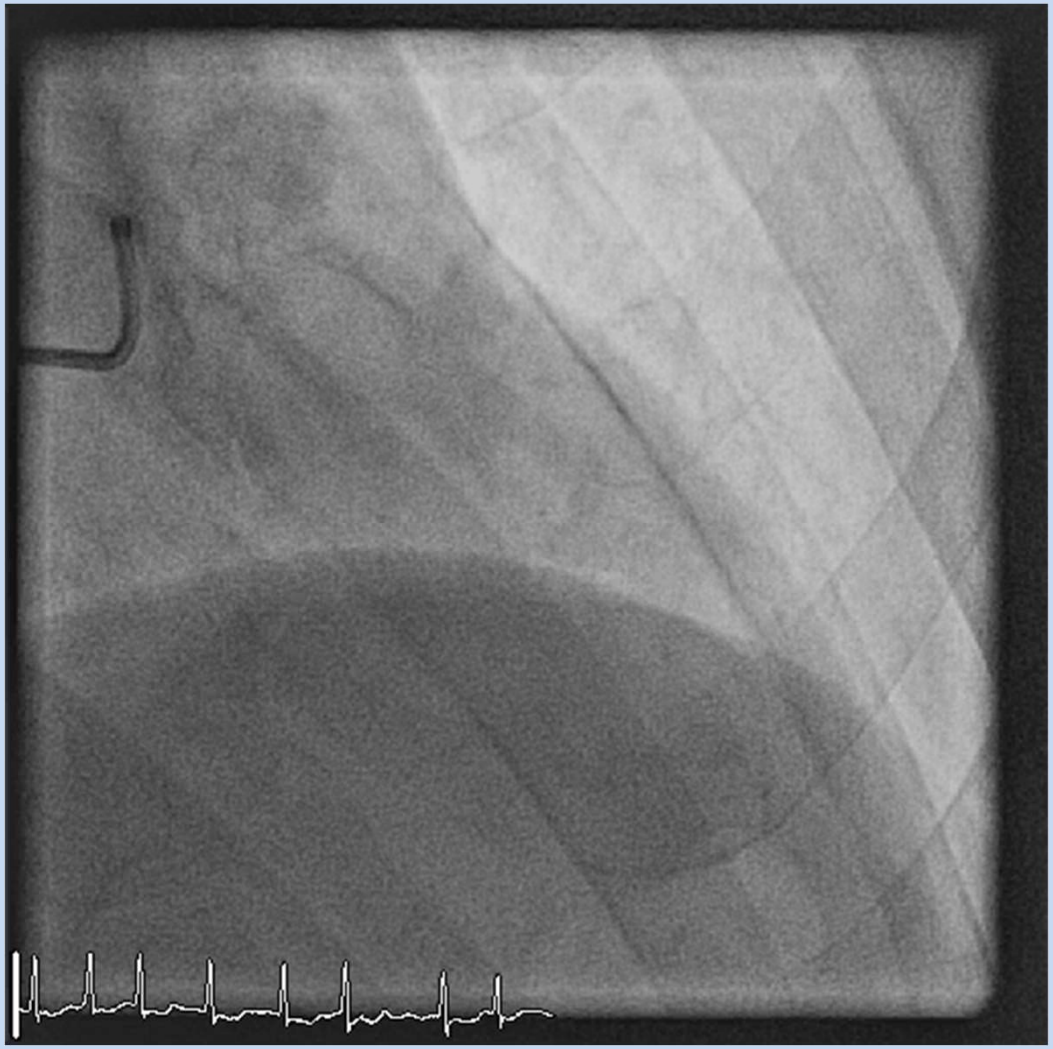
What is NOT (M)INOCA: “Chronic myocardial damage”

11.2017

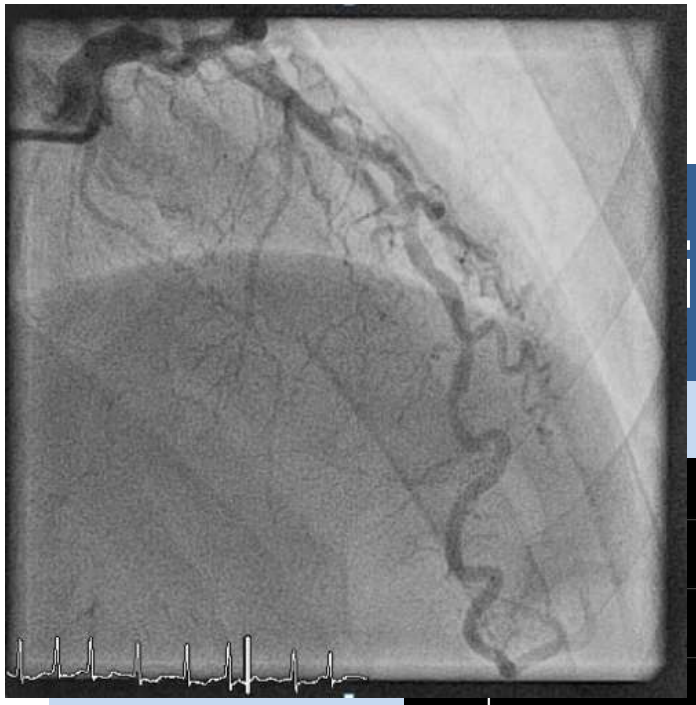
- Ausschluss KHK
- MRT V.a. Z.n. Myokarditis

Mehrfach 2018

- Trop I 40/80ng/ml, thorakale Beschwerde



ic myocardial damage”



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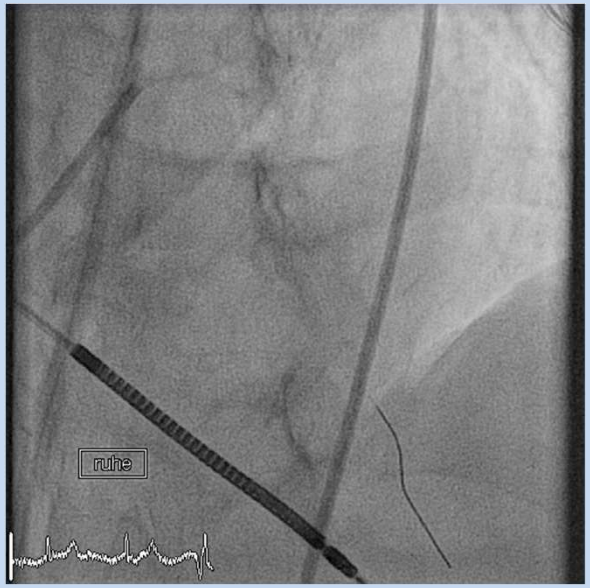
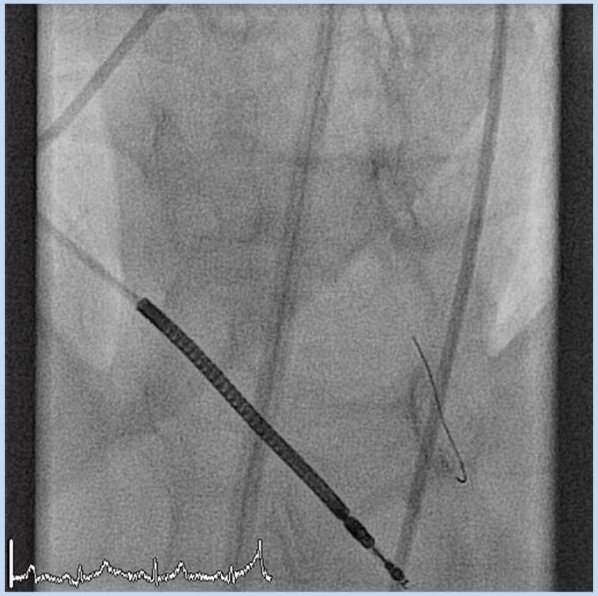
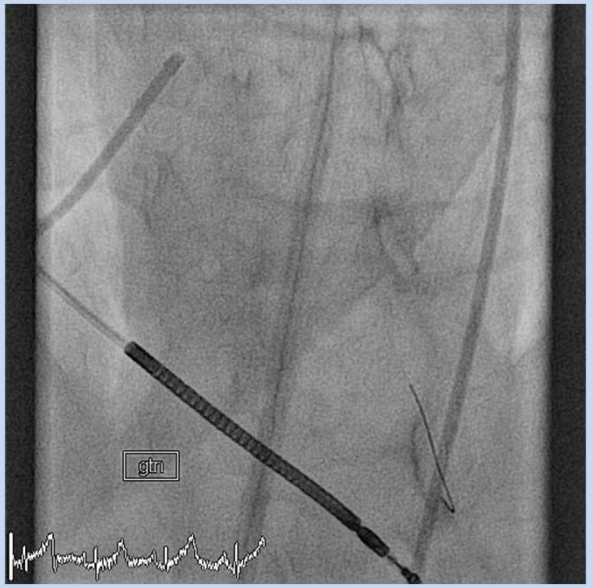
MINOCA







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MINOCA

Onlineveranstaltung

Webkonferenz

Anmeldung und Informationen

Anmeldung bitte per Fax an: 06131 176428

Anmeldeschluss: 12.01.2022

Name, Vorname:

Anzahl Teilnehmer:

Anschrift:

EFN:

E-Mail-Adresse :

Zentrum für Kardiologie - Kardiologie I
PRAXISWORKSHOP

Mikrovaskuläre Angina pectoris: Ischämie ohne Stenosen

Mittwoch, 19. Januar 2022
18.00 - 19.00 Uhr
(Onlineveranstaltung)

Unser Wissen für Ihre Gesundheit

UNIVERSITÄTSmedizin. MAINZ

Zentrum für Kardiologie - Kardiologie I
PRAXISWORKSHOP

Mikrovaskuläre Angina pectoris: Ischämie ohne Stenosen

Liebe Kolleginnen und Kollegen,

die Koronarangiographie stellt den Goldstandard zum Nachweis einer obstruktiven koronaren Herzkrankheit dar und wird routinemäßig zur Untersuchung von Patienten mit Angina pectoris durchgeführt. Bei bis zu 40% aller Patienten, die sich einer elektiven Koronarangiographie mit Anzeichen einer myokardialen Ischämie unterziehen, liegt jedoch keine behandlungsbedürftige koronare Obstruktion vor. Betroffene Patienten erhalten häufig keine endgültige Diagnose und leiden fortwährend an ausgeprägten Beschwerden. Bei etwa der Hälfte dieser Patienten besteht eine Form der Angina pectoris, welche auf eine Erkrankung der koronaren Mikrozirkulation zurückzuführen ist (mikrovaskuläre Angina pectoris). Diese Erkrankung stellt eine enorme Belastung für Betroffene dar und geht mit erhöhten Raten an schweren kardiovaskulären Ereignissen einher. Der Identifizierung und Behandlung dieser Patientengruppe kommt daher eine besondere Bedeutung zu. Im Rahmen unseres Workshops geben wir Ihnen einen praktischen Einblick in dieses häufige, aber unterdiagnostizierte Krankheitsbild und stellen Ihnen moderne katheterbasierte Techniken und mögliche Therapieoptionen vor. Hierfür laden wir Sie herzlich zum gemeinsamen Austausch ein.

Wir freuen uns auf eine spannende Veranstaltung!

Univ.-Prof. Dr. Thomas Münzel
Univ.-Prof. Dr. Tommaso Gori

Die Veranstaltung ist mit einem Fortbildungspunkt zertifiziert und richtet sich an niedergelassene Kardiologen und Hausärzte.

Veranstaltungsdatum: 19.01.2022

Programm

18.00 Uhr **Begrüßung**
Univ.-Prof. Dr. Thomas Münzel
Univ.-Prof. Dr. Tommaso Gori

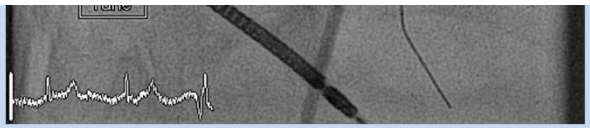
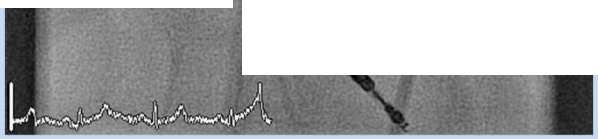
18.05 Uhr **Mikrovaskuläre Angina pectoris: Das steckt dahinter**
Dr. med. Helen Ullrich

18.20 Uhr **Live Case: Koronarangiographie mit Messung der mikrovaskulären Funktion (IMR Messung)**
Herzkatheterlabor der Universitätsmedizin Mainz
PD Dr. med. Maike Knorr

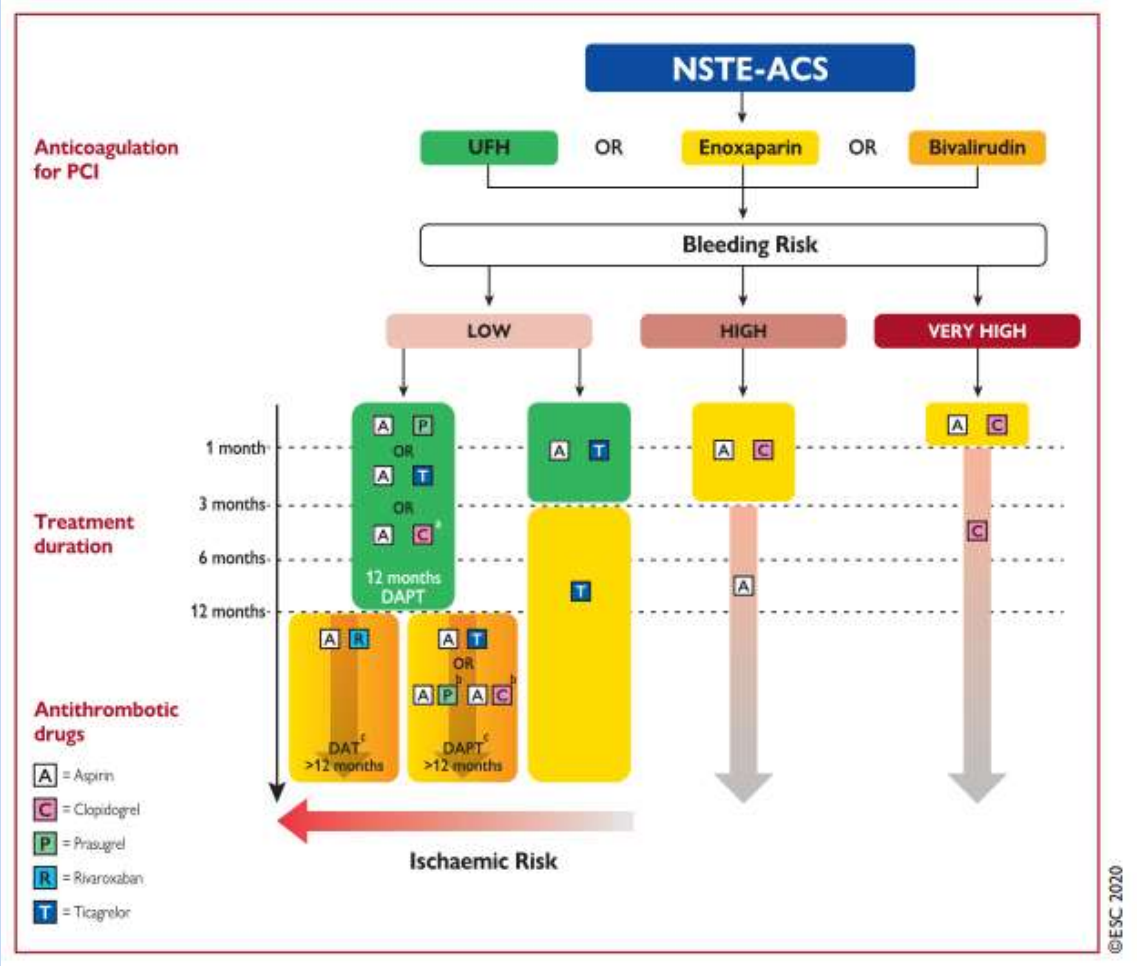
18.50 Uhr **Implikationen der Erkrankung, Diagnostik und Therapie**
Univ.-Prof. Dr. Tommaso Gori

Kontakt

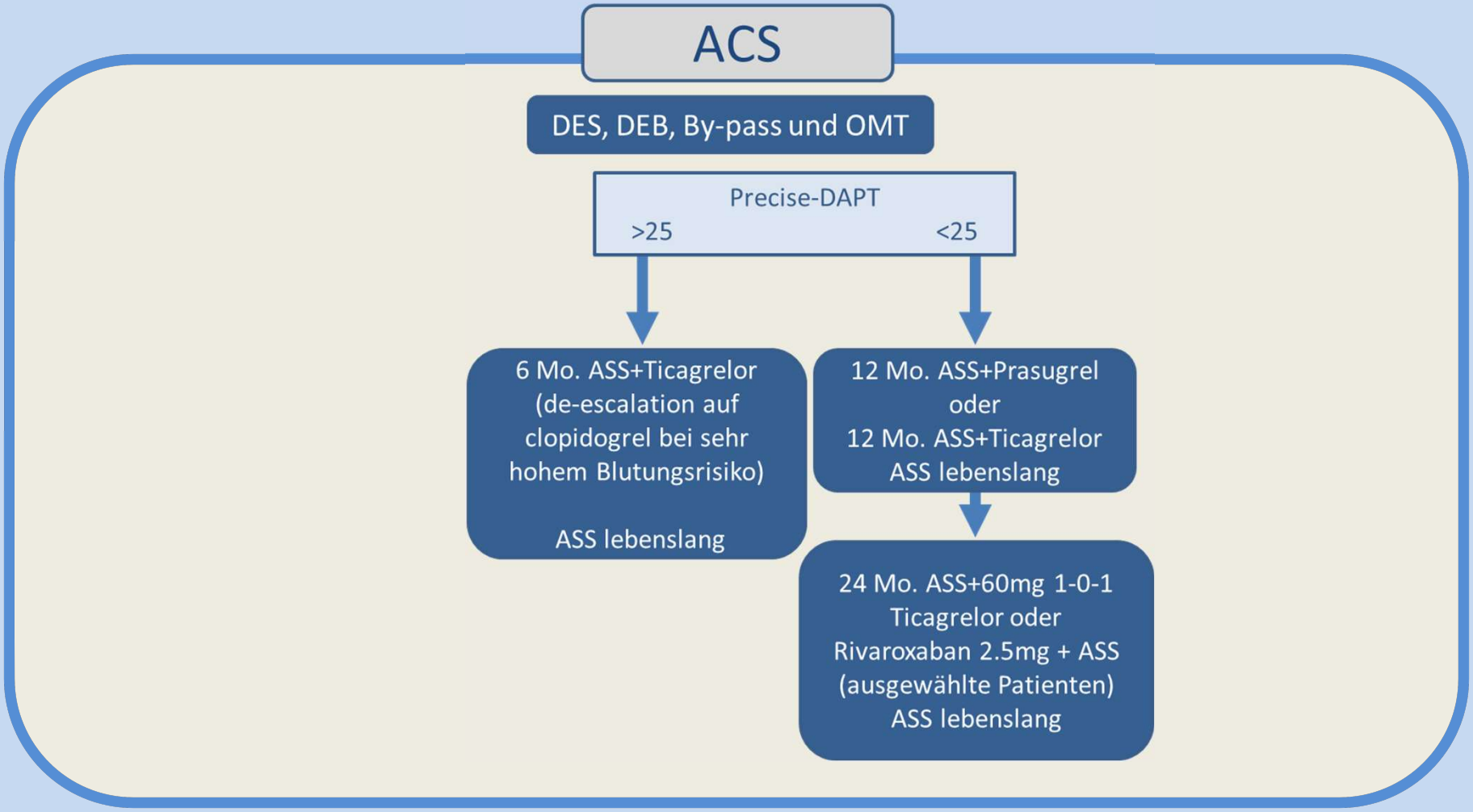
Univ.-Prof. Dr. Tommaso Gori
Zentrum für Kardiologie - Kardiologie I
Leiter Herzkatheterlabor
Leiter Klinisches Studienzentrum


DAPT


NSTE-ACS
Anticoagulation for PCI
UFH
OR
Enoxaparin
OR
Bivalirudin
Bleeding Risk
LOW
HIGH
VERY HIGH
Treatment duration
1 month
3 months
6 months
12 months
12 months DAPT
DAT >12 months
DAPT >12 months
Antithrombotic drugs
A = Aspirin
C = Clopidogrel
P = Prasugrel
R = Rivaroxaban
T = Ticagrelor
Ischaemic Risk
©ESC 2020

DAPT


ACS
DES, DEB, By-pass und OMT
Precise-DAPT
>25
<25
6 Mo. ASS+Ticagrelor
(de-escalation auf
clopidogrel bei sehr
hohem Blutungsrisiko)
ASS lebenslang
12 Mo. ASS+Prasugrel
oder
12 Mo. ASS+Ticagrelor
ASS lebenslang
24 Mo. ASS+60mg 1-0-1
Ticagrelor oder
Rivaroxaban 2.5mg + ASS
(ausgewählte Patienten)
ASS lebenslang

DAPT

Patienten mit VHF, CHADSVASC ≥ 2
(keine Daten für andere Indikationen zu Antikoagulation sind vorhanden)

ACS, Stabile Angina

↓

ASS nach Schema +
12 Mo. Clopidogrel +
Xarelto 15mg oder
Dabigatran 110mg 1-0-1
Edoxaban 60mg oder
Eliquis 5mg 1-0-1

		Blutungsrisiko (nach PRECISE-DAPT)	
	Zusätzlich ASS	**Niedrig**	**Hoch**
Ischämie Risiko	**Niedrig**	**1 Monat**	**0 Monate**
	Hoch	**6 Monate**	**1 Monat**

Aktive Blutung

LAA Verschluss

↓

DAPT

Conclusions

„CHEST-PAINS“ acronym

Shared decision

Multiple culprit and non-culprit lesions are frequent (40%): implications

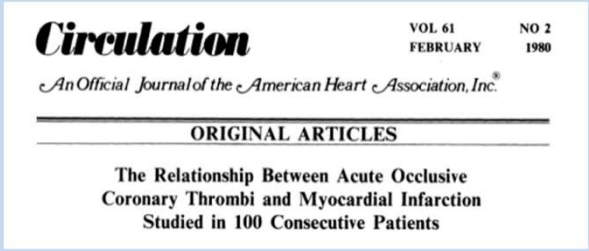
Angiography is inaccurate for culprit diagnosis and non-culprit assessment

- Spasm
- Oculo-stenotic reflex
- Plaque regression

MINOCA and not-so-MINOCA (OCT, FFR!)

DAPT: 12 months is not a dogma anymore

≠ MINOCA



Circulation

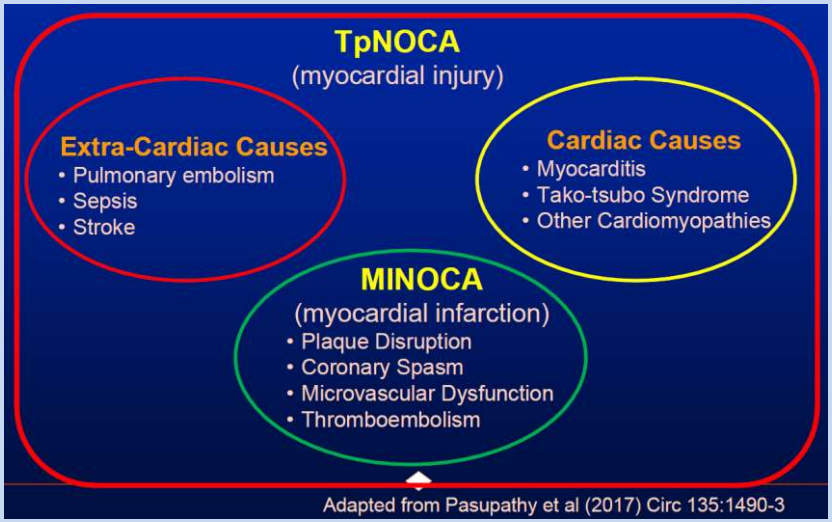
VOL 61 NO 2
FEBRUARY 1980

An Official Journal of the American Heart Association, Inc.

ORIGINAL ARTICLES

The Relationship Between Acute Occlusive Coronary Thrombi and Myocardial Infarction Studied in 100 Consecutive Patients

>90% of the acute MI patients had angiographic evidence of obstructive CAD
At OCT, 80% of the other 10% have some form of CAD



Positive cardiac biomarker and corroborative clinical evidence of an AMI

The diagnosis of MINOCA is made immediately upon coronary angiography in a patient presenting with features consistent with an AMI, as detailed by the following criteria:
(1) Universal AMI criteria[8]
(2) Non-obstructive coronary arteries on angiography, defined as no coronary artery stenosis ≥50% in any potential IRA
(3) No clinically overt specific cause for the acute presentation

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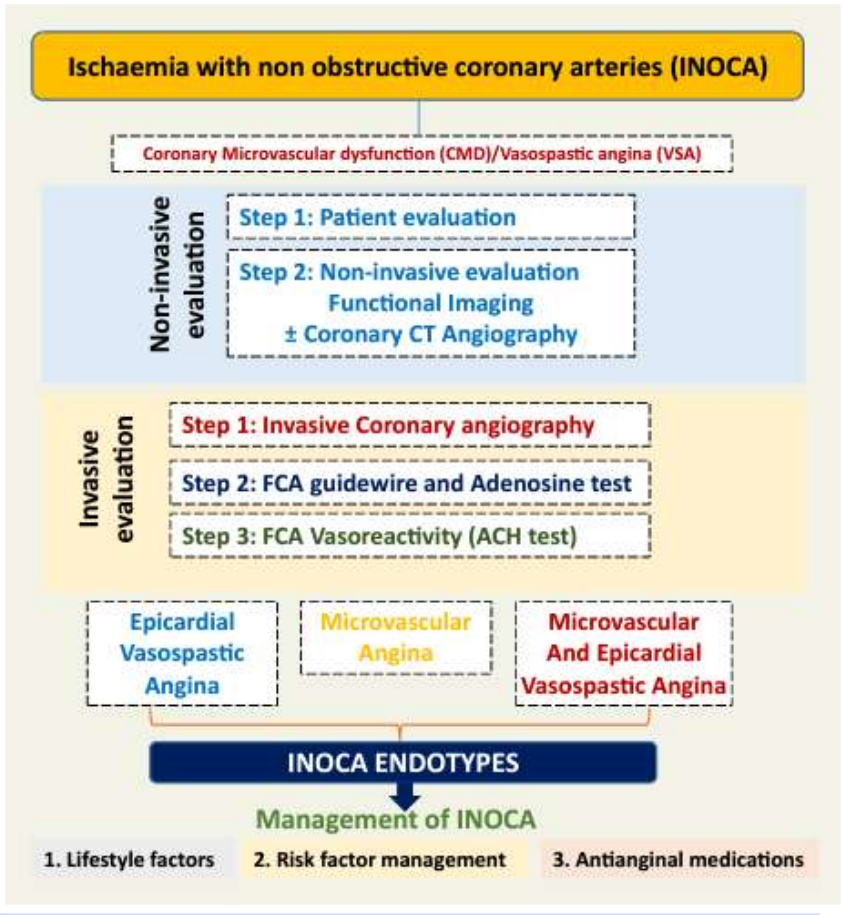
An EAPCI Expert Consensus Document on Ischaemia with Non-Obstructive Coronary Arteries in Collaboration with European Society of Cardiology Working Group on Coronary Pathophysiology & Microcirculation Endorsed by Coronary Vasomotor Disorders International Study Group

Definition

In the setting of CCS, a mismatch of demand-supply of coronary artery blood flow may lead to transient or recurrent cardiac chest pain related to myocardial ischaemia due to inadequate cellular availability of adenosine-50 - triphosphate.



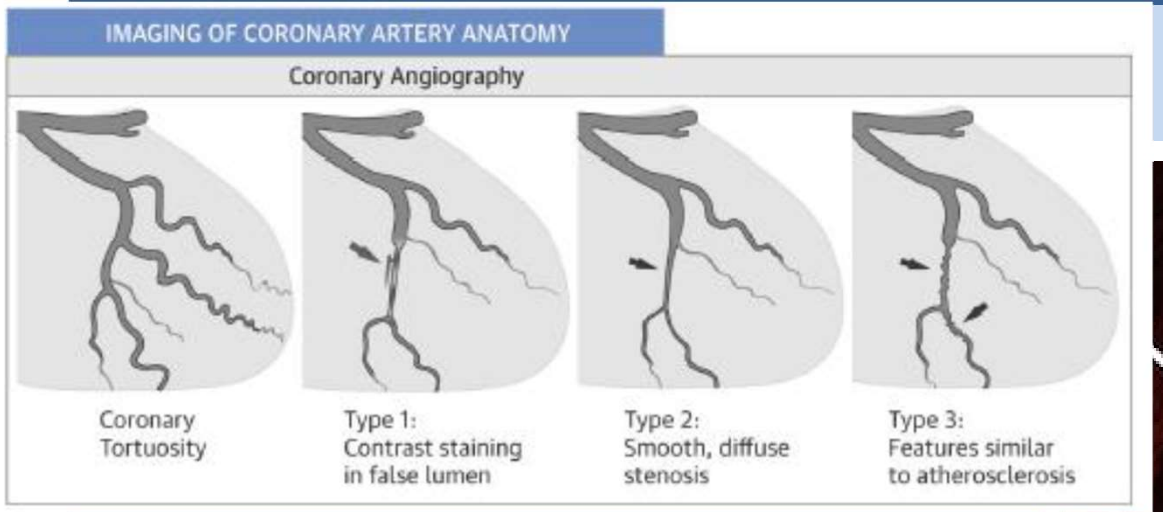
"INOCA" is a 'working diagnosis', analogous to heart failure

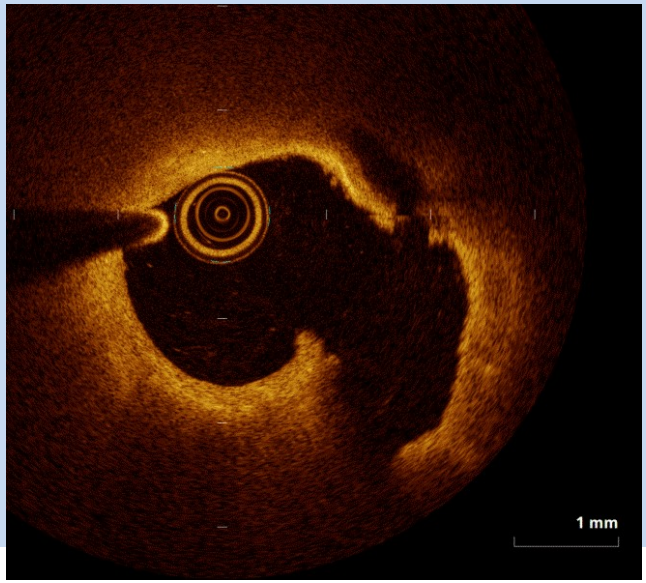
Definition

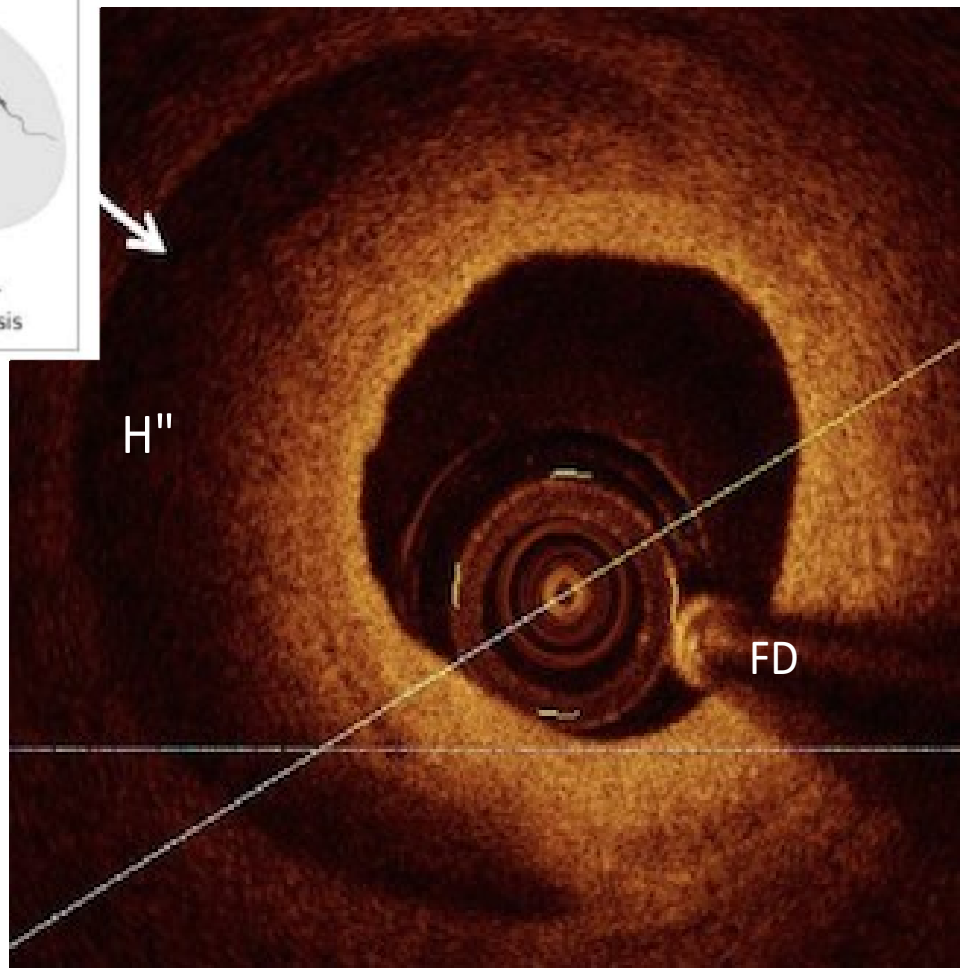
In INOCA, the mismatch between blood supply and myocardial oxygen demands may be caused by **CMD and/or epicardial coronary artery spasm**, typically in the setting of non-obstructive coronary atherosclerosis

Discussion of angina caused by CMD in the context of cardiomyopathy (hypertrophic, dilated), myocarditis, aortic stenosis, infiltrative diseases of the heart, percutaneous/surgical interventions, and other possible mechanisms[7] (*Figure 1*) such as inflammation, systemic inflammatory or autoimmune disease (lupus, rheumatoid arthritis), platelet/coagulation disorders, primary metabolic abnormalities, as well as by myocardial bridging, is beyond the scope of this consensus document

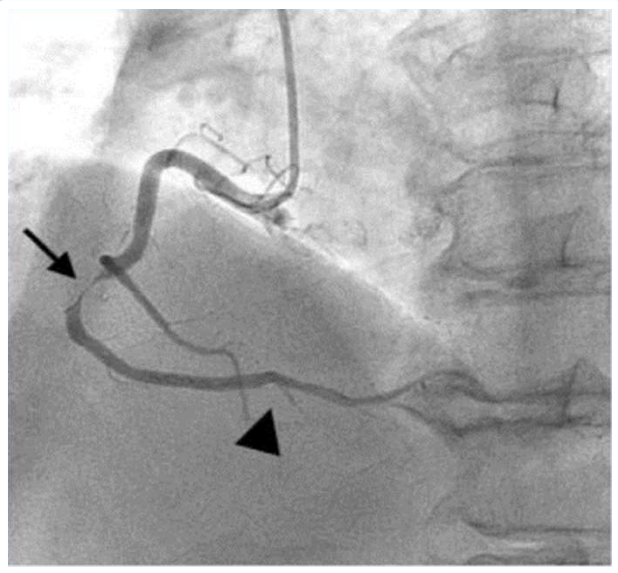
What is not (M)INOCA: erosion/dissection







Prevalence

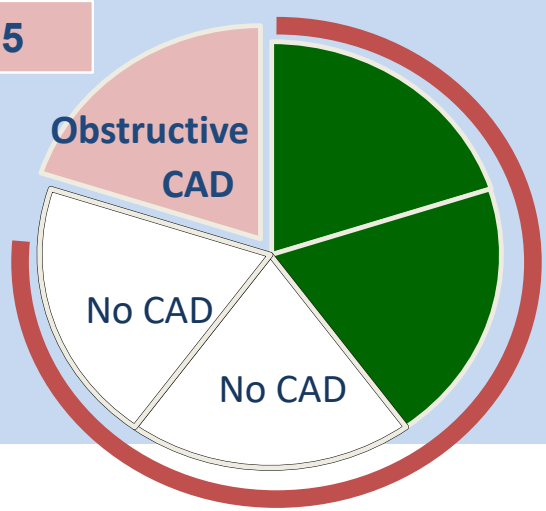


Diagnostic test e.g. CTCA

Blocked coronary arteries

1 in 5

Stents
Bypass surgery



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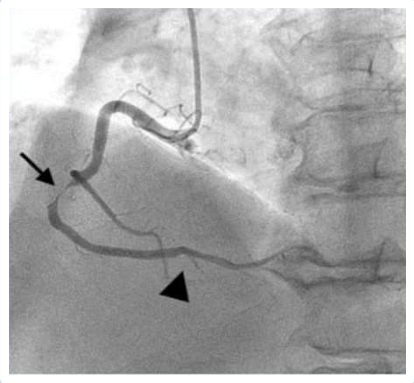
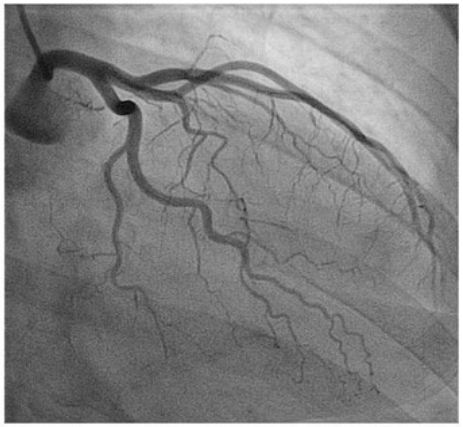
Prevalence



Diagnostic test e.g. CTCA



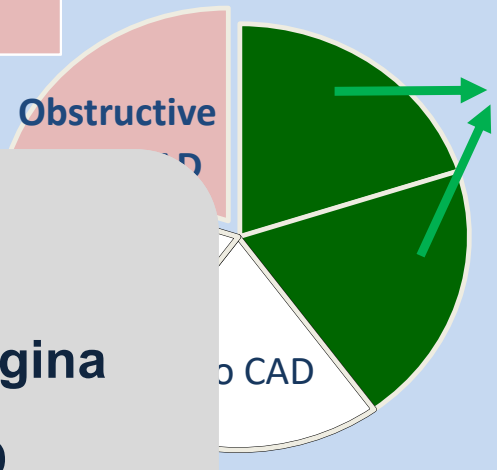
Blocked coronary arteries

No obstructive coronary lesions

1 in 5

Stents
Bypass surgery

2 in 5
Have other causes of ischemia



40% of the patients with angina have no epicardial CAD

Stable angina pectoris with no obstructive coronary artery disease is associated with increased risks of major adverse cardiovascular events

Lasse Jespersen[1*], Anders Hvelplund[2,3], Steen Z. Abildstrøm[1], Frants Pedersen[4], Søren Galatius[3], Jan K. Madsen[3], Erik Jørgensen[4], Henning Kelbæk[4], and Eva Prescott[1,5]

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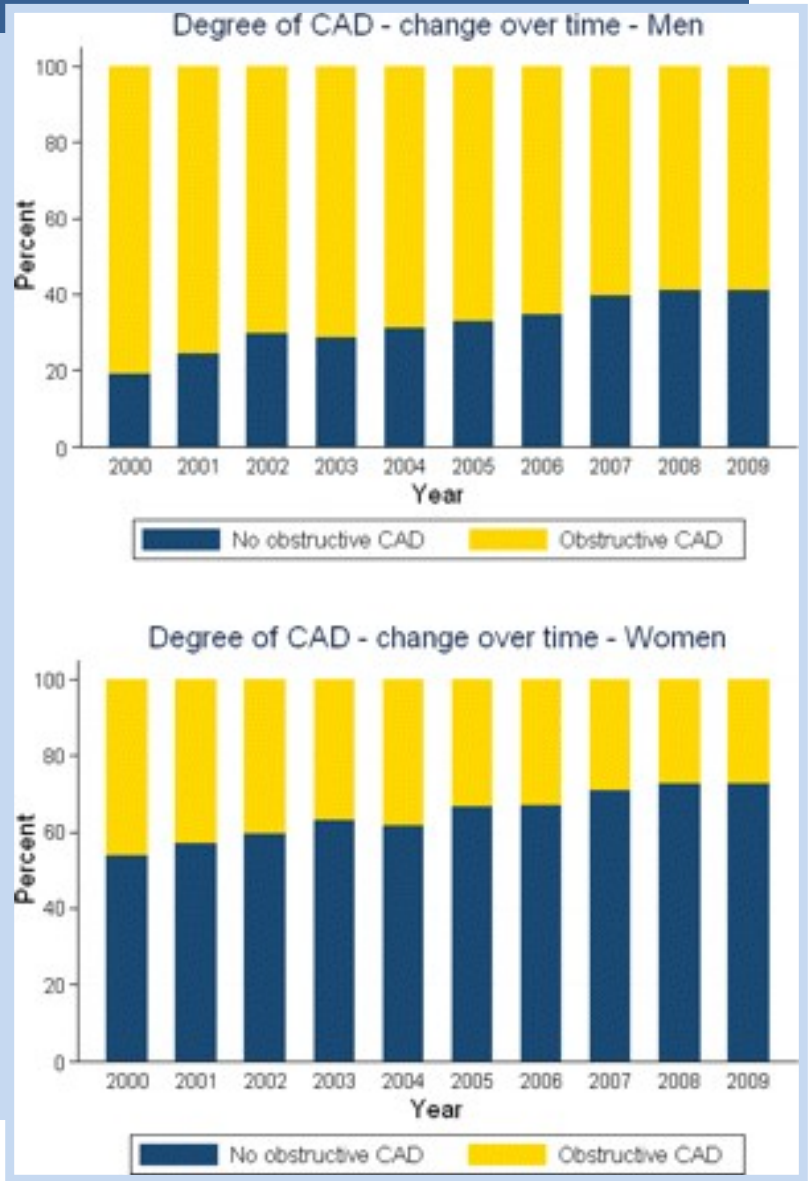
Patient characteristics: sex

Patients suspected of stable angina pectoris frequently have no obstructive CAD, i.e. 65% women compared with 32% of men with an increasing trend over time.

(not when adjusted for age, BMI, diabetes, smoking, lipid-lowering or antihypertensive medication) - **This probably reflects a lowering of the threshold for CAG.**



11 223 patients referred for coronary angiography (CAG) in 1998–2009, 5705 controls (CCHS)

Jespersen Eur H J 2012

Clinical characteristics and prognosis of patients with microvascular angina: an international and prospective cohort study by the Coronary Vasomotor Disorders International Study (COVADIS) Group

Hiroaki Shimokawa ✉, Akira Suda, Jun Takahashi, Colin Berry, Paolo G Camici, Filippo Crea, Javier Escaned, Tom Ford, Eric Yii, Juan Carlos Kaski ... Show more

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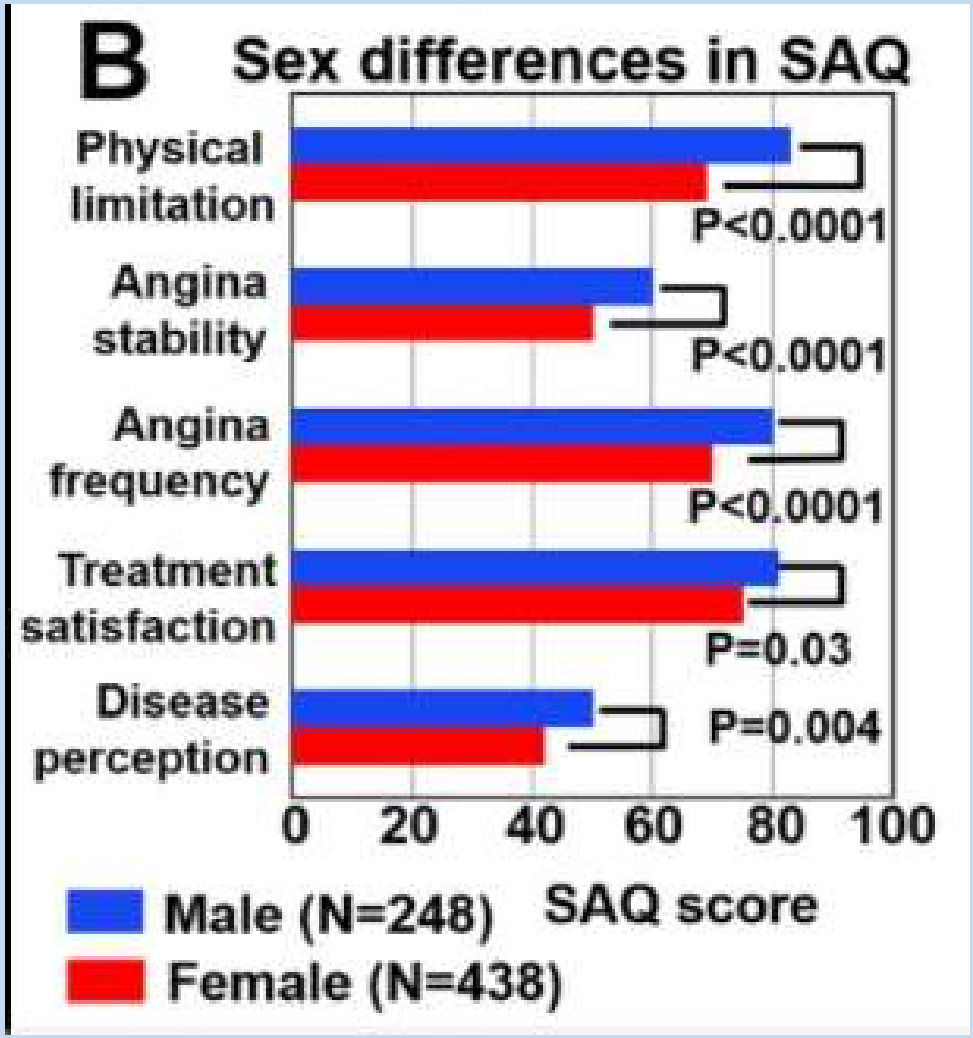
What about quality of life?



Of the 686 patients,

59% had objective evidence of myocardial ischemia during non-invasive stress testing.

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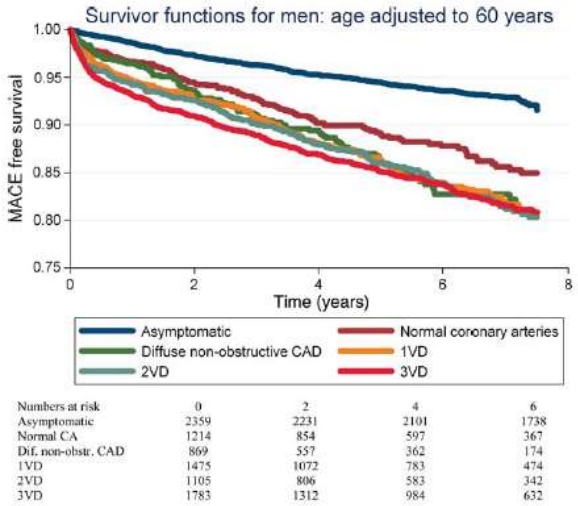
What about prognosis?

Normal coronary arteries and diffuse non-obstructive CAD were associated with 52 and 85% increased risk of MACE and with 29 and 52% increased risk of all-cause mortality, respectively, with no differences between men and women. For both men and women, a graded increase in risk of future MACE and all-cause mortality with increasing levels of CAD was demonstrated.

Table 2 Hazard ratios (95% confidence interval) for patients with no obstructive coronary artery disease compared with asymptomatic women and men, respectively, in successively adjusted models

MACE	Events, *n*	Model 1[a]		Model 2[b]	
Degree of CAD	Women/men	Women	Men	Women	Men
Reference population	302/256	—	—	—	—
Normal coronary arteries	156/127	1.34 (1.08–1.66)	1.50 (1.19–1.89)	1.57 (1.21–2.02)	1.53 (1.18–2.00)
Diffuse non-obstr. CAD	87/132	1.62 (1.25–2.10)	1.79 (1.43–2.25)	1.86 (1.35–2.56)	1.87 (1.43–2.46)
All-cause mortality					
Reference population	356/298	—	—	—	—
Normal coronary arteries	105/103	0.97 (0.77–1.23)	1.30 (1.02–1.65)	1.20 (0.92–1.57)	1.44 (1.11–1.88)
Diffuse non-obstr. CAD	66/95	1.31 (1.00–1.71)	1.33 (1.05–1.69)	1.56 (1.13–2.15)	1.52 (1.15–2.01)

[a]Adjusted for age.
[b]Adjusted for age, BMI, diabetes, smoking status, and use of lipid-lowering and antihypertensive medication.



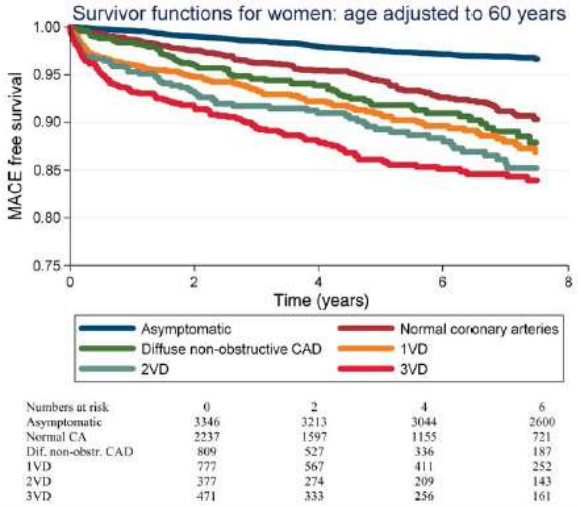


Figure 3 Major adverse cardiovascular event-free survivor functions for men and women. Age adjusted to 60 years. VD, vessel disease (indicates ≥50% stenosis).

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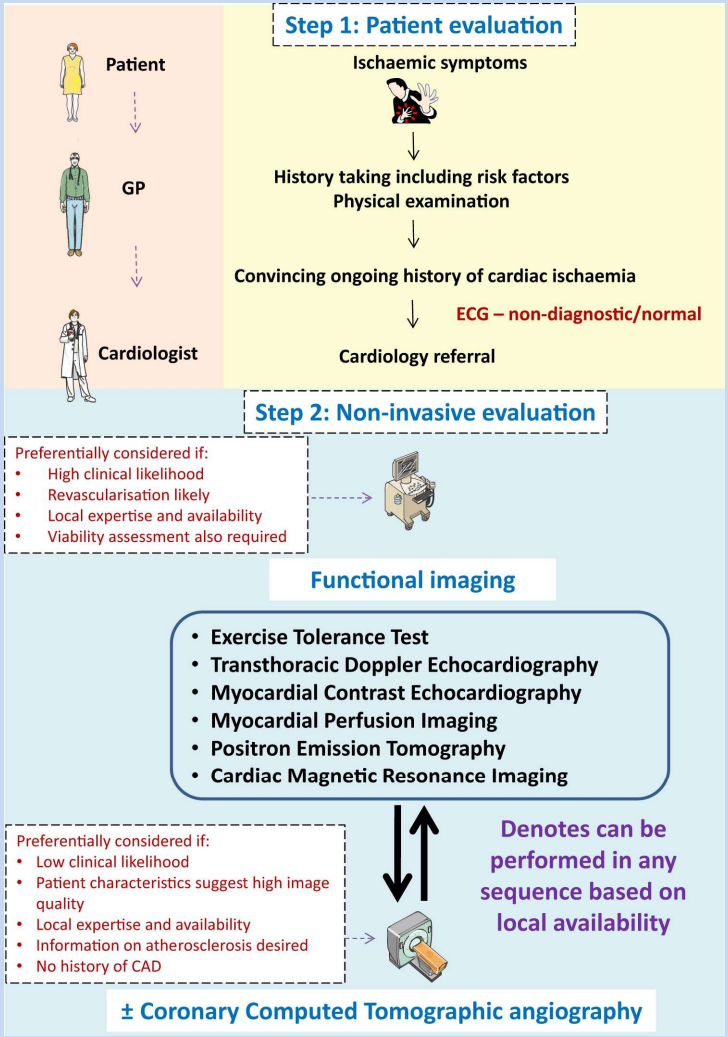
How to study these patients (non-invasive)



- **TTE**: Blood flow velocity (LAD)
- **MRT**: Myokardial Perfusions index (rest and vasodilator-stress first-pass myocardial perfusion study, each following the injection of a gadolinium-based contrast agent)
- **PET, SPECT** (rest and vasodilator-stress myocardial perfusion study, each following the injection of a blood flow radiotracer (82Rubidium and 13N-ammonia))

Limitations:

- Exercise ECG: Low sensitivity and specificity for CMD
- Stress imaging tests: frequently normal but can occasionally show regional abnormalities that may not follow typical vascular distributions.

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Non-invasive methods

- **TTE**: Blood flow velocity im Bereich der LAD
- **MRT**: Myokardialer Perfusionsindex (rest and vasodilator-stress first-pass myocardial perfusion study, each following the injection of a gadolinium-based contrast agent)
- **PET, SPECT** (rest and vasodilator-stress myocardial perfusion study, each following the injection of a blood flow radiotracer (82Rubidium and 13N-ammonia))

Limitations:
- Exercise ECG: Low sensitivity and specificity for CMD
- Stress imaging tests: frequently normal but can occasionally show regional abnormalities that may not follow typical vascular distributions.

Methods	PRO	CONS
TTDE	Low cost Lack of ionizing radiation Potentially broad access Good reproducibility and validity against invasive measures Proven predictive of adverse outcome	Requires extensive training More feasible on LAD, less satisfactory on the other arteries
MCE	Lack of ionizing radiation Potentially broad access	No clinical validation Rare but severe adverse reactions are reported to some ultrasound contrast agents
PET	Well-validated, accurate and reproducible High-sensitivity, spatial resolution, reduced radiation dose with new generation machines Proven predictive of adverse outcome	Less availability Costly Ionizing radiation
MRI	Better availability than PET Less expensive than PET High spatial and temporal resolution Lack of ionizing radiation	Dark rim artefacts in the sub-endocardium need to be differentiated from true perfusion defects Lacks validation and reproducibility studies
CCTA	Anatomical test High sensitivity for coronary artery disease High sensitivity for coronary atherosclerotic plaque	Lacks information on coronary vasomotion Ionising radiation exposure Needs for heart rate control and beta-adrenergic blockade False negative results
CT-derived CFR	Opportunity to combine accurate anatomic and functional assessments of both the myocardium and the coronary arteries	High effective radiation dose Increased contrast medium dose Needs for heart rate control and beta-adrenergic blockade Required further clinical validation Ionizing radiation Lacks evidence from randomised trials

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Diagnosis

Table I **Diagnostic criteria for microvascular angina**

Criteria	Evidence	Diagnostic parameters
1	Symptoms of myocardial ischaemia[a]	Effort or rest angina ~~Exertional~~ dyspnoea
2	Absence of obstructive CAD (~~<50% diameter reduction or~~ FFR >0.80) Not necessarily!	Coronary CTA Invasive coronary angiography
3	Objective evidence of myocardial ischaemia[b]	Presence of reversible defect, abnormality or flow reserve on a functional imaging test
4	Evidence of impaired coronary microvascular function	Impaired coronary flow reserve (cut-off <2.0), invasive or noninvasively determined Not alone ! Coronary microvascular spasm, defined as reproduction of symptoms, ischaemic ECG shifts but no epicardial spasm during acetylcholine testing Abnormal coronary microvascular resistance indices (e.g. IMR ≥25)

Definitive microvascular angina is only diagnosed if criterias 1, 2, 3 and 4 are present.
CAD, coronary artery disease; CCTA, coronary computed tomographic angiography; ECG, electrocardiogram; FFR, fractional flow reserve; IMR, index of microcirculatory resistance.
[a]Many patients with heart failure with preserved ejection fraction would fulfil these criteria: dyspnoea, no obstructive CAD and impaired CFR. For this reason, consider measuring LV end-diastolic pressure (normal ≤10 mmHg) and NT-proBNP normal <125 pg/mL.[16]
[b]Signs of ischaemia may be present but are not necessary. However, evidence of impaired coronary microvascular function should be present.

Kunadian V, et al., Eur Heart J. 2020 Jul.

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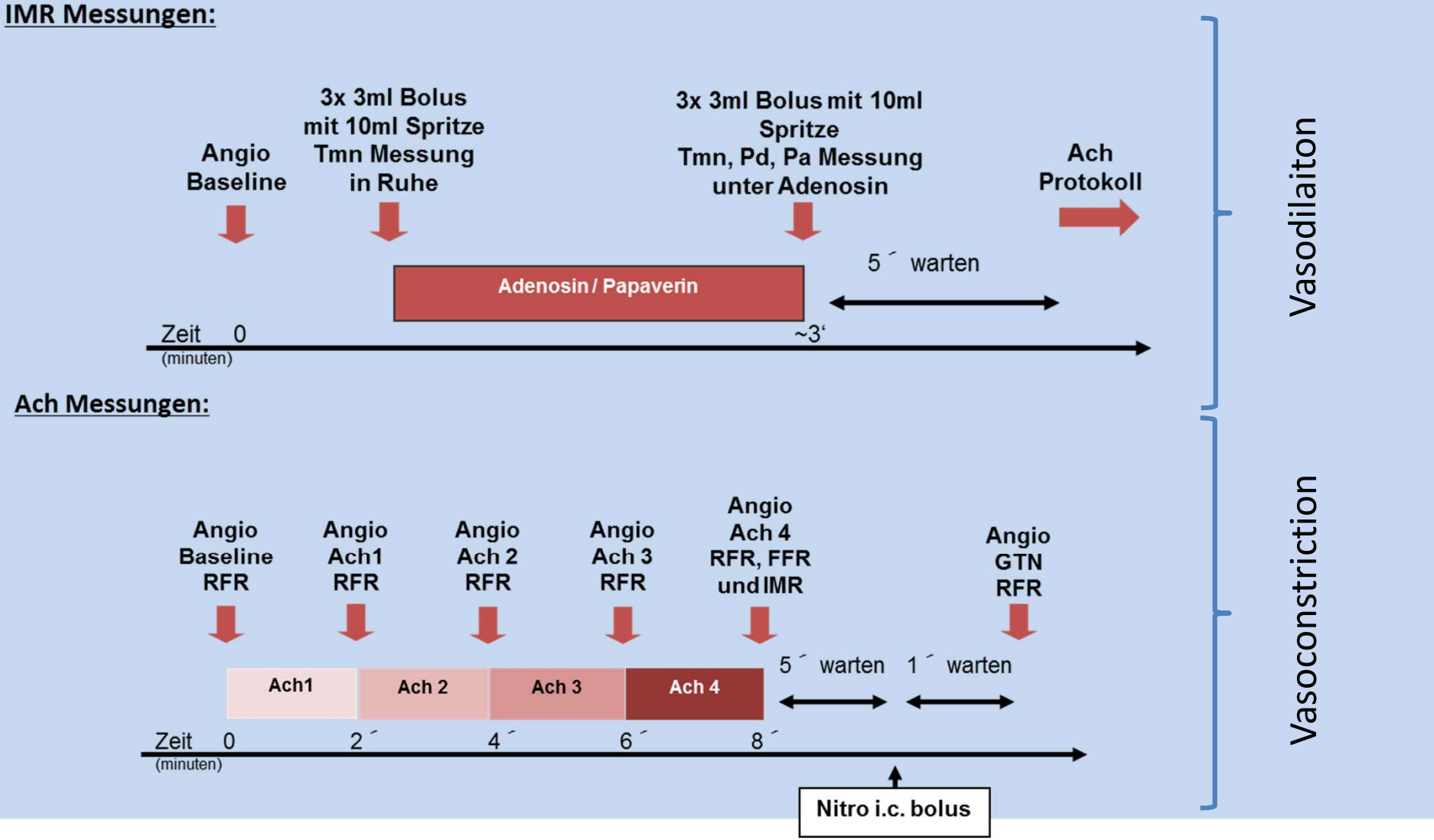
How to study these patients (Mainz protocol)



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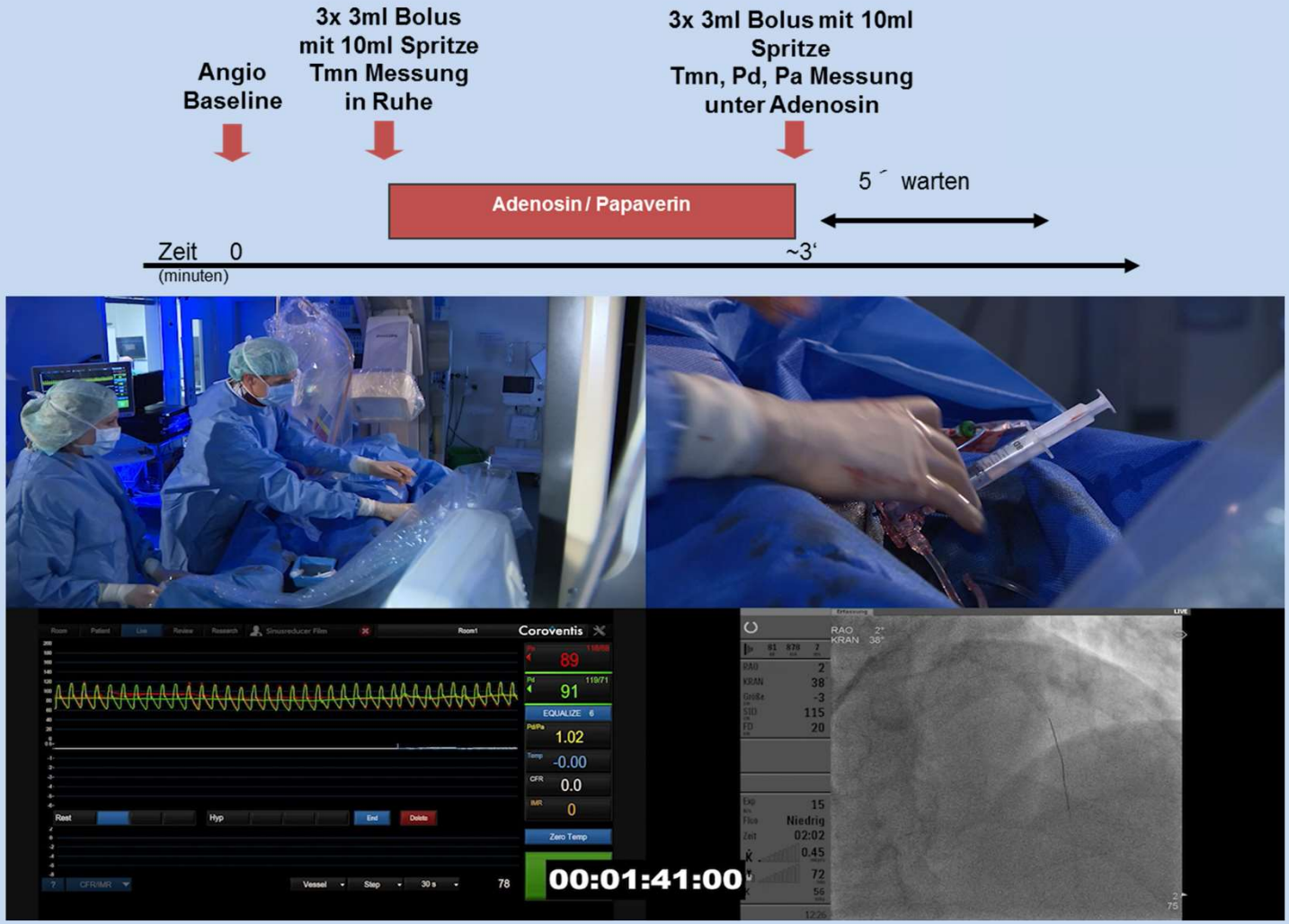
"Endotypes"

Diagnosis	Mechanism	Definition
Microvascular disease		
	Abnormally high microvascular resistance at rest	Coronary slow flow / Syndrome Y
	Impaired microvascular relaxation	- With microvascular disease: IMR >25 AND/OR HMR >2.4 - No clear conclusion about microvascular disease: CFR <2.0 with FFR>0.80 and/or resting indexes>0.89
	Microvascular spasm	Angina during intracoronary infusion of acetylcholine with typical ischemic ST-segment changes, FFR/resting indexes normal AND IMR>25 immediately after highest dose Ach

"Endotypes"

Diagnosis	Mechanism	Definition
Epicardial disease		
	Epicardial spasm	1) reproduction of the usual symptoms AND; 2) ischemic ECG changes (1mm horizontal or downsloping ST depression OR ST elevation OR T Wave inversion AND; 3) >75% vasoconstriction on angiography AND FFR<0.80 OR resting indexes<0.89
	Obstructive epicardial disease	FFR <0.80 Contrast FFR <0.83 Resting indexes <0.89

Abnormal resistances – abnormal vasodilation



How to study these patients (Mainz protocol)

Diagnoses (51 J.a. W)

1. Chest pain CCS III, severe limitation of life quality.
Dobutamine-Echocardiography: no regional abnormality, appearance of negative T-waves in III, aVF, V4-V6

2. Symptomatic ventricular extrasystole (2 morphologies, predominant LVOT), VES burden 14%
Therapy with ß-Blocker and Flecainide

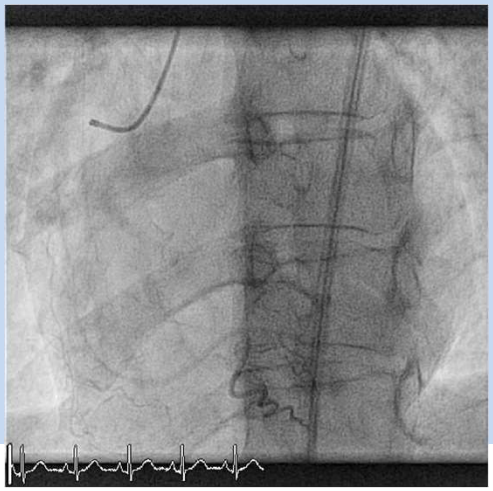
3. Unsuccessful Ablation, intraprocedural Tamponade 2019

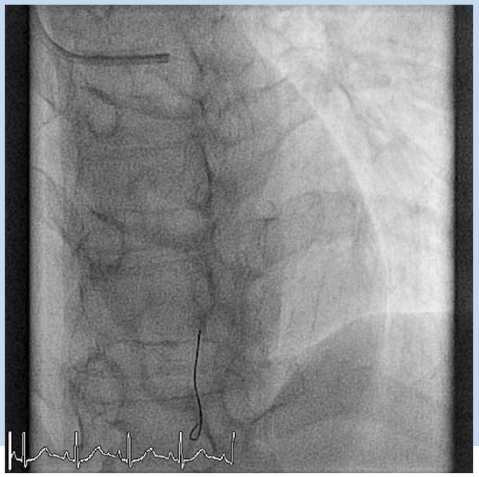
4. Currently good LVEF (58% with small posterolateral scar)

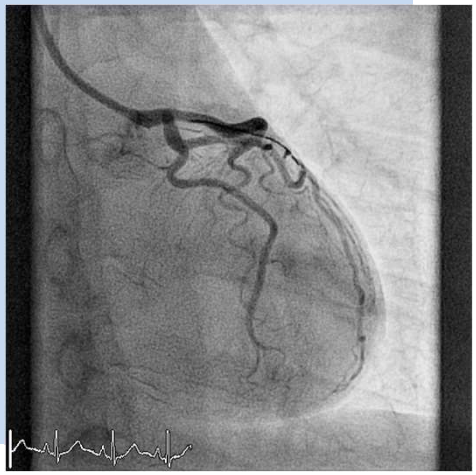
5. Asthma

6. Anorexia nervosa

7. CVRF: none







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IMR (papaverine i.c. 15mg in the LAD)

Abnormal resistances – abnormal vasodilation

Diagnosis: severe microvascular dysfunction, no epicardial stenosis.

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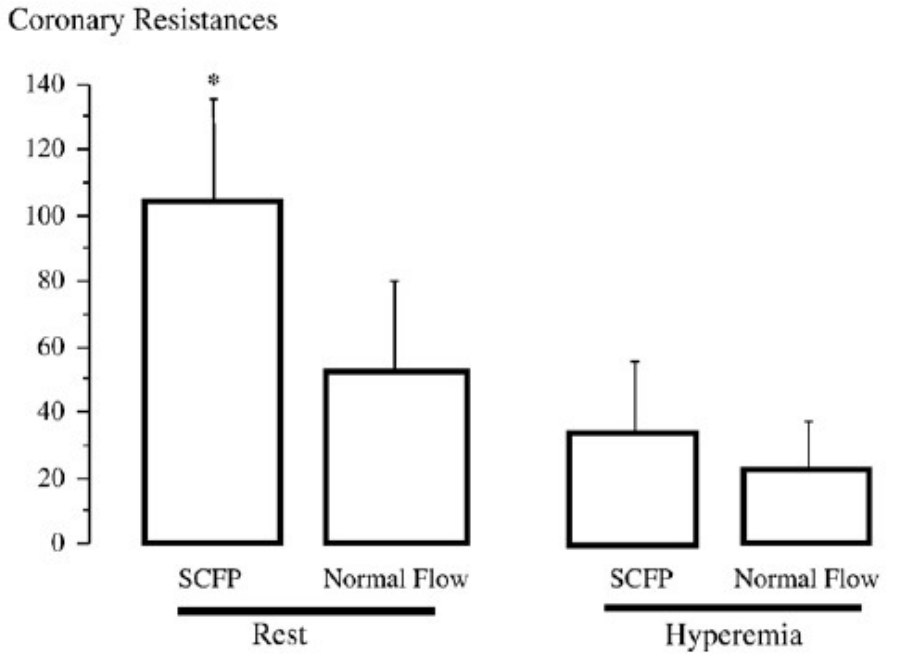
Therapy (according to CORMICA, drugs chosen are in red)

Abnormal resistances – abnormal vasodilation

Endotype	Diagnosis: Coronary vasomotion disorder	Stratified medical therapy
Microvascular angina	IMR ≥ 25 (Microvascular resistance)	Baseline therapy: aspirin, statin and ACE inhibitor therapy in all patients. PRN sublingual GTN Antianginal therapy 1st Line – Beta blocker (e.g. nebivolol 2.5mg OD or carvedilol 6.25mg BD uptitrated) 2nd Line - Calcium channel blockers (CCB) substituted (Non DHP e.g. verapamil 40mg BD uptitrated) - where β-blockers are not tolerated or ineffective. 3rd Line – Add in therapy (avoid long acting nitrates) •CCB - DHP (e.g. amlodipine) – only for those on beta-blockers •Ranolazine (375mg BD, uptitrated) Avoid long acting nitrate unless previously established good response or co-existent epicardial spasm
	CFR < 2.0 (Coronary vasorelaxation)	

Impact of sex on baseline resistances

	Syndrome Y	Syndrome X
Patients	Young males, smokers	Postmenopausal females
Clinical presentation	Unstable angina	Stable angina
Involved mediators	Inappropriate peptide Y secretion	X
Resting resistance	↑	normal
Response to vasodilators	normal	↓



Gori Int J Card 2008

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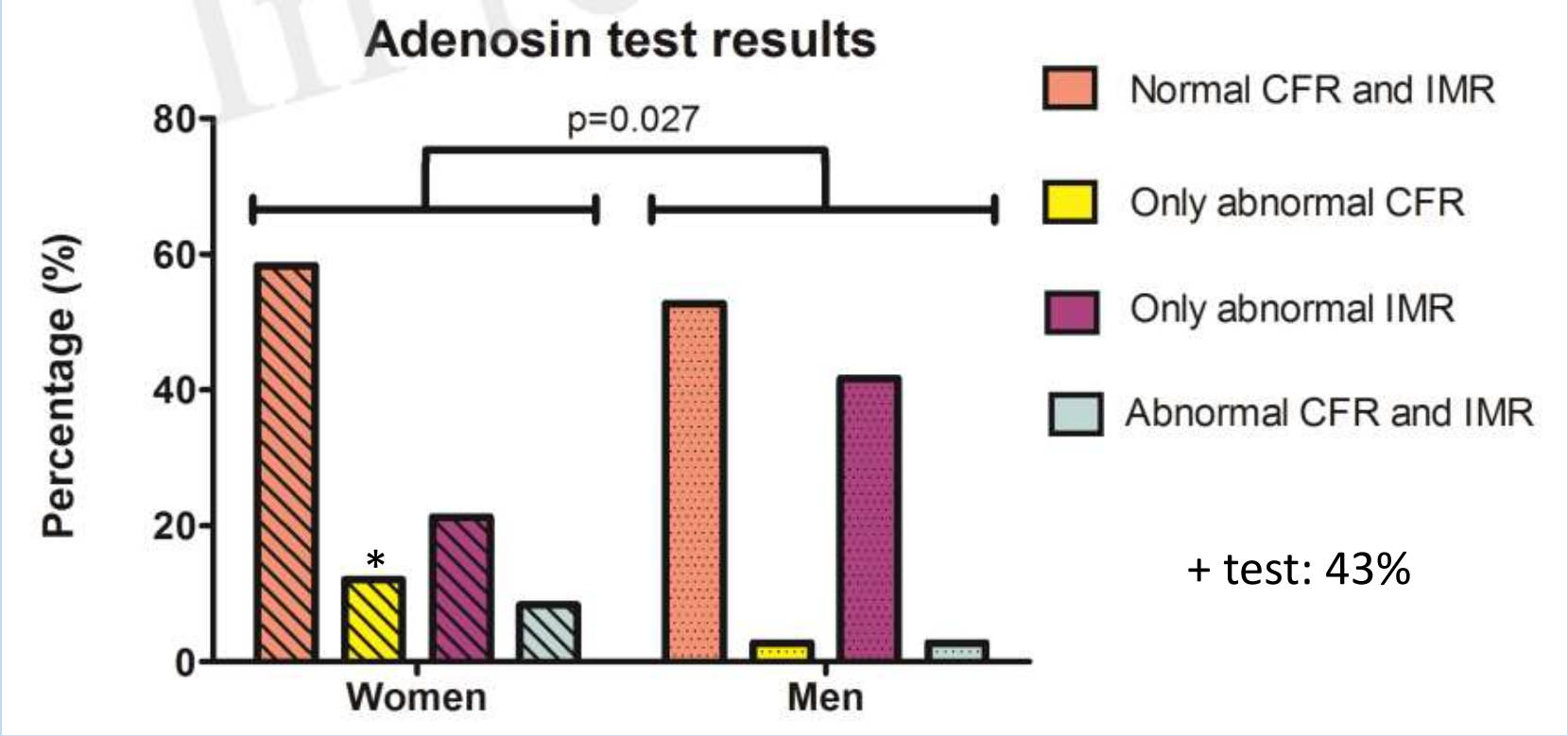
Abnormal resistances – abnormal vasodilation



+ test: 43%

frontiers

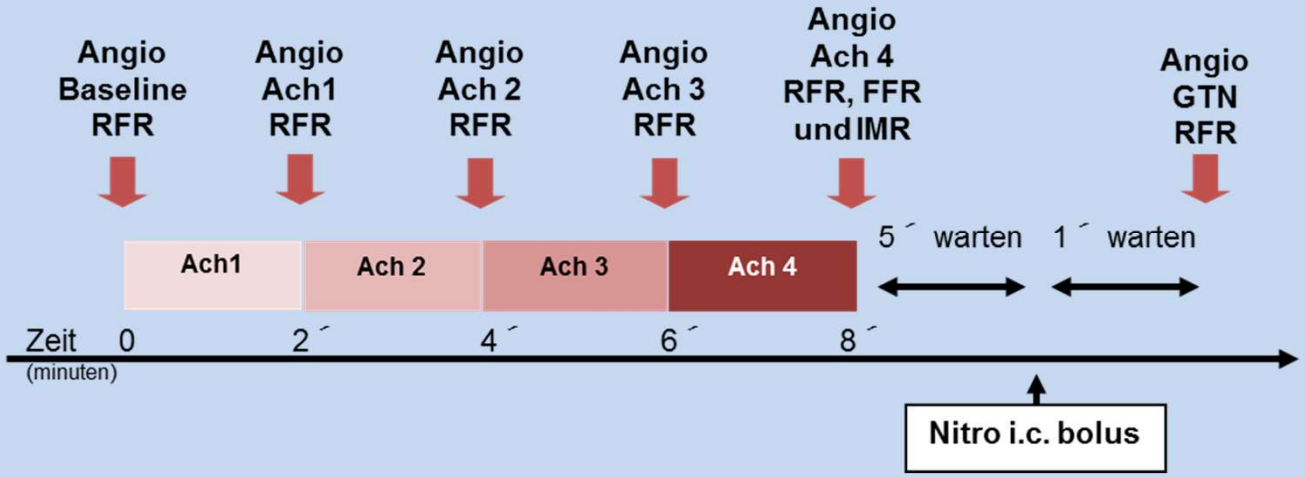
Sex differences in coronary function test results in patient with angina and nonobstructive disease

Tijn P.J. Jansen[1], Suzette E. Elias-Smale[1], Stijn van den Oord[1], Helmut Gehlmann[1], Aukelien Dimitiriu-Leen[1], Angela H.E.M. Maas,[1] Regina E. Konst[1], Niels van Royen[1], Peter Damman[1]

[1]Radboudumc, Department of Cardiology, Nijmegen, The Netherlands

N=228 females
N=38 males

Coronary spasm



Koronare 1-Gefäß Erkrankung (RCX) (61 J.a., W)

STEMI bei thrombotischem RCX-Verschluss, Reanimation bei VFib 08/2017

Implantation eines 2-Kammer ICD-Systems 08/2017 (Krankenhaus XXX)

Koronarangiographie vom 16.01.2020: Ausschluss epikardialer KHK

CVRF: arterielle Hypertonie, ex-Nikotinkonsum (40 PY)

Aktuell CCS III

Coronary spasm

Very frequent in asian populations
(up to 40%, underestimated in western countries)

Multivessel in ~20% (versus 7% of caucasians)

Most frequent 40-70 years of age

Epicardial coronary spasm has good prognosis but can cause infarction, LV impairment and sudden cardiac death.

More frequent in women than men

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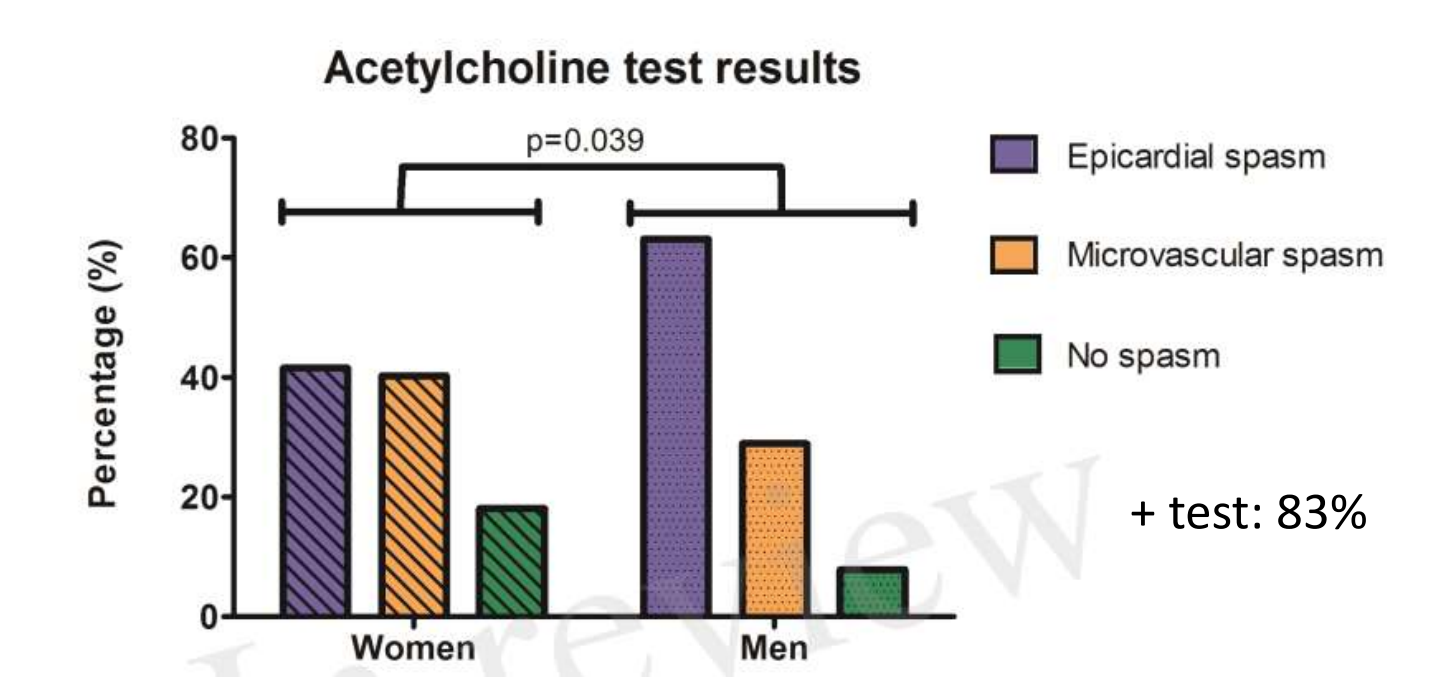
Impact of sex on Ach responses



+ test: 83%

N=228 female
N=38 males

frontiers

Sex differences in coronary function test results in patient with angina and nonobstructive disease

Tijn P.J. Jansen[1], Suzette E. Elias-Smale[1], Stijn van den Oord[1], Helmut Gehlmann[1], Aukelien Dimitiriu-Leen[1], Angela H.E.M. Maas,[1] Regina E. Konst[1], Niels van Royen[1], Peter Damman[1]

[1]Radboudumc, Department of Cardiology, Nijmegen, The Netherlands

Both sexes experienced symptoms at rest or during exercise to equal extent. In females, however, symptoms were more often provoked by emotion or stress (69% vs. 37%, p=0.001).

FFR: 0.90 (0.87-0.93) vs 0.87 (0.84-0.91), 0.003

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Koronarspasmen

Endotype	Diagnosis: Coronary vasomotion disorder	Stratified medical therapy
Microvascular angina	IMR ≥ 25 (Microvascular resistance)	Baseline therapy: Consider **aspirin, statin and ACE inhibitor therapy** in all patients. PRN sublingual GTN Antianginal therapy 1st Line – Beta blocker (e.g. ~~nebivolol 2.5mg OD or carvedilol 6.25mg~~ BD uptitrated) 2nd Line - Calcium channel blockers (CCB) substituted (Non DHP e.g. **verapamil 40mg BD uptitrated**) - where β-blockers are not tolerated or ineffective. 3rd Line – Add in therapy (avoid long acting nitrates) •CCB - DHP (e.g. amlodipine) – only for those on beta-blockers •Ranolazine (375mg BD, uptitrated) Avoid long acting nitrate unless previously established good response or co-existent epicardial spasm
	CFR < 2.0 (Coronary vasorelaxation)	
	Microvascular spasm to Ach (Propensity to microvascular constriction)	
Vasospastic angina	Epicardial spasm (>90%)	Baseline therapy: If atherosclerosis or endothelial impairment, aspirin, statin and ACE inhibitor should be considered. PRN sublingual GTN Antianginal Rx 1st Line – Calcium channel blocker (CCB) - e.g. verapamil 40mg BD uptitrated 2nd Line – **Add Nitrate - e.g. PETN 50mg BD-TID**
Non-cardiac	Nil	Cessation of antianginal therapy. Stop antiplatelet and statin unless other indication. Consider non cardiac investigation or referral where appropriate (e.g psychological referral, gastroenterology)

Conclusions

INOCA is a heterogeneous syndrome caused by different pathophysiologic mechanisms

“INOCA” is a working hypothesis, even advanced diagnostic is often inconclusive

Impacts prognosis and quality of life

Advanced invasive diagnostics is necessary