Time for full physiology

ANOCA/MINOCA:
from Cinderella to Princess

Filippo Crea
Editor-in-Chief of the European Heart Journal
Ospedale Gemelli Isola – Catholic University

Transient myocardial ischemia during daily life in patients with syndrome X

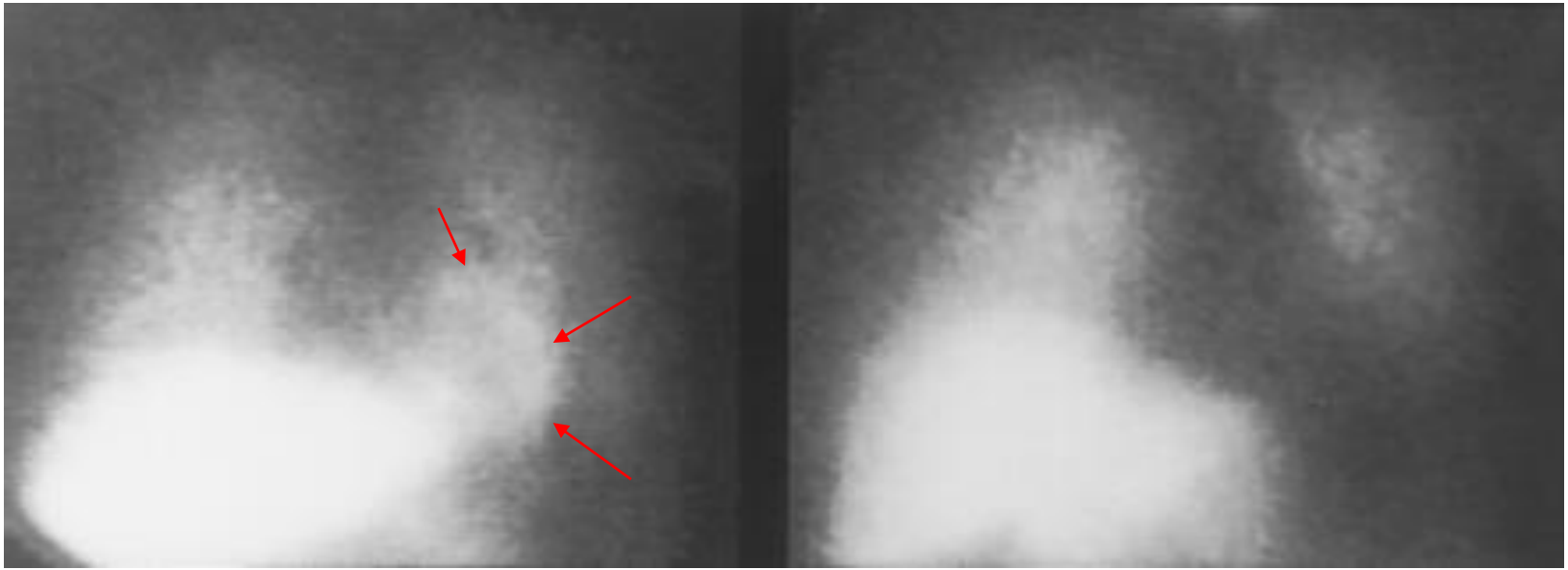
Kaski JC, Crea F, Nihoyannopoulos P, Hackett D, Maseri A

Am J Cardiol. 1986 Dec 1;58(13):1242-7

Pathogenetic uncertainties in SX

- **Is it a cardiac disease?**
- **Is microvascular dysfunction present?**
- **Does myocardial dysfunction cause ischemia?**

Abnormal cardiac adrenergic nerve function in SX detected by MIBG myocardial scintigraphy

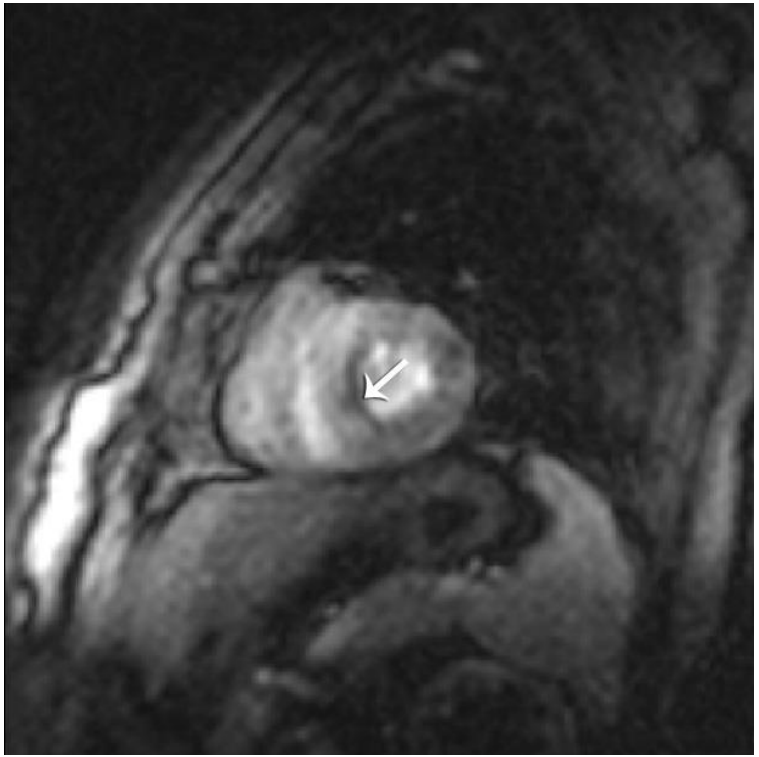


(Lanza et al, Circulation 1998)

Pathogenetic uncertainties in SX

- **Is it a cardiac disease?**
- **Is microvascular dysfunction present?**
- **Does myocardial dysfunction cause ischemia?**

Microvascular dysfunction in SX detected by stress CMR

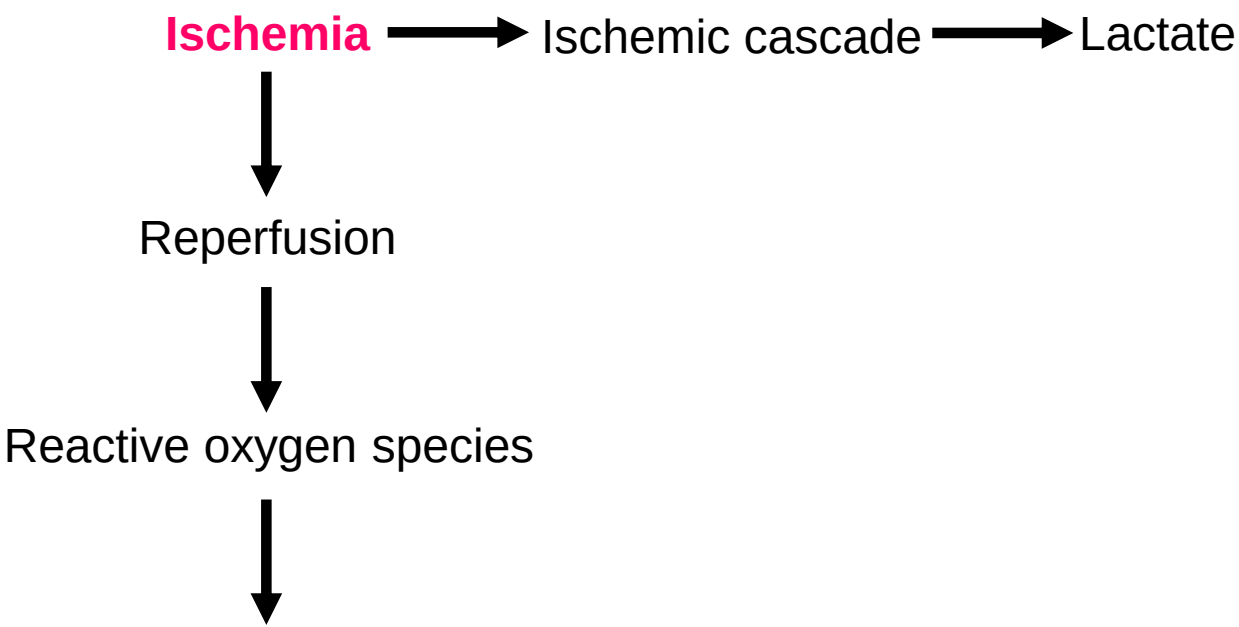


(Lanza et al, JACC 2008)

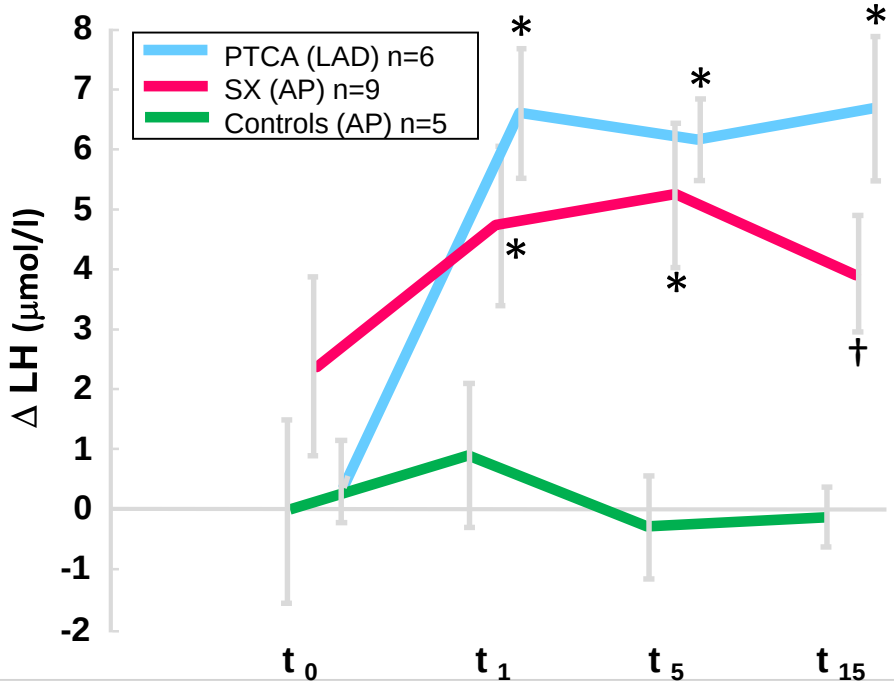
Pathogenetic uncertainties in SX

- **Is it a cardiac disease?**
- **Is microvascular dysfunction present?**
- **Does myocardial dysfunction cause ischemia?**

Consequences of ischemia-reperfusion



Myocardial ischemia in SX detected by the release of lipid peroxidation products during stress



(Buffon et al, Am J Physiol 2001)

The NEW ENGLAND JOURNAL of MEDICINE

ESC European Society of Cardiology

REVIEW ARTICLE

MEDIC

Coronary Microv

Paolo G. Camici, M

Table 1. Clinical Classification of Coronary Microvascular Dysfunction.

Coronary microvascular dysfunction in the absence of obstructive CAD and myocardial diseases	This type represents the functional counterpart of traditional coronary risk factors (smoking, hypertension, hyperlipidemia, and diabetes and insulin-resistant states). It can be identified by noninvasive assessment of coronary flow reserve. This type is at least partly reversible, and coronary flow reserve can also be used as a surrogate end point to assess efficacy of treatments aimed at reducing the burden of risk factors.
Coronary microvascular dysfunction in the presence of myocardial diseases	This type is sustained in most instances by adverse remodeling of intramural coronary arterioles. It can be identified by invasive or noninvasive assessment of coronary flow reserve and may be severe enough to cause myocardial ischemia. It has independent prognostic value. It remains unclear whether medical treatment may reverse some cases. It is found with primary (genetic) cardiomyopathies (e.g., dilated and hypertrophic) and secondary cardiomyopathies (e.g., hypertensive and valvular).
Coronary microvascular dysfunction in the presence of obstructive CAD	This type may occur in the context of either stable CAD or acute coronary syndromes with or without ST-segment elevation and can be sustained by numerous factors. It is more difficult to identify than the first two types and may be identified through the use of an integrated approach that takes into account the clinical context with the use of a combination of invasive and noninvasive techniques. There is some early evidence that specific interventions might prevent it or limit the resultant ischemia.
Iatrogenic coronary microvascular dysfunction	This type occurs after coronary recanalization and seems to be caused primarily by vasoconstriction or distal embolization. It can be identified with the use of either invasive or noninvasive means on the basis of a reduced coronary flow reserve, which seems to revert spontaneously in the weeks after revascularization. Pharmacologic treatment has been shown to promptly restore coronary flow reserve, and it may also change the clinical outcome. The likelihood of distal embolization can be reduced by the use of appropriate devices during high-risk procedures.

European Heart Journal

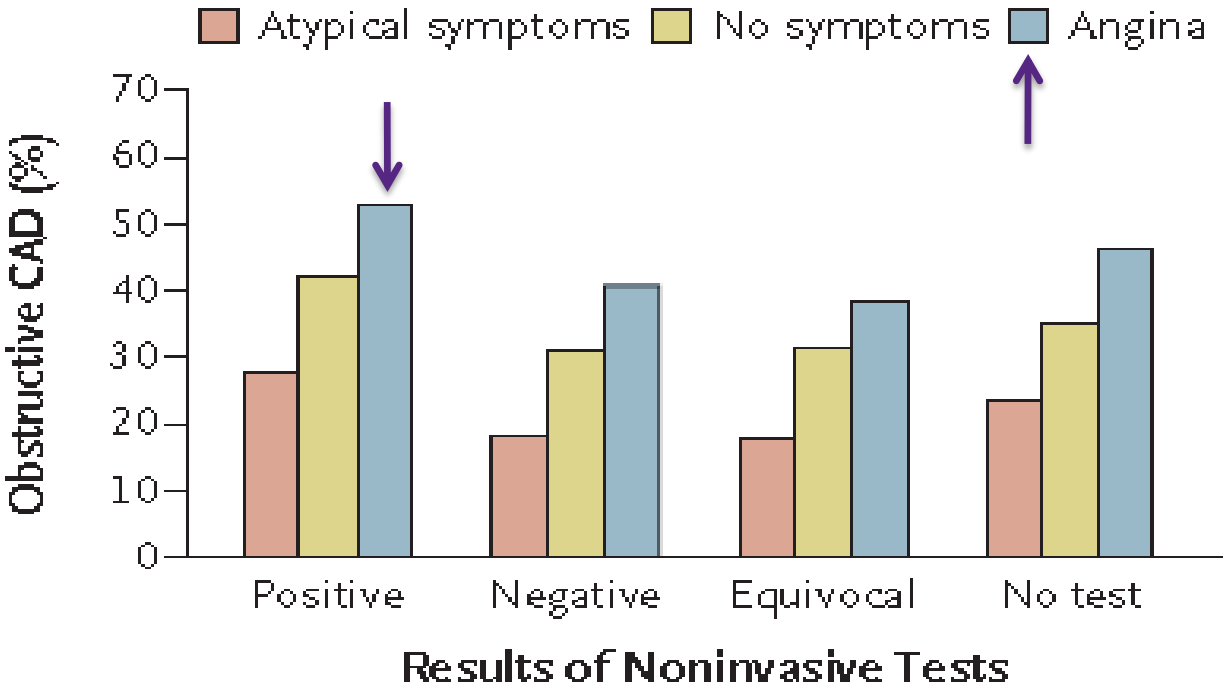
ESC
European Society of Cardiology

2019 ESC Guidelines for the diagnosis and management of chronic coronary syndromes

The Task Force for the diagnosis and management of chronic coronary syndromes of the European Society of Cardiology (ESC)

6.1 Microvascular angina

Obstructive CAD in patients with suspected angina (n=398,978)



(Patel et al, NEJM 2010)

ESC European Society of Cardiology
European Heart Journal (2021) **00**, 1–9
doi:10.1093/eurheartj/ehab282

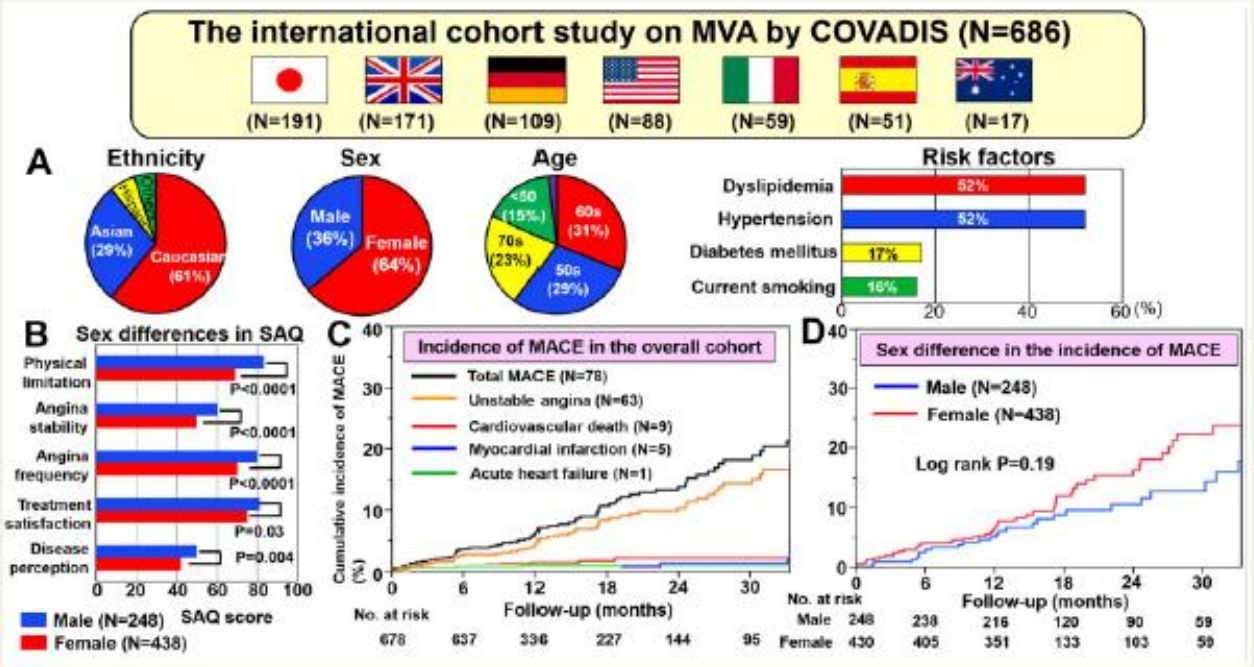
CLINICAL RESEARCH
Clinical trials

ESC European Society of Cardiology

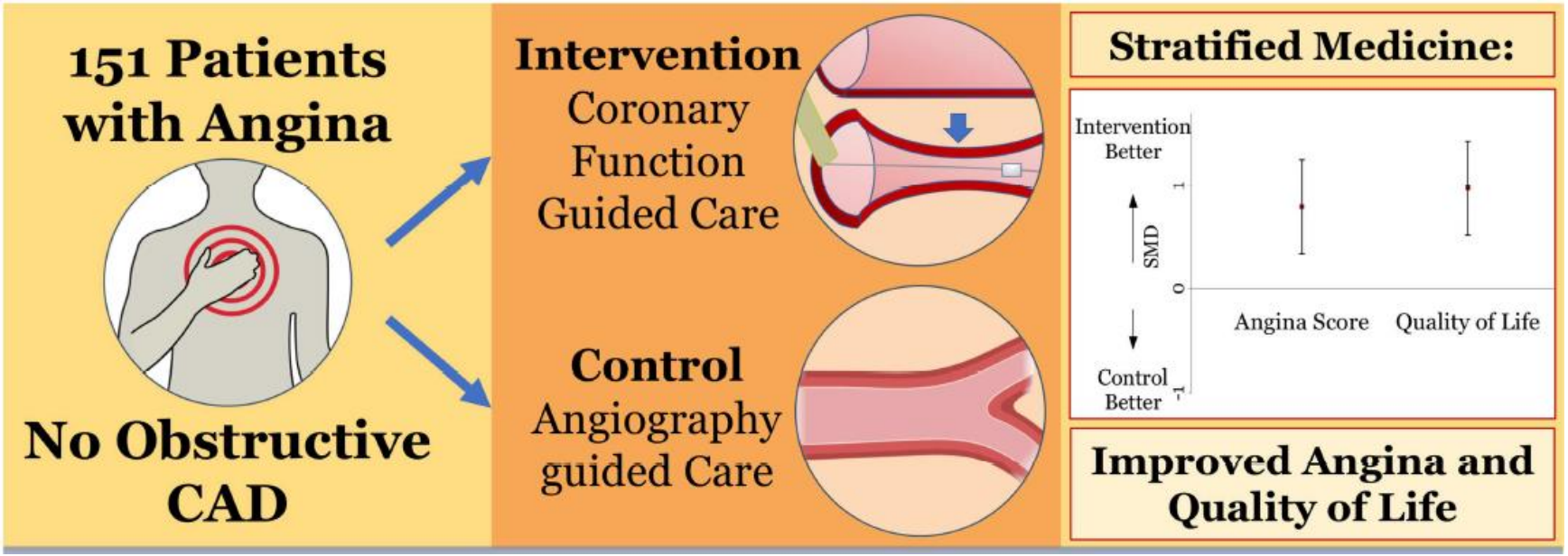
Clinical charact
patients with m
international ar
by the Coronary
International St

Hiroaki Shimokawa[1,2]*, Aki

Graphical Abstract



Stratified medical therapy using invasive coronary function testing in angina: CORMICA trial



(Ford et al, JACC 2018)

Suspected Stable Angina

ESC European Society of Cardiology

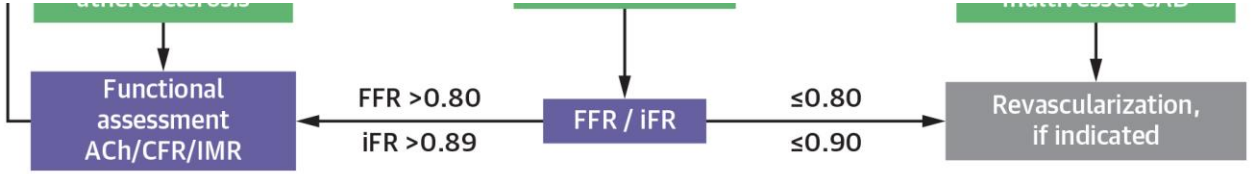
European Heart Journal (2020) **41**, 3219–3221
doi:10.1093/eurheartj/ehaa050

VIEWPOINT
Ischaemic heart disease

Doctor, I feel microvascular chest pain

Filippo Crea [1,2]*

[1]Fondazione Policlinico Universitario A. Gemelli IRCCS, Rome, Italy; and [2]Department of Cardiovascular and Thoracic Sciences, Catholic University of the Sacred Heart, Largo A. Gemelli, 8, 00168 Rome, Italy



(Boden et al, JACC 23)

ESC European Society of Cardiology

European Heart Journal (2017) **00**, 1–66
doi:10.1093/eurheartj/ehx393

ESC GUIDELINES

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

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

ESC European Society of Cardiology
European Heart Journal (2018) **00**, 1–33
doi:10.1093/eurheartj/ehy462

EXPERT CONSENSUS DOCUMENT

ESC European Society of Cardiology

Fourth universal definition of myocardial infarction (2018)

New sections

- Takotsubo syndrome.
- MINOCA.
- Chronic kidney disease.
- Atrial fibrillation.
- Regulatory perspective on myocardial infarction.
- Silent or unrecognized myocardial infarction.

Causes of MINOCA

- **Epicardial causes**
  - **Coronary spasm**
  - **Plaque fissure with positive remodeling**
  - **Coronary dissection**
- **Microvascular causes**
  - **Unstable microvascular angina**
  - **Takotsubo syndrome**
  - **Myocarditis**
  - **Coronary thromboembolism**

Eliminato l'impossibile, ciò che resta, *per quanto improbabile sia*, deve essere la verità

Il segno dei quattro

Sherlock Holmes (Sir Arthur Conan Doyle)