

Caring of patients after PCI

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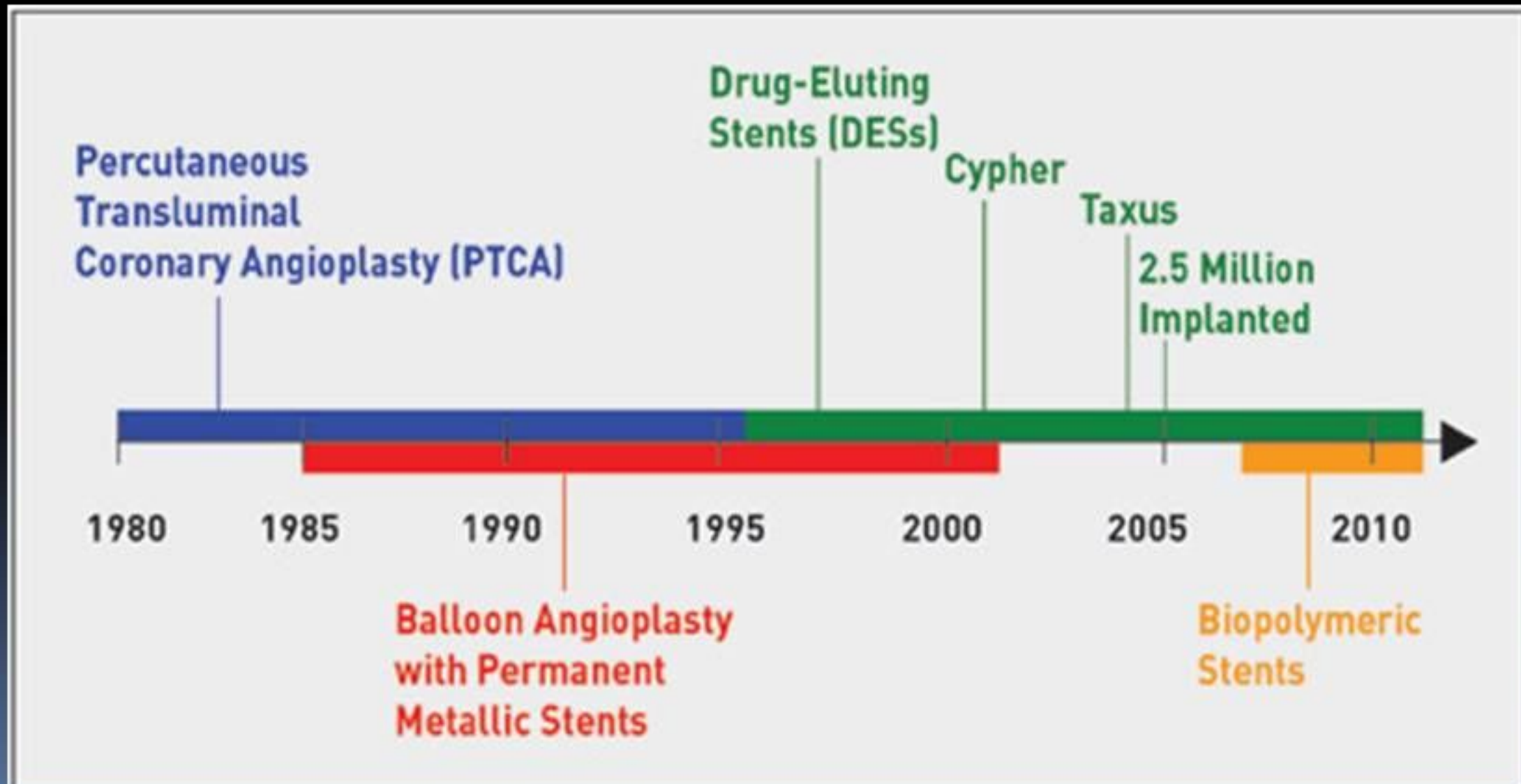
Madras medical college

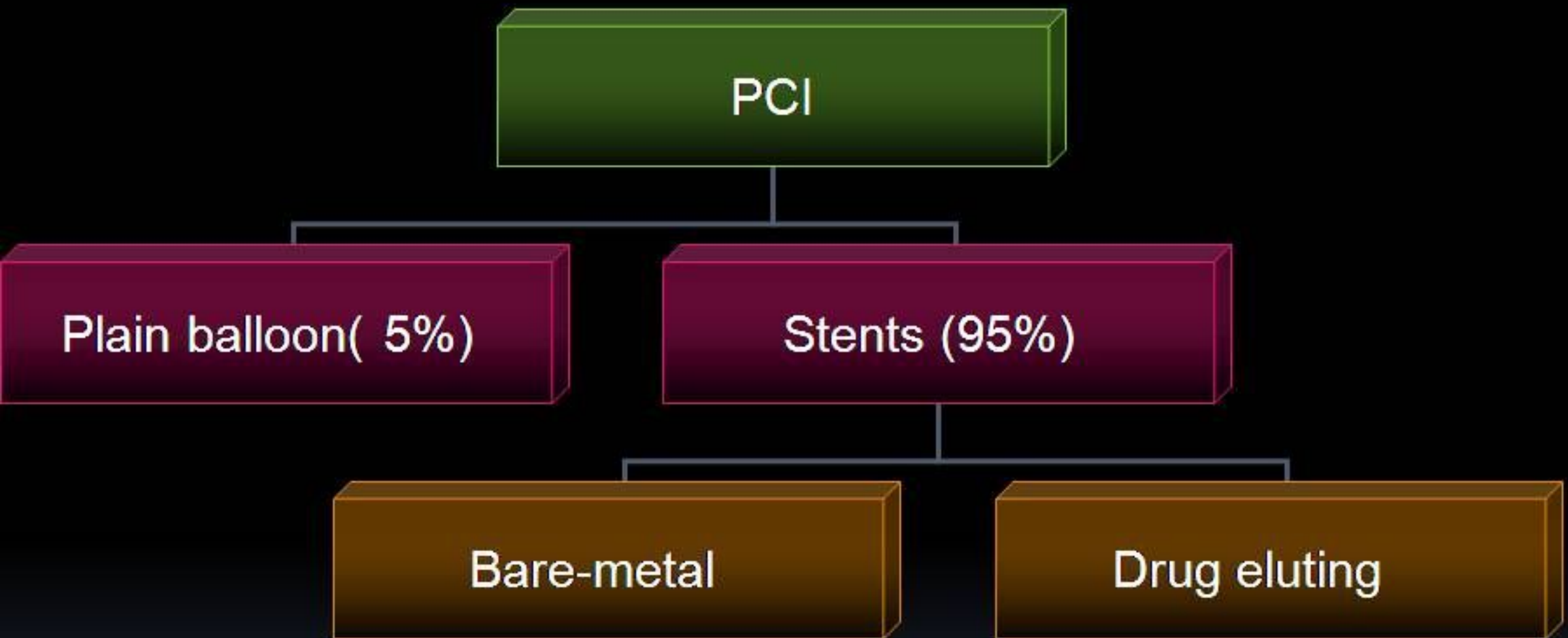
Chennai



A brief history of PCI

PCI revolutionized CAD outcome





POBA < Stent < DES / India leading the world

PCI is more complex than it appears !

Pre procedure issues

Patient selection

Lesion selection

Timing

Emergency/Elective



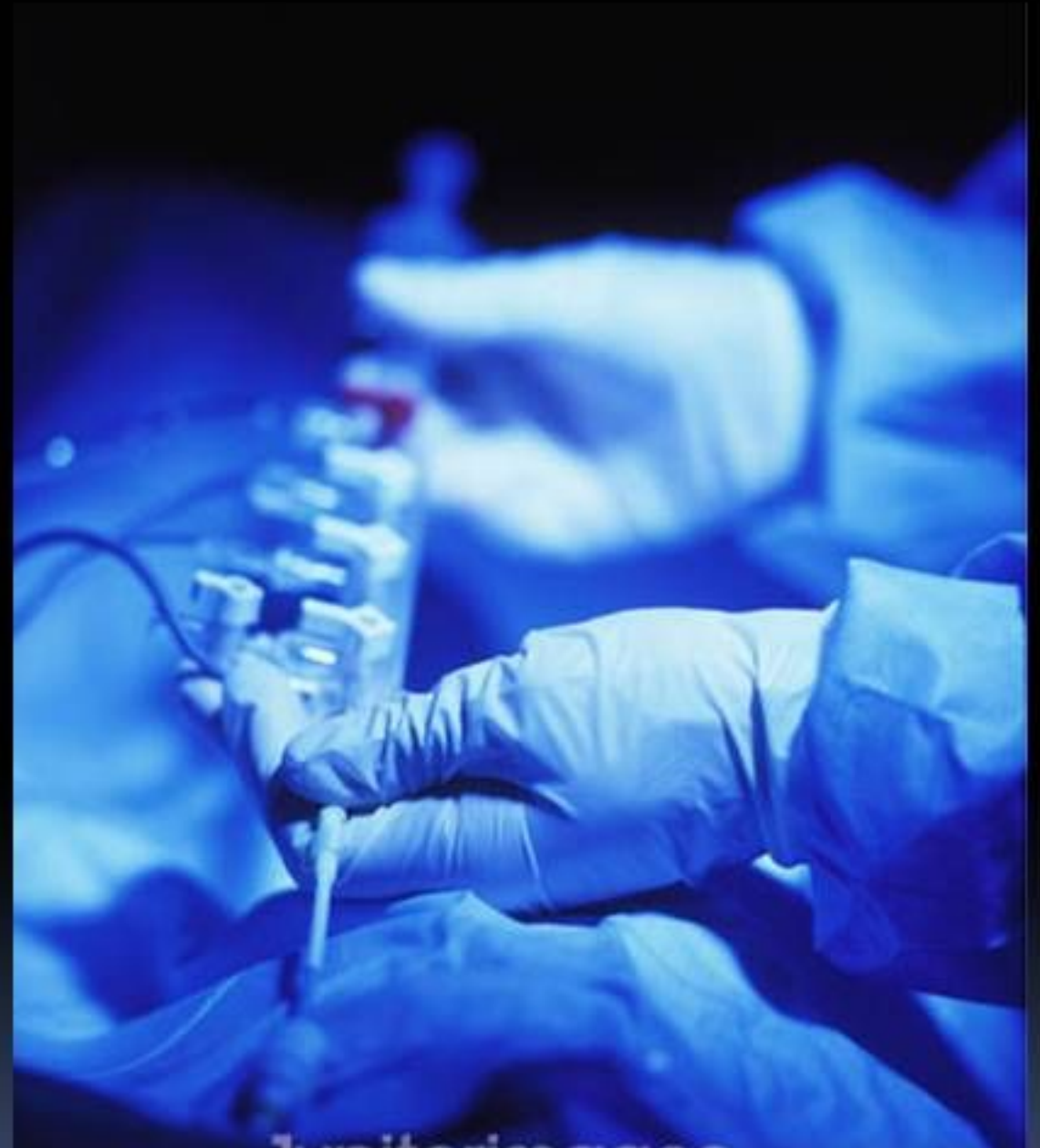
Intra- procedure

Drugs /Anticoagulation protocol

Vascular access

Hardware

Special devices





Post procedure

Sheath removal

Monitoring /Hemodynamics

ECG/ACT

Anticoagulation protocol

Success is not angiographic . . .



It is in the follow up and it starts right from the point the patient is wheeled out of cath lab . . .

Post PCI

First 24 hours : Most of patients can be discharged

Chest pain /Mild hypotension are common in the immediate post PCI. Usually due to medications, hypovolemia / NPO

Contrast induced diuresis

Responds to supportive treatment

Persistent hypotension/Angina

Vasovagal can be dangerous

First week :

Symptoms settle down . Usually not procedure related

First month

Events unrelated to procedure

6 months

1 year

“Real success is achieved only when the patient is followed up without any complication and favorable impact in the clinical outcome”

Currently long term means > 1 YEAR

Why special care required for post PCI patients ?

PCI is a focal treatment of systemic problem

It is usually done only to flow limiting lesions

All physiologically insignificant (<70%) lesions are left alone

To be taken care of medical management

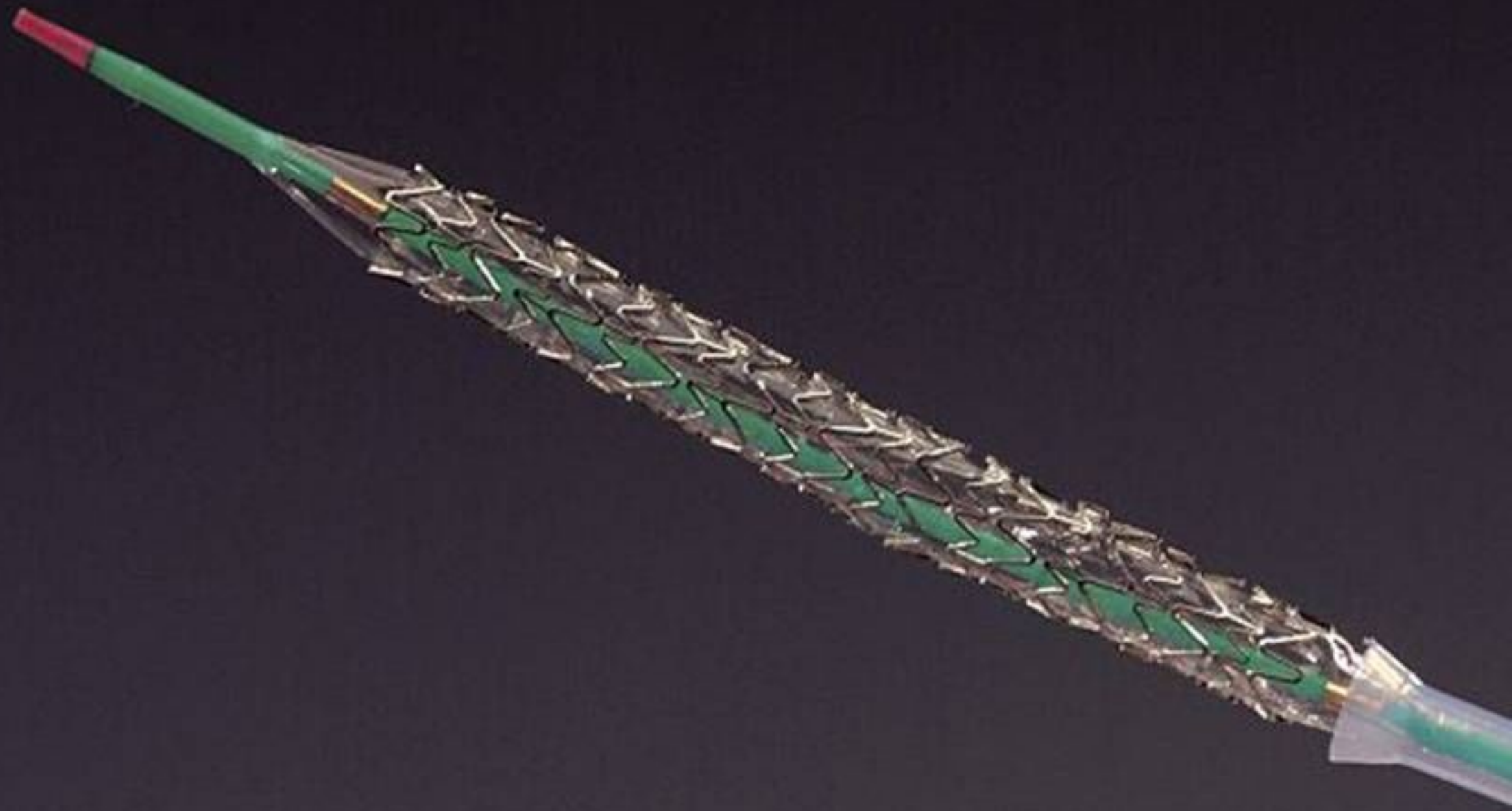
What happens to the non PCI vessels ?

It is estimated , every patient who has undergone a PCI has at least a few coronary lesions that has a potential to cause ACS in the same vessel or the remote vessel.

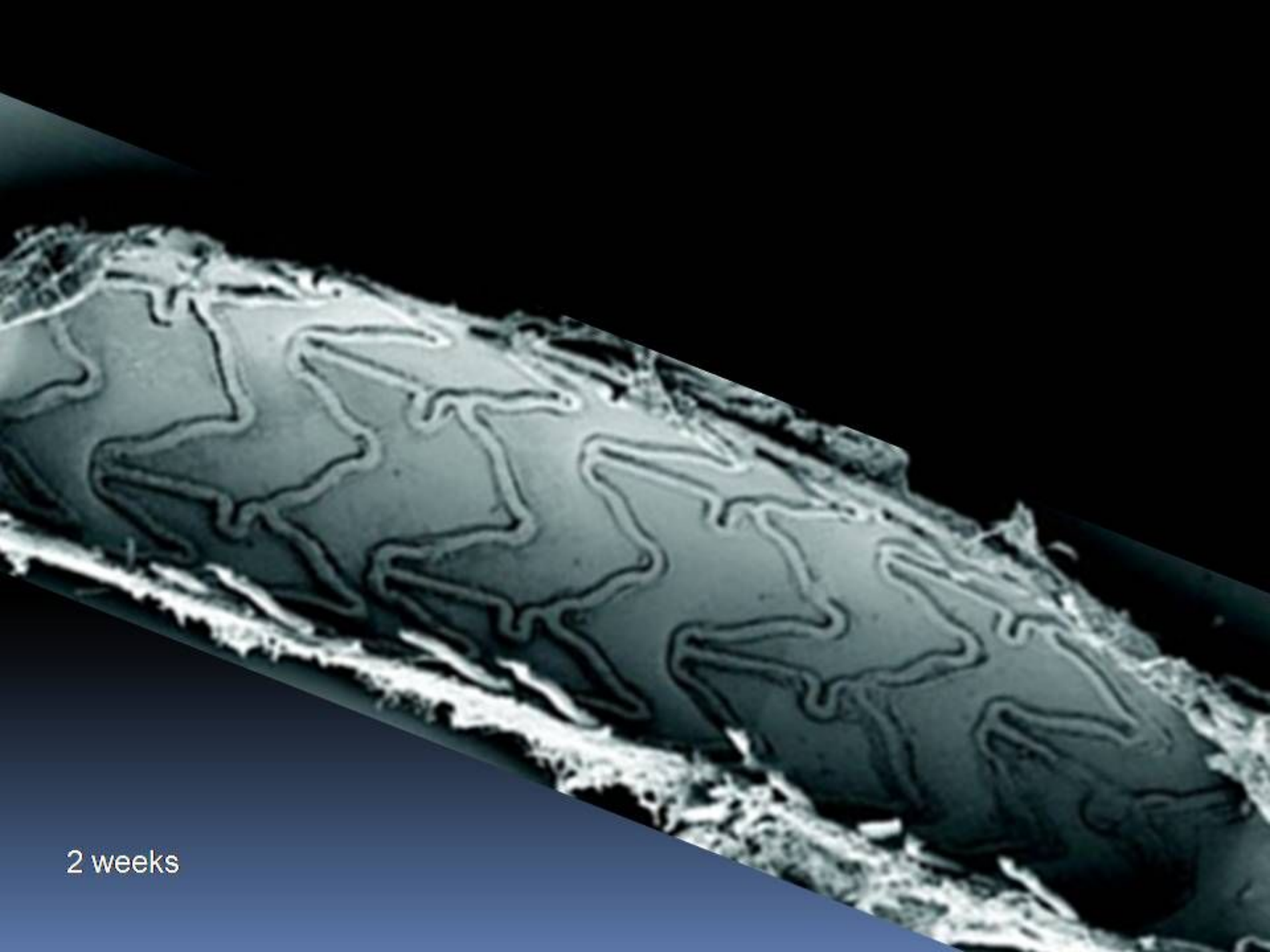
What is the risky period ?

The concept of stent healing

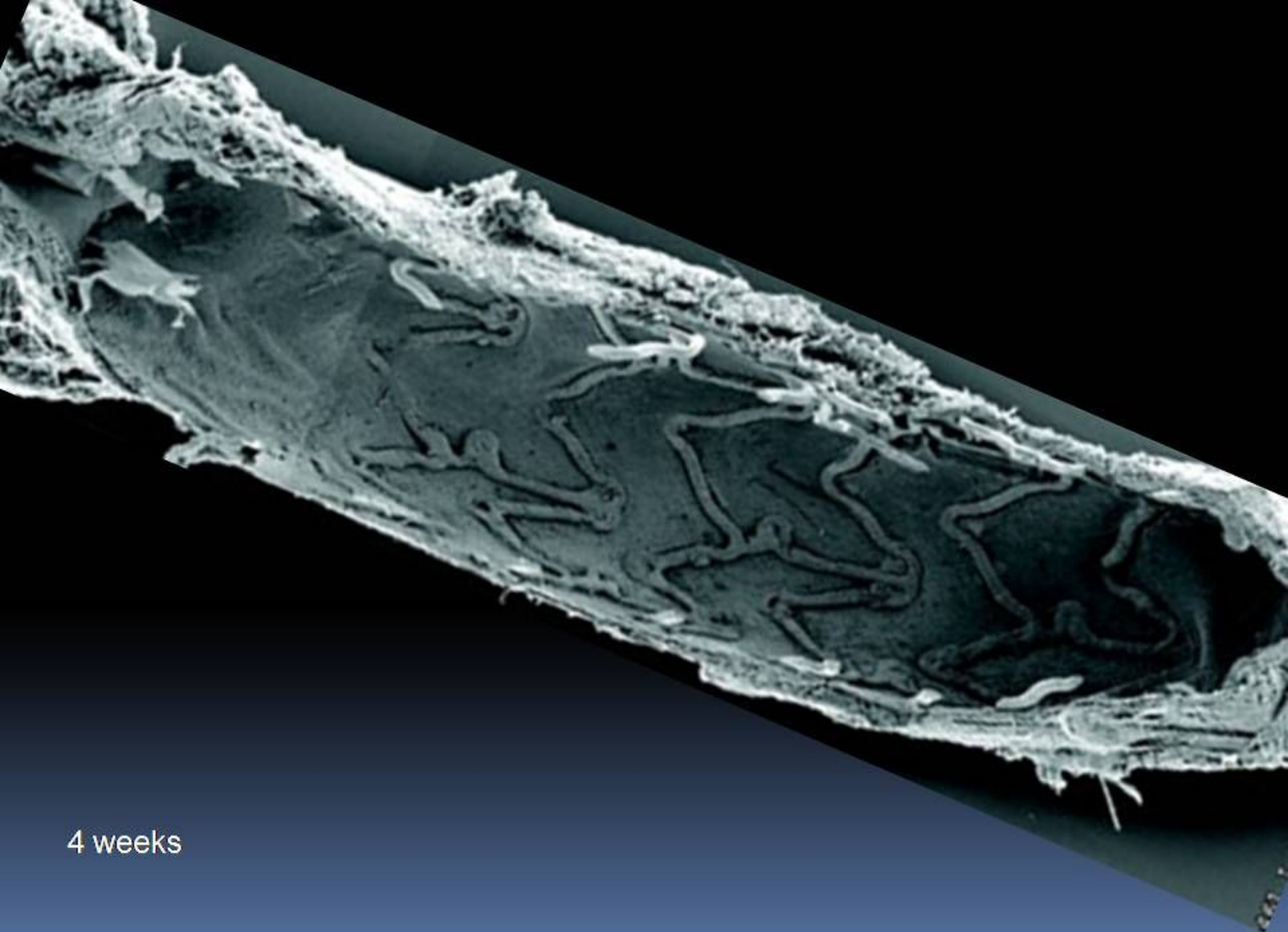
How long will it take ?



What looks like a simple metal coil outside . . .



2 weeks



4 weeks



6- 8 weeks

Post PCI patients

Are not conventional medical patients who have CAD

All have a base line risk profile

“They carry a metallic transplant ”

They should be considered a special group like a prosthetic valve and pacemaker patient.

Who should follow up the patient ? and where ?

Who ?

General practitioners

Physicians

Cardiologists

Where ?

Clinics

Nursing homes

Tertiary centres



Post PCI follow up

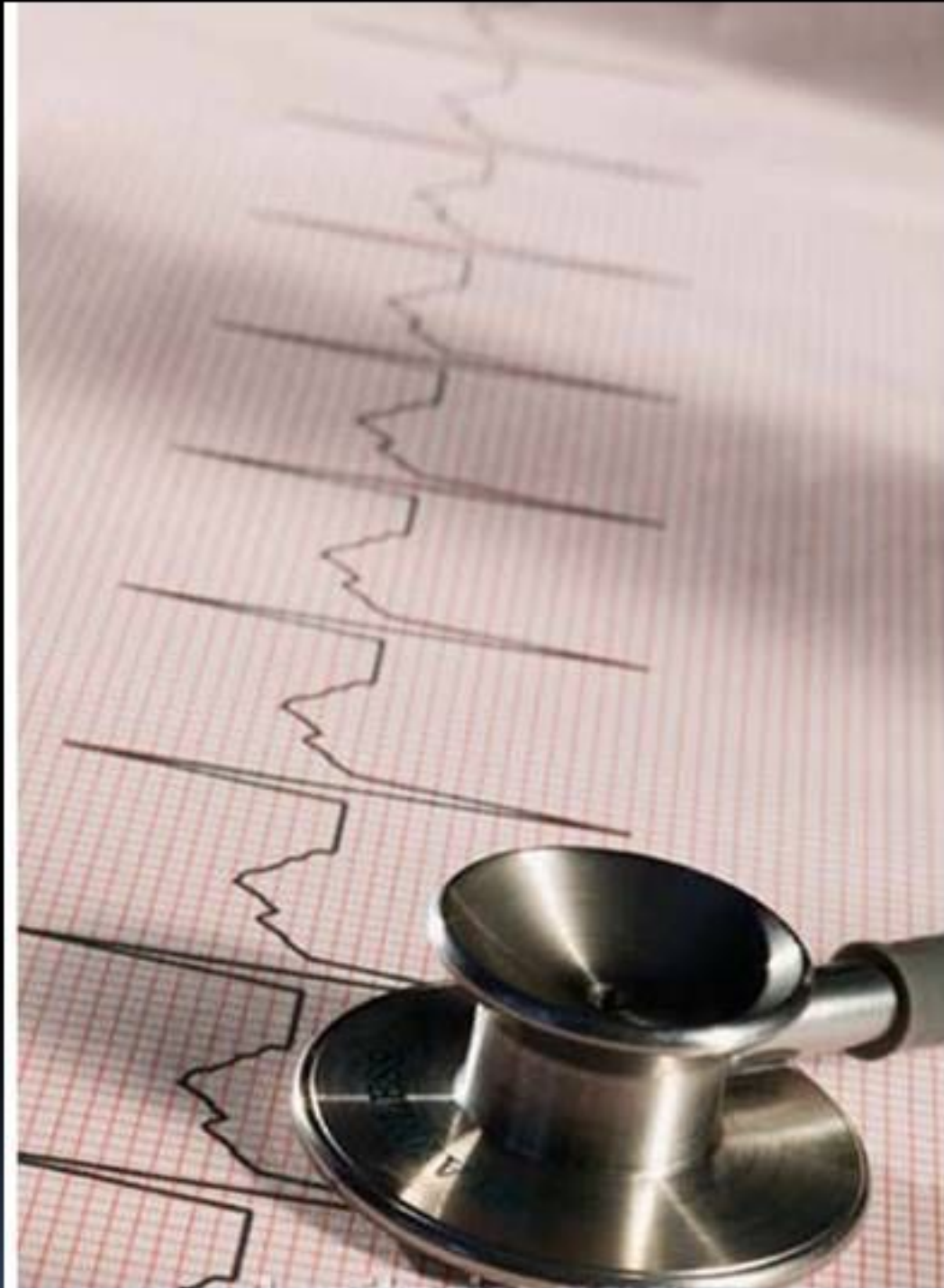
Follow up done 10, 20,30 days

Standard drugs

Aspirin/ACEI/Beta blockers as indicated

Clopidogrel : Platelet count /TC

Statin : SGOT /SGPT /CPK



Clinical examination

ECG

Echocardiogram

Stress testing

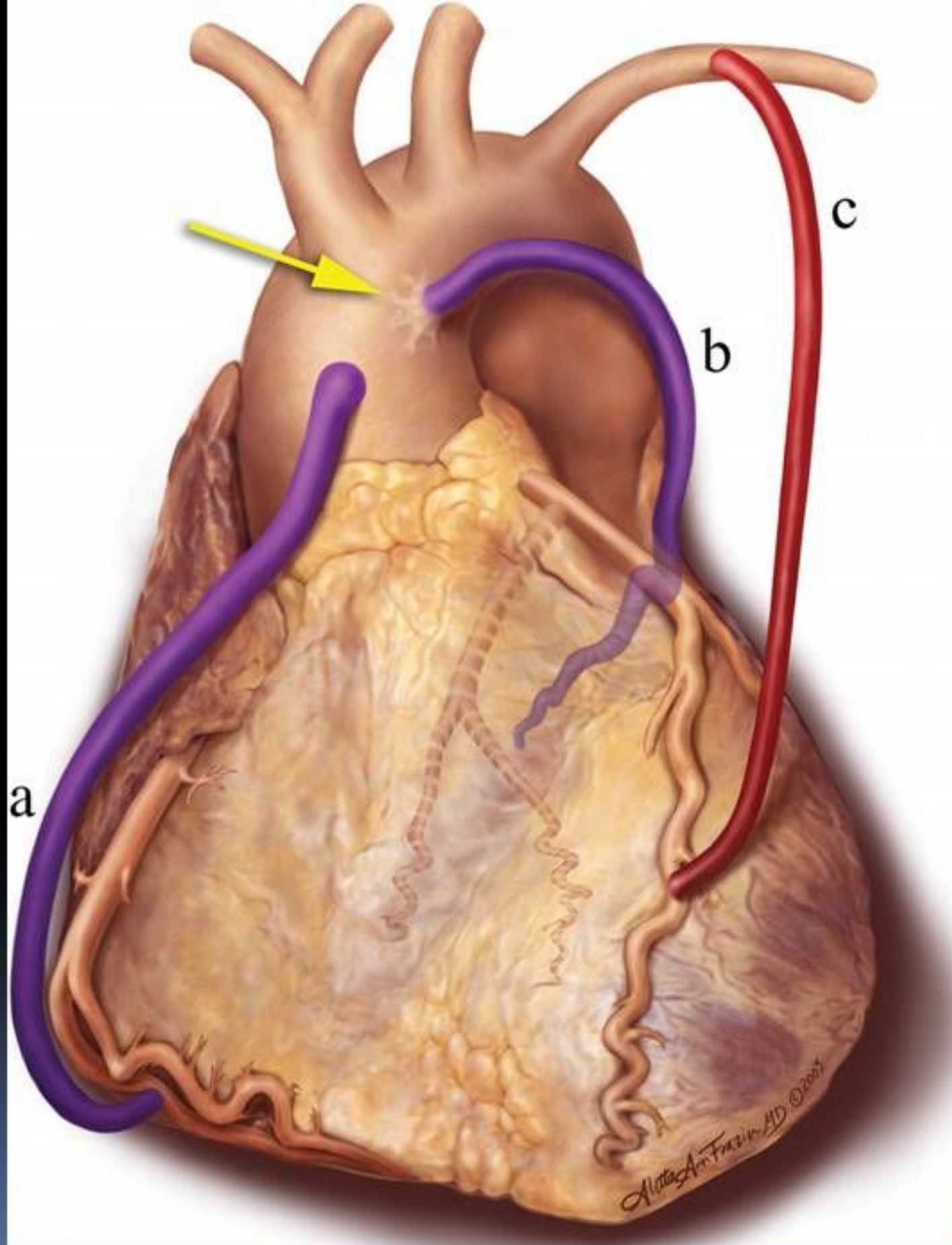
CAG

Post PCI high risk subset

Patients with complex lesion morphology, multivessel stenting,
Left main, underlying severe LV dysfunction

Primary PTCA/PCI in cardiogenic shock

Need more intensive and frequent follow up ideally by the same team
that performed the procedure



PCI after CABG

Graft occlusions

Complex lesions

Recognition &

Management

requires

Special competence

What to watch for ? Short & Long term

Annual cardiac events reach up to 6-8% at 1 year

Cardiac events

Stable angina

Recurrent ACS

STEMI

Progression of LV dysfunction

SCD

Non Ischemic events

Drug related

Anticoagulant issues

Non cardiac surgery

Post PCI follow up

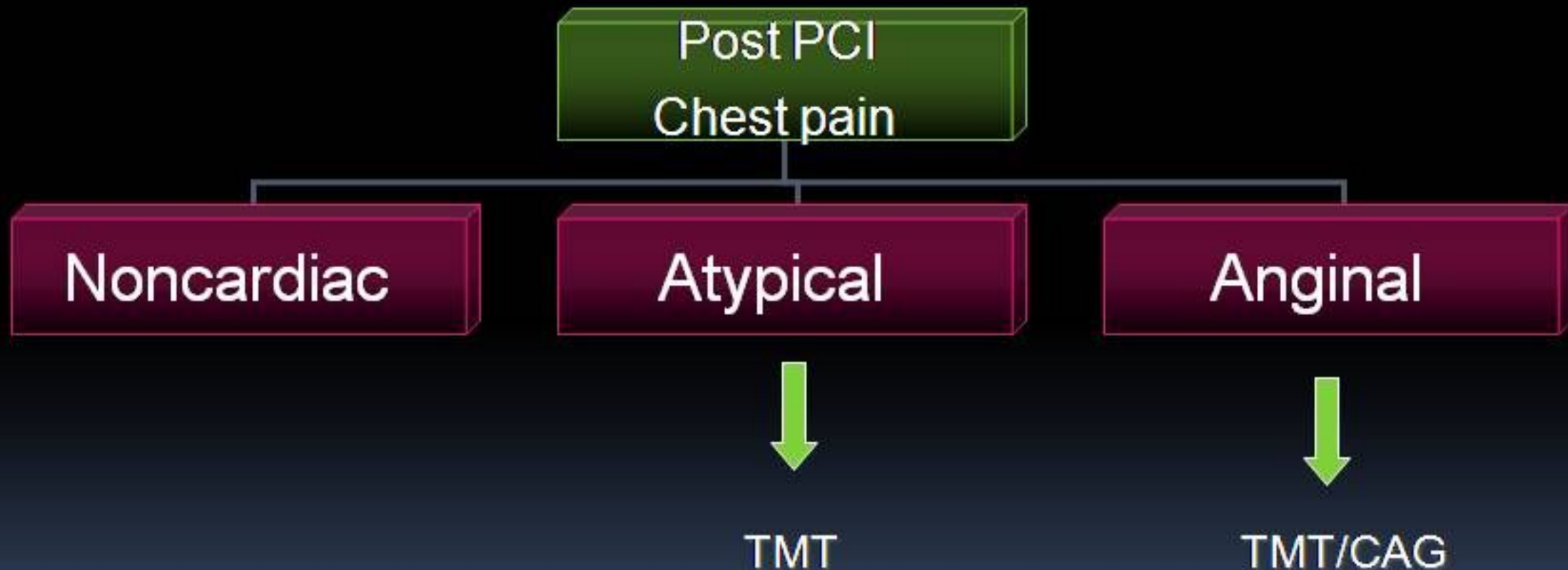
Routine asymptomatic

Chest pain

Recurrent ACS

Cardiac failure

Approach a patient with chest pain following PCI ?



General guidelines applicable except Exercise stress testing

Post PCI angina – Always high or intermediate Risk /Never Low risk

TABLE 49G-1 American College of Cardiology/American Heart Association System for Risk Stratification of Patients with Unstable Angina

Feature	High Risk <i>At Least One of the Following Features</i>	Intermediate Risk <i>No High-Risk Feature but Must Have One of the Following</i>	Low Risk <i>No High- or Intermediate-Risk Feature but May Have Any of the Following Features</i>
History	Accelerating tempo of ischemic symptoms in preceding 48 hr	Prior MI, peripheral or cerebrovascular disease, or CABG, prior aspirin use	
Character of pain	Prolonged ongoing (>20 min) rest pain	Prolonged rest angina, now resolved, with moderate or high likelihood of CAD Rest angina <20 min or relieved with rest or sublingual NTG	New-onset or progressive CCS Class III or IV angina the past 2 wk without prolonged rest pain but with moderate or high likelihood of CAD
Clinical findings	Pulmonary edema, most likely due to ischemia New or worsening MR murmur S ₃ or new worsening rales Hypotension, bradycardia, tachycardia Age >75 yr	Age >70 yr	
ECG	Angina at rest with transient ST segment changes >0.05 mV Bundle branch block, new or presumed new Sustained ventricular tachycardia	T wave inversions >0.2 mV Pathological Q waves	Normal or unchanged ECG during an episode of chest discomfort
Cardiac markers	Elevated	Slightly elevated	Normal

CABG = coronary artery bypass graft; CAD = coronary artery disease; CCS = Canadian Cardiovascular Society; ECG = electrocardiogram; MI = myocardial infarction; MR = mitral regurgitation; NTG = nitroglycerin.

When post PCI patient require coronary angiogram ?

Rarely indicated in an asymptomatic patient

TMT positive

Left main stenting routine CAG after 6 months

PCI issues in specific clinical situations

Chronic stable angina

Bare metal

UA

Following AMI

DES

CSA

Post PCI : Follow up issues

Drug related

Stent related

Restenosis

Subacute / Late stent thrombosis

Overall risk profile reduction

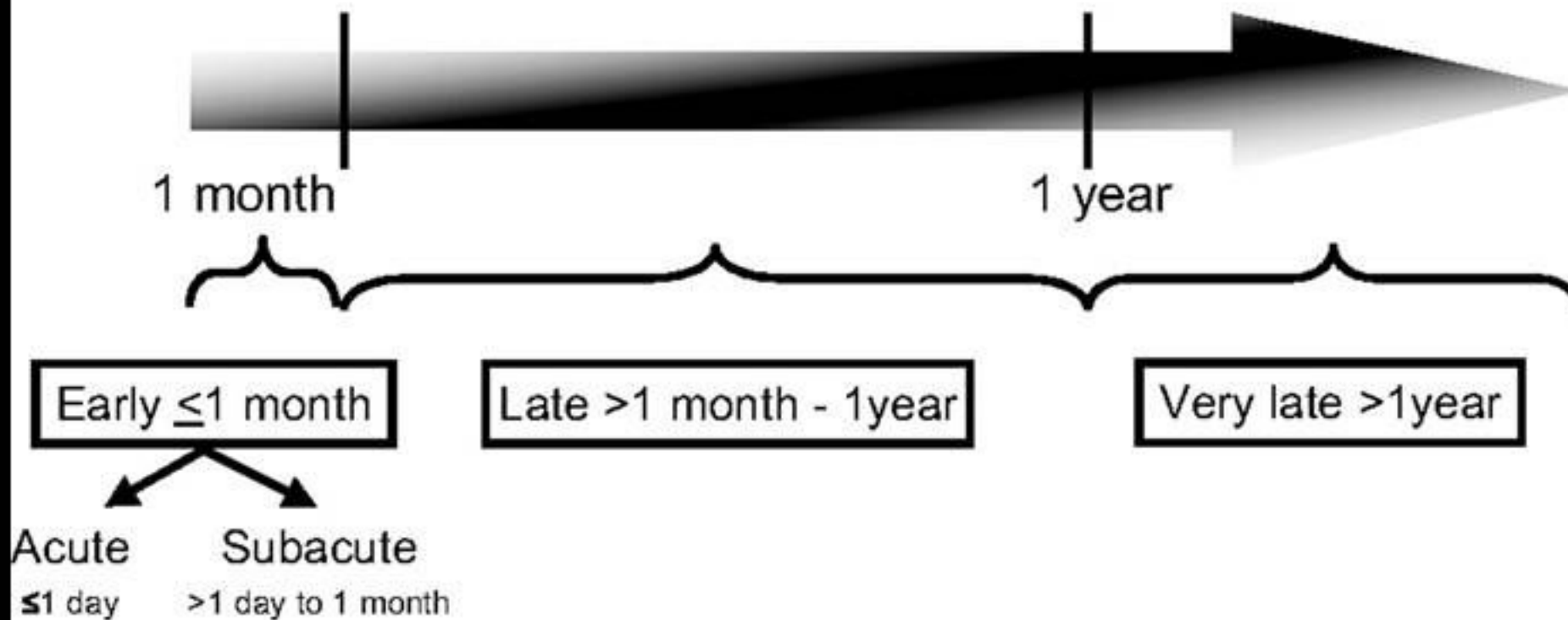
DM

HT

Lipids

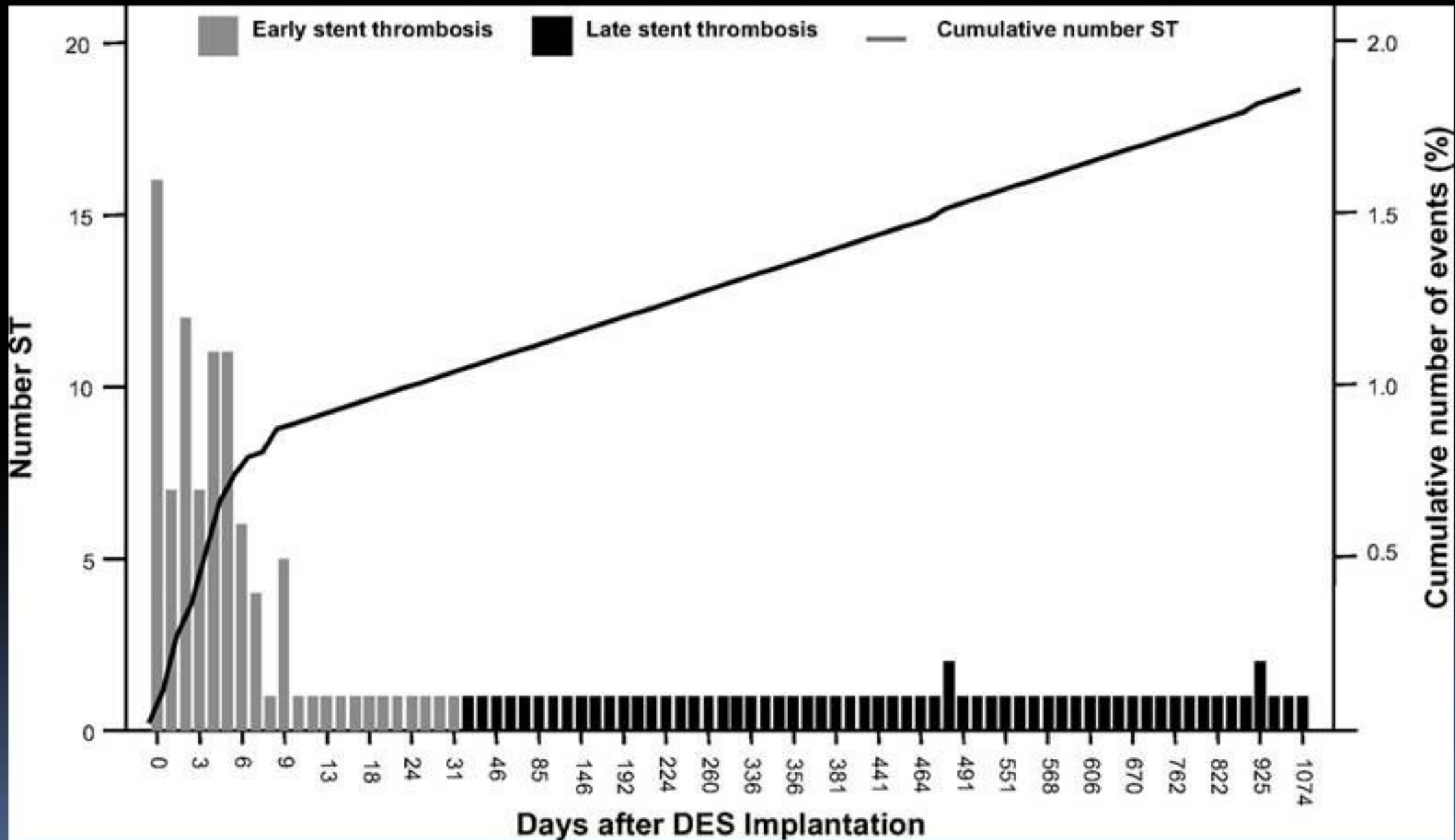
Stress reduction

Time Frame of Stent Thrombosis



≤ 1 day		Acute stent thrombosis
> 1 day	to 1 month	Subacute stent thrombosis
> 1 month	to 1 year	Late stent thrombosis
> 1 year		Very late stent thrombosis

Stent thrombosis



Endothelium : Unfriendly DES

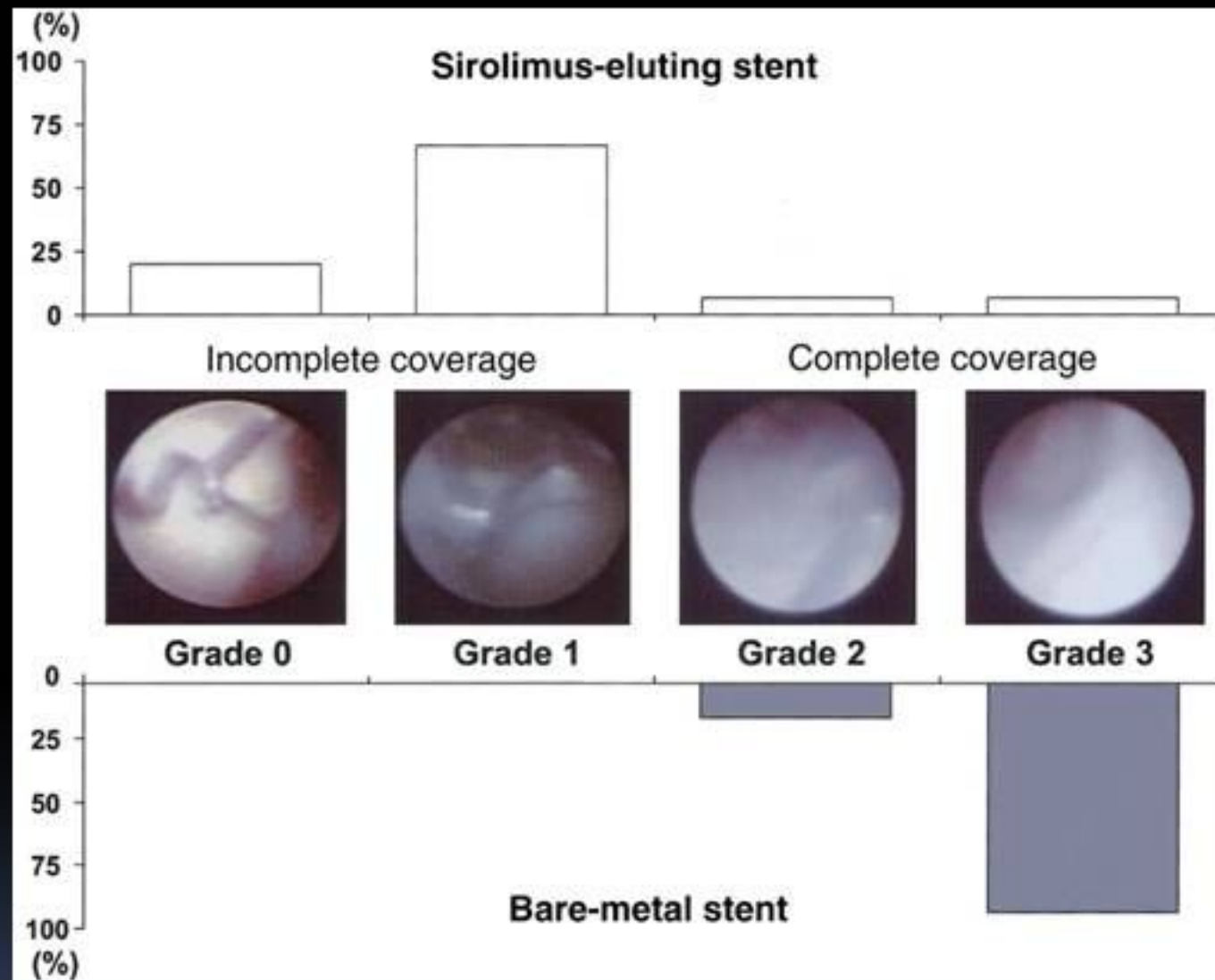
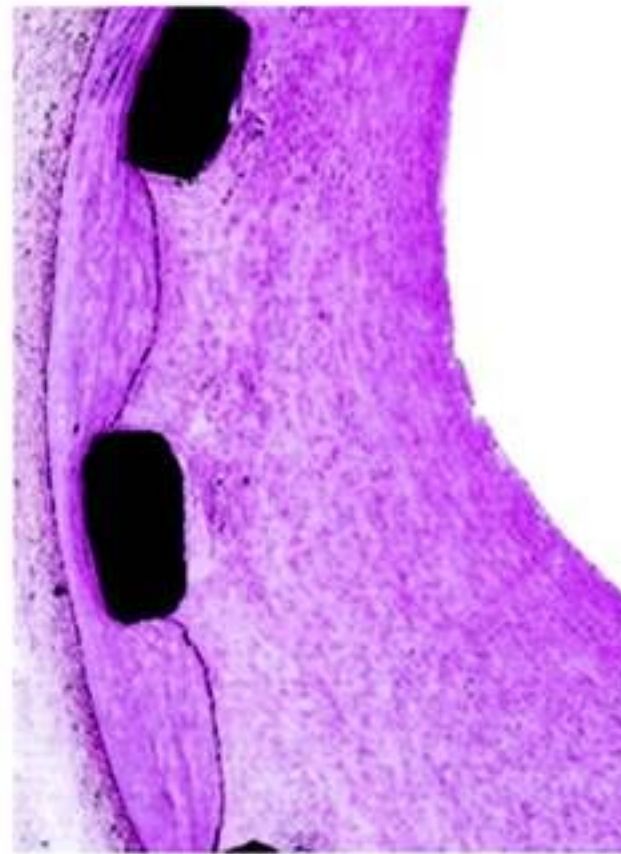
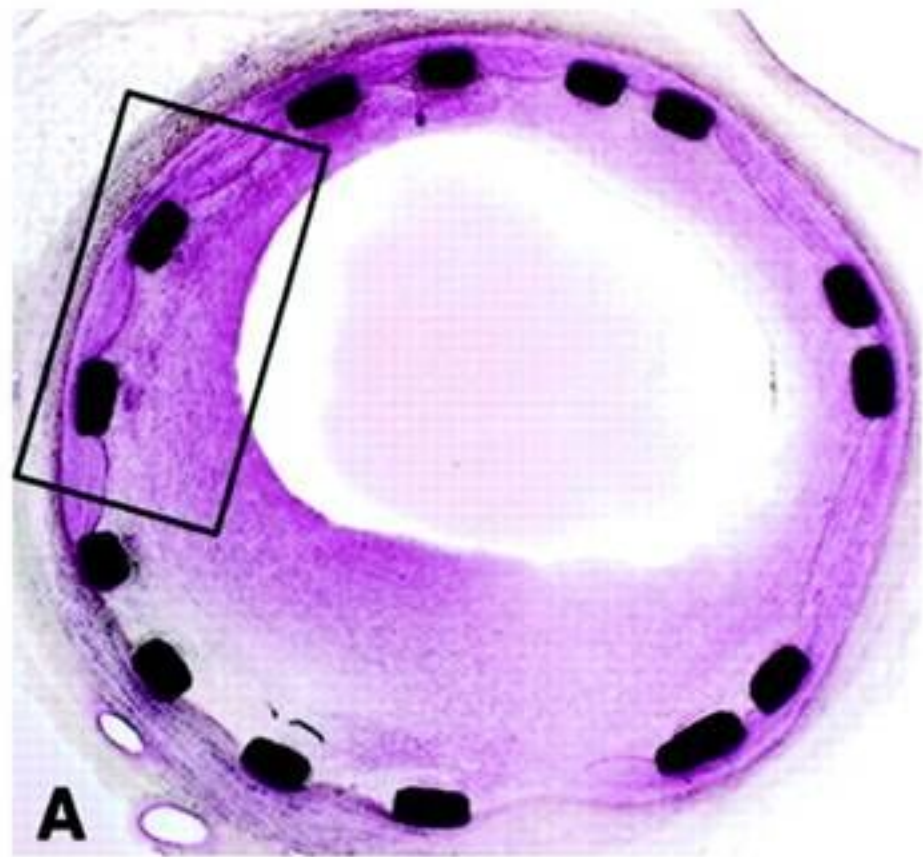
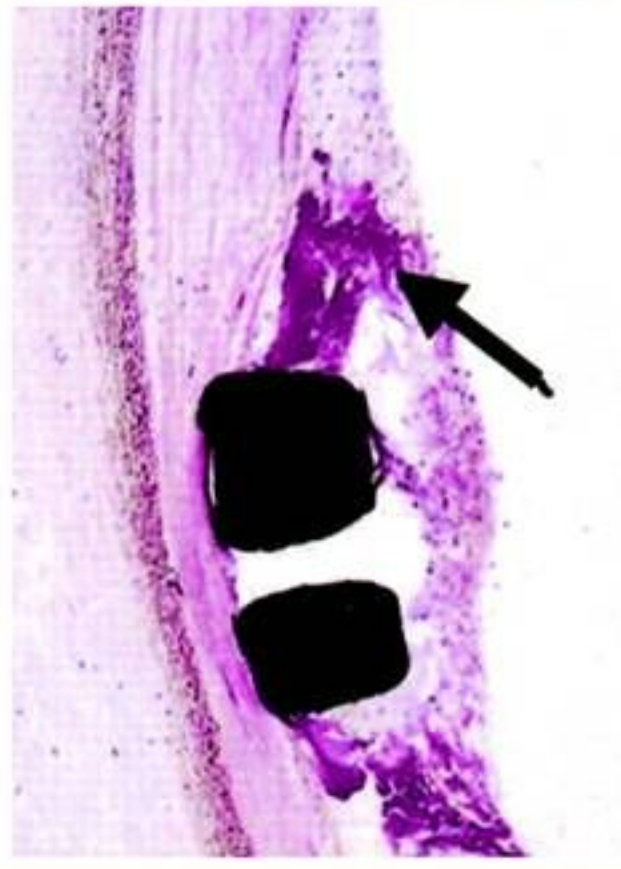
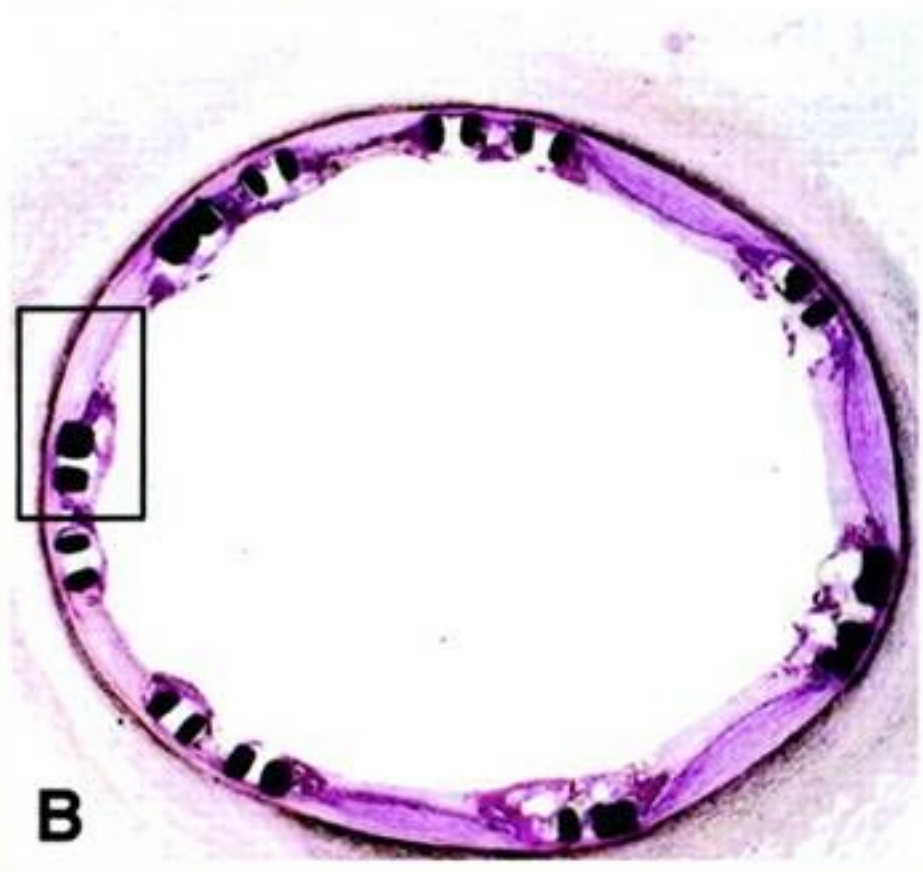


Figure 1 Angioscopic images show the grading for neointimal stent strut coverage. Neointimal coverage was more complete with bare-metal stents compared with sirolimus-eluting stents ($p < 0.0001$).



Bare metal

Healing is complete with fibromuscular neointimal covering struts



Paclitaxel stent.

At site of struts where the drug is present, healing is not complete.

Long term dual antiplatelet therapy

Main strategy in post PCI risk reduction

Within the stent

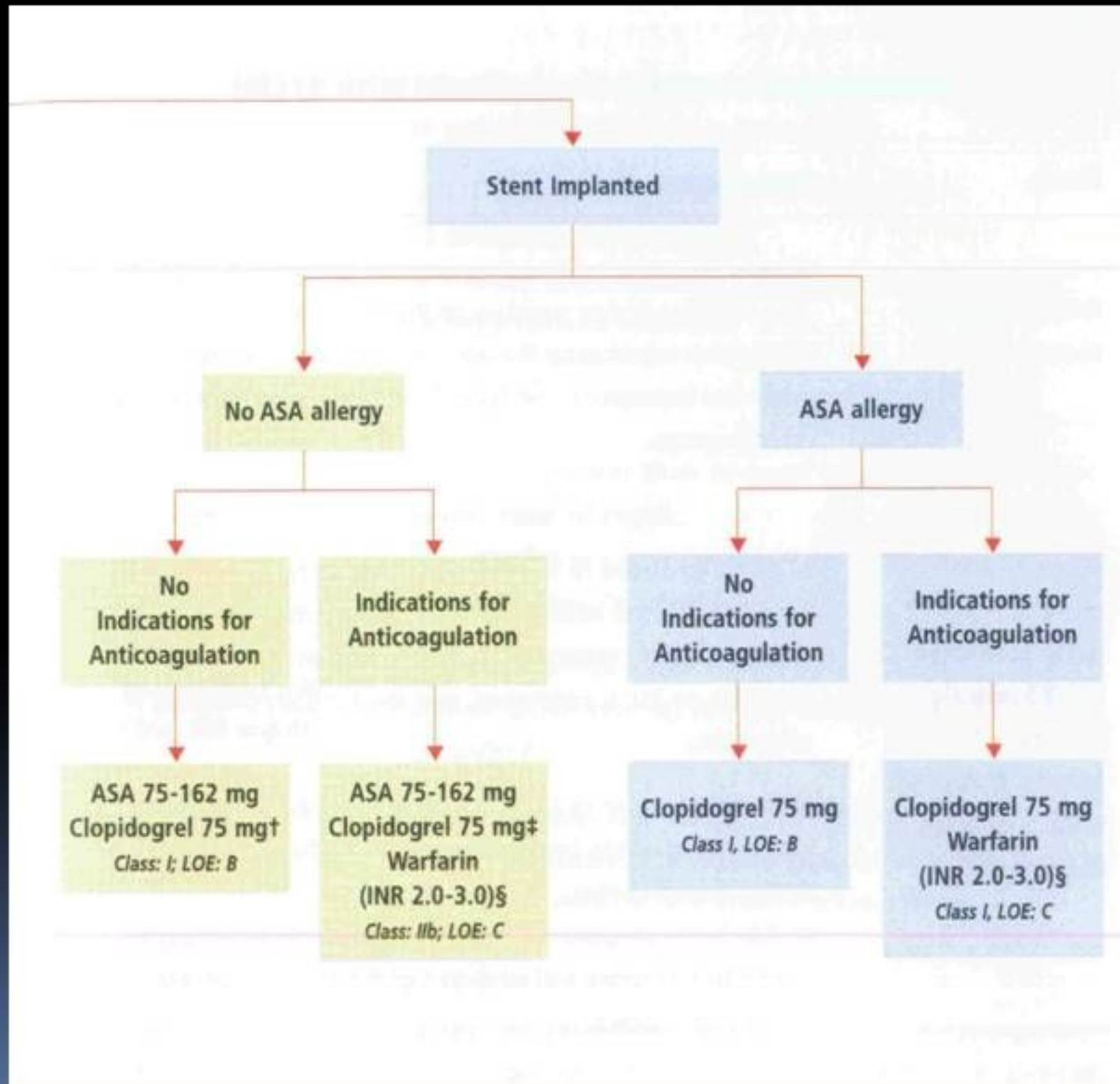
Beyond the stented segment

Non PCI vessels

Systemic vascular events

	Plain balloon	Baremetal	DES	
			Sirolimus	Paclitaxel
Clopidogrel 75mg	-	1 month	3 months	6 -12 months
Aspirin 162 -325 mg	Indefinite	Indefinite	Indefinite	Indefinite

Oral anticoagulation : Indication not related to stent




All PCI patients are medical patients by default !

LONG-TERM CARE AFTER PERCUTANEOUS CORONARY INTERVENTION

TABLE 2. Cardiac Rehabilitation After Percutaneous Coronary Intervention*

Cardiac risk factor	UA/NSTEMI guideline recommendations ⁵⁴	STEMI guideline recommendations ⁵⁵
Hypertension	Blood pressure goal of <130/85 mm Hg (class Ib)	Blood pressure goal of <140/90 mm Hg or <130/80 mm Hg if kidney disease or diabetes present (class Ib)
Hyperlipidemia	Initiate statin if LDL-C >130 mg/dL (class Ia)	Initiate statin if LDL-C >100 mg/dL (class Ia)
Diabetes	Tight control of hyperglycemia (class Ib)	Hypoglycemic therapy initiated to achieve hemoglobin A _{1c} <7% (class Ib)
Smoking	Cessation (class Ib)	Cessation (class Ib)
Obesity	Maintenance of optimal weight (class Ib)	BMI goal of 18.5-24.9 (class Ib)
Physical inactivity	Maintenance of daily exercise (class Ib)	Daily goal of at least 30 min of exercise (class Ib)
High-fat diet	Maintenance of appropriate diet (class Ib)	Switch to a low-fat diet; increase fresh fruit and vegetable intake (class Ia)

*BMI = body mass index; LDL-C = low-density lipoprotein cholesterol; NSTEMI = myocardial infarction without ST-segment elevation; STEMI = myocardial infarction with ST-segment elevation; UA = unstable angina.



M.D.

V. Secondary Prevention and Long-Term Management

Diabetes

**Diabetes
management
Goal: HbA1c
less than 7%**

Appropriate hypoglycemic therapy to achieve near-normal fasting plasma glucose, as indicated by HbA1c.

Treatment of other risk factors (e.g., physical activity, weight management, blood pressure, and cholesterol management).

Hypertension

Blood pressure control

Goal: Less than 140/90 mm Hg or less than 130/80 mm Hg if chronic kidney disease or diabetes

If blood pressure is 120/80 mm Hg or greater:

- Initiate lifestyle modification (weight control, physical activity, alcohol moderation, moderate sodium restriction, and emphasis on fruits, vegetables, and low-fat dairy products) in all patients.

If blood pressure is 140/90 mm Hg or greater or 130/80 mm Hg or greater for individuals with chronic kidney disease or diabetes:

- Add blood pressure reducing medications, emphasizing the use of beta-blockers and inhibitors of the renin-angiotensin-aldosterone system.

Lipid management

**Lipid management
(TG 200 mg/dL or
greater)**

Primary goal:

**Non-HDL-C*
substantially less
than 130 mg/dL**

If TGs are greater than or equal to 150 mg/dL or HDL-C is less than 40 mg/dL:

- Emphasize weight management and physical activity. Advise smoking cessation.

If TG is 200–499 mg/dL:

- After LDL-C–lowering therapy,[†] consider adding fibrate or niacin.[‡]

If TG is greater than or equal to 500 mg/dL:

- Consider fibrate or niacin[‡] before LDL-C–lowering therapy.[†]
- Consider omega-3 fatty acids as adjunct for high TG.

**Lipid management
(TG less than
200 mg/dL)**

Primary goal:

Start dietary therapy in all patients (less than 7% of total calories as saturated fat and less than 200 mg/d cholesterol). Promote physical activity and weight management. Encourage increased consumption of omega-3 fatty acids

Smoking

Goals

Smoking
Goal: Complete
cessation

Recommendations

Assess tobacco use. Strongly encourage patient and family to stop smoking and to avoid secondhand smoke. Provide counseling, pharmacological therapy (including nicotine replacement and bupropion), and formal smoking cessation programs as appropriate.

Weight management

Weight management

Goal:

**BMI 18.5-24.9
kg/m²**

Waist circumference:
Women: less than 35 inches
Men: less than 40 inches

Calculate BMI and measure waist circumference as part of evaluation. Monitor response of BMI and waist circumference to therapy.

Start weight management and physical activity as appropriate. Desirable BMI range is 18.5–24.9 kg/m².

If waist circumference is greater than or equal to 35 inches in women or greater than or equal to 40 inches in men, initiate lifestyle changes and treatment strategies for metabolic syndrome.

Mental stress Emotional stability :

Stented and worried ?

When will I have the second heart attack ?

Anti depressants and anti-anxiety
drugs useful.

Anxiety can trigger an event

Selective , patient specific information



Ignorance still a bliss ?

Should we disclose all complications and potential side effects to the patients

One of the health web site describes a DES tickling time bomb

Is too much information harming the patients

Special situations post PCI patients

Exercise & Physical activity following PCI

Indications

Contraindication



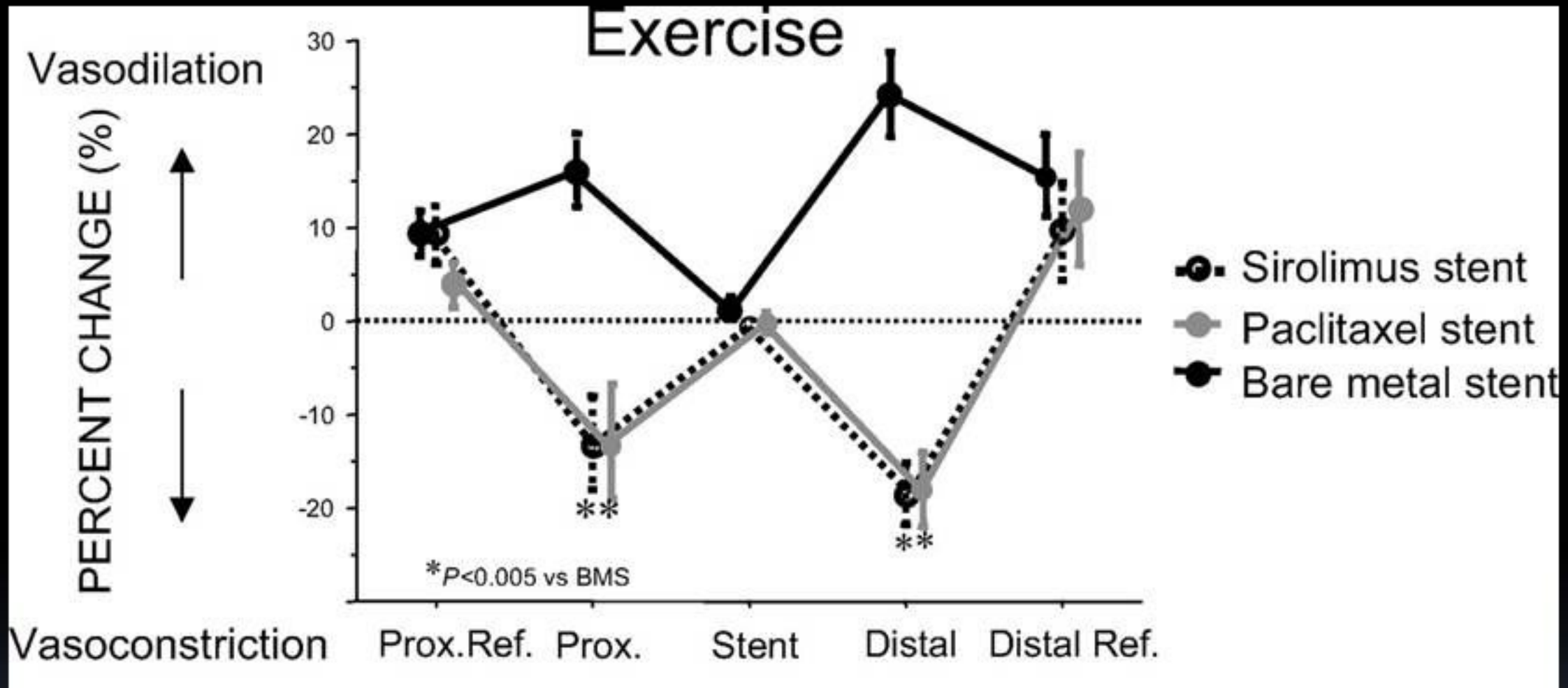
Coronary stent occlusion following strenuous exertion: is the risk actual? Is it preventable?

A total of four cases of stent occlusion

Between 2 days and 3 months.

Stent occlusion ranged from up to 2 h after the stress test.

Bicycle exercise testing during coronary angiogram



SES and PES show exercise-induced vasoconstriction proximal and distal to the stent, whereas BMS maintain exercise-induced vasodilatation of the respective segments. Adapted from Togni et al,⁶¹ copyright © 2005, and Togni et al,⁶² copyright © 2007, with permission from Elsevier.

When exercise stress testing to be avoided ?

Who is at risk for stent thrombosis ?

Within 3 months

PCI following UA

Improper stent deployment

? DES

Exercise prescription for Post PCI patients

Exercise Prescriptions for CAD Patients

Patients	Intensity	Frequency	Duration
Aerobic Exercise			
General CAD	70%–85% peak HR	≥3 Times weekly	≥20 min per session
With asymptomatic ischemia	70%–85% Ischemic HR	≥3 Times weekly	≥20 min per session
With angina	70%-85% Ischemic HR or angina onset	≥3 Times weekly	≥20 min per session
With angioplasty ±stent	As for general CAD patient
With claudication	Walking to pain tolerance	≥3 Times weekly	≥30 min per session
With NYHA class I–III HF	As for general CAD patient
Resistance Exercise			
For most CAD patients	30%–50% RM	2–3 Times weekly	12–15 Repetitions

RM indicates 1-repetition maximal weight.

Contemporary Reviews in Cardiovascular Medicine

Exercise Prescription and Proscription for Patients With Coronary Artery Disease

Paul D. Thompson, MD

Non cardiac surgery in patients
with PCI

Elective

Emergency

Peri-operative Clopidogrel

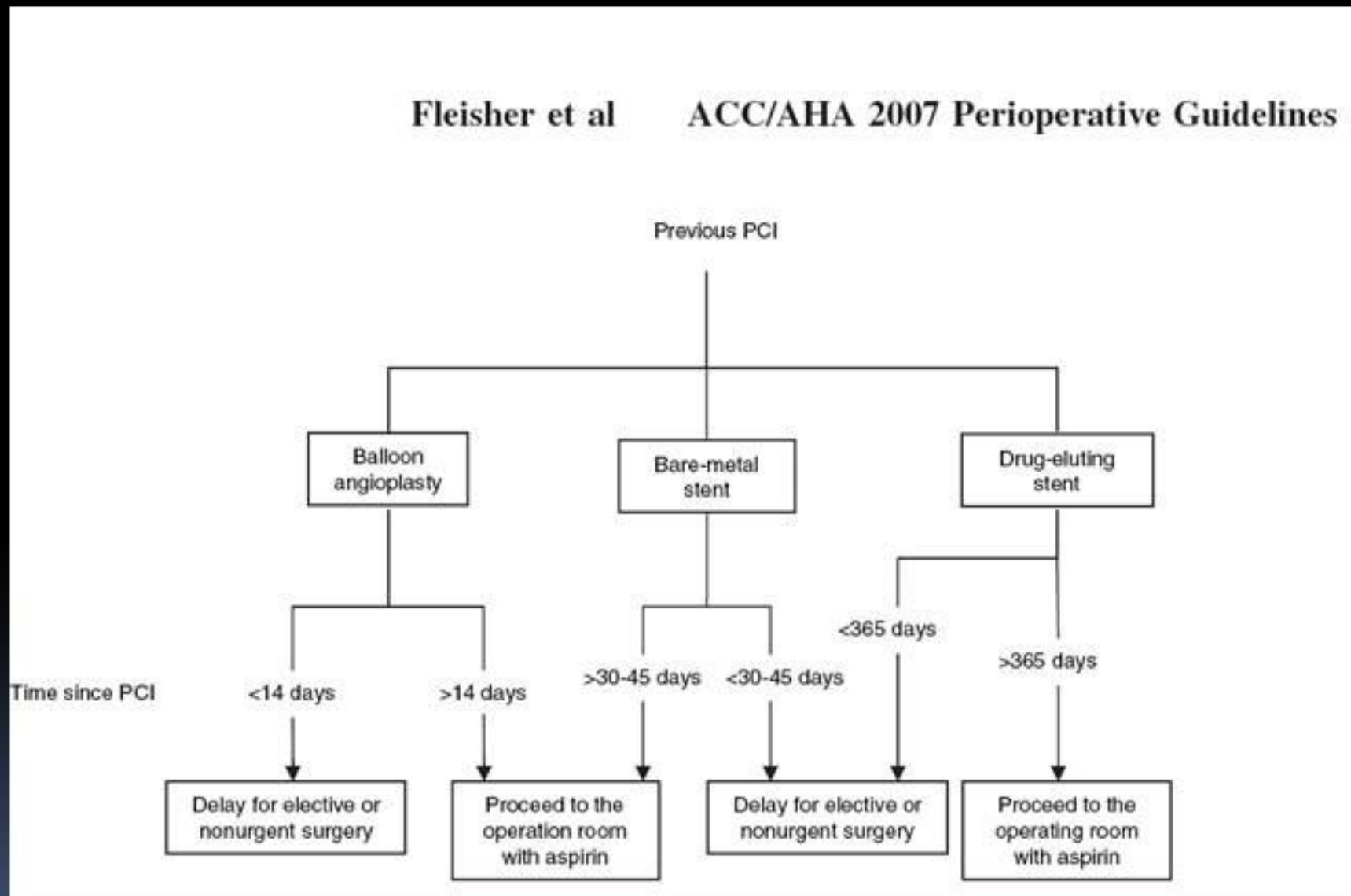
When to stop ?

When to resume ?

Withhold clopidogrel for 5-7 d before CABG, unless the urgency of revascularization outweighs the risks of excess bleeding; aspirin should not be withheld before elective or nonelective CABG after STEMI; aspirin, 75-325 mg/d, should be prescribed within 24 h of CABG unless contraindicated

Emergency non cardiac surgery in post PCI patients

How safe to withdraw clopidogrel?



Spinal anesthesia /GA

Neuro axial blockade on a patient in whom you suspect abnormal platelet function, you should perform platelet function testing and correct the *platelet function as guided by the test result or, if testing is unavailable, transfuse platelets before you proceed.*

Dual Antiplatelet therapy and non-cardiac surgery risk; what are the anaesthetists and surgeons doing? Eur Heart J 2006; 27: 380-1

Point of care platelet function testing



Accu:metrics[®]
The Platelet Function Company

Imaging Intra coronary stents

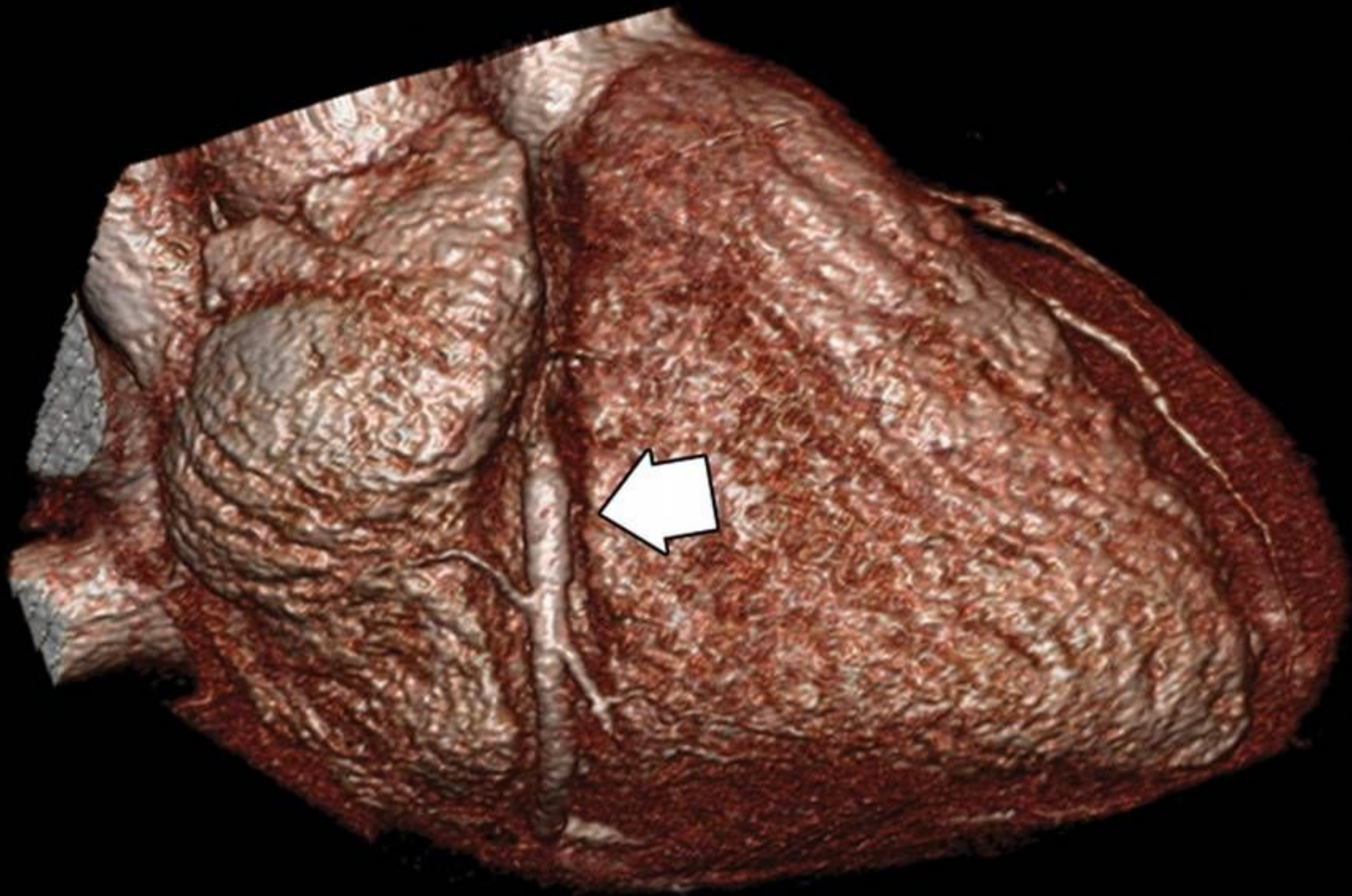
Should we need to visualize the stent ?

64 slice CT

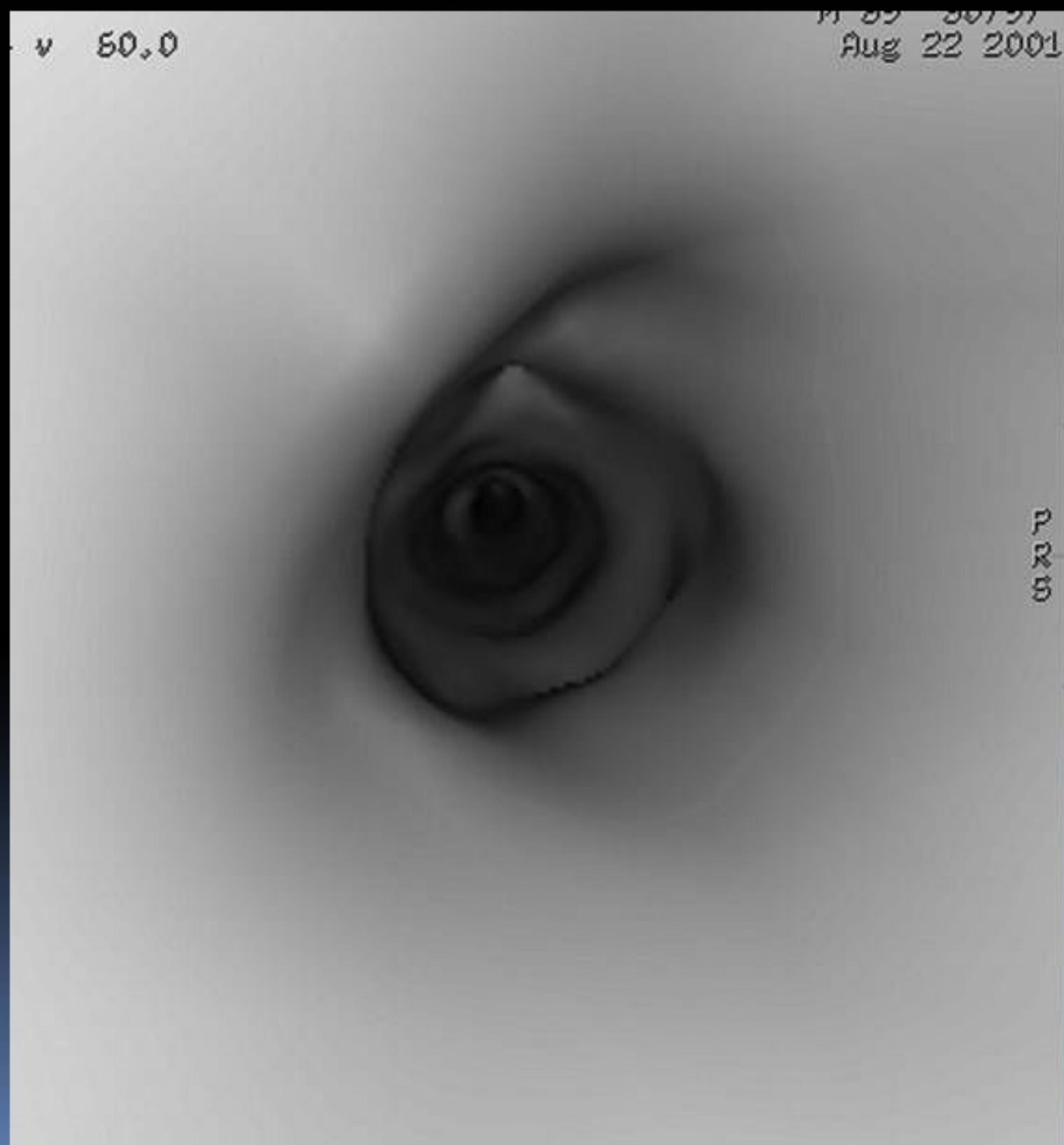
IVUS

MRI

64 slice CT intra stent view



Direct visualisation of stent



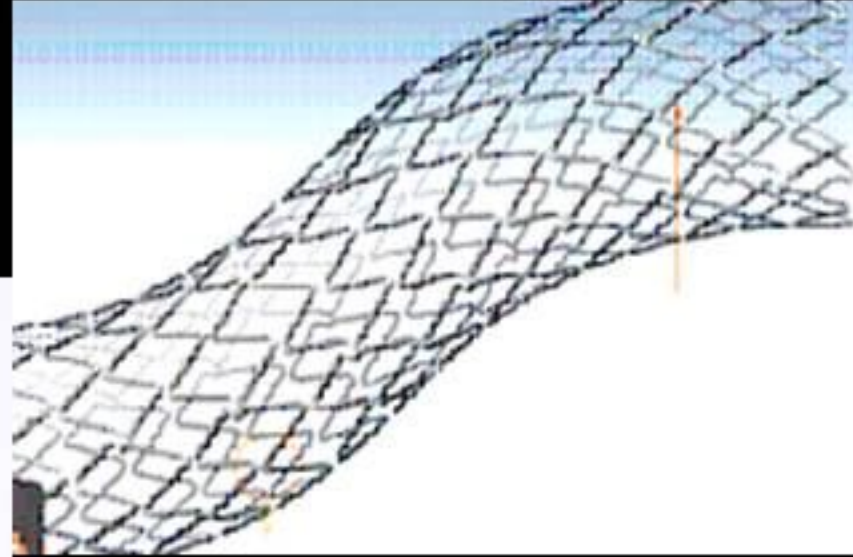
Newer imaging modalities

Have great potential

Imaging stents in the routine follow up

Is generally neither advised nor required

Is MRI safe in patients with stent ?



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(Circulation. 2007;116:2878-2891.)

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AHA Scientific Statement

Safety of Magnetic Resonance Imaging in Patients With Cardiovascular Devices

An American Heart Association Scientific Statement From the Committee on Diagnostic and Interventional Cardiac Catheterization, Council on Clinical Cardiology, and the Council on Cardiovascular Radiology and Intervention: Endorsed by the American College of Cardiology Foundation, the North American Society for Cardiac Imaging, and the Society for Cardiovascular Magnetic Resonance

Glenn N. Levine, MD, FAHA; Antoinette S. Gomes, MD, FAHA; Andrew E. Arai, MD, FAHA; David A. Bluemke, MD, FAHA; Scott D. Flamm, MD; Emanuel Kanal, MD; Warren J. Manning, MD, FAHA; Edward T. Martin, MD, FAHA; J. Michael Smith, MD; Norbert Wilke, MD; Frank S. Shellock, PhD

MRI post PCI is generally safe !

Old generation Stents :

Better to wait for 6 weeks for stent anchoring.
(Migration/heating reported)

Newer generation Stents/ DES are MRI safe

Weakly ferromagnetic platinum cobalt alloy, gold, tantalum,

Non-ferromagnetic : Titanium, titanium alloy, or nitinol

Post PCI care :Logistics

Telemetry

Access to emergency services



Who will take care ?

Insuring post PCI patients



PCI follow up : Future directions . . .

- Non invasive Imaging
- Newer drugs
- Maintenance free stents ?
- Bio degradable stents

Caring after PCI



Caring does not mean caring for

~~The Percutaneous coronary~~
The stent!

intervention is a focal treatment

~~The Coronary artery!~~
of a systemic disease process

~~And patients require lifelong~~
The Heart!

“caring”

It is caring for the whole patient . . .



Thank you

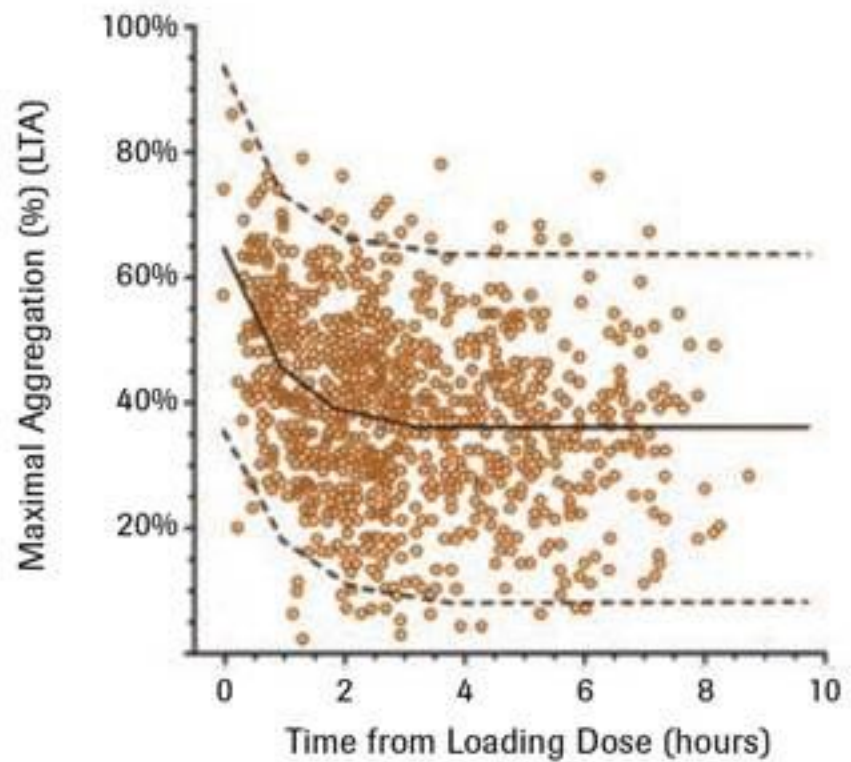
Personal perspective

While we take every pain to reduce the conventional risk factors and reduce a coronary event we should always remember

Is PCI by itself a coronary risk factor ?

Variability of response to clopidogrel administered in the cath lab

- As measured by aggregometry



Variability of residual response after cessation of clopidogrel therapy

- As measured by VerifyNow

