Considering DAPT in Difficult Cases

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Disclosure Statement of Financial Interest

Within the past 12 months, I or my spouse/partner have had a financial interest/arrangement or affiliation with the organization(s) listed below.

Affiliation/Financial Relationship	Company
Grant/Research Support	None
Consulting Fees/Honoraria	Volcano-Philips
Major Stock Shareholder/Equity	Technology Solutions Group
Royalty Income	None
Ownership/Founder	Technology Solutions Group, BioInfo Accelerator Fund
Intellectual Property Rights	None
Other Financial Benefit	None

DAPT (Dual AntiPlatelet Therapy)

- Foundations for DAPT therapy
- Importance with drug eluting stents (DES)
- Difficult patient subsets
  - Those who also need antithrombin therapy, or oral anticoagulants (OAC)
  - Those who need surgery early after initiation
  - Those who develop serious bleeding
  - Those who develop stent thrombosis on DAPT
- Recommendations for general internists

Why DAPT?

- Original stents placed in early 1990's without intravascular imaging and at low balloon pressure, usually for "bail out"indications
  - Required extensive anticoagulation to prevent thrombosis (coumadin, dextran, ASA, heparin, dipyridamole). 5-7 days in hospital
- In mid 90's intravascular imaging showed marked stent under-expansion.
  - Columbo et al used higher pressure, better expansion and a new antiplatelet $P2Y_{12}$ inhibitor: ticlopidine.
  - No need for antithrombins or OAC: DAPT was born!

DAPT and DES

- In early 2000's DES developed to combat restenosis
- Initial concern was on cost and proper allocation of these stents
- But then…….
  - Excessive rates of stent thrombosis led to work wide "crisis" regarding how long DAPT was needed
  - DAPT "education" efforts spread to all medical fields

Late thrombosis in drug-eluting coronary stents after discontinuation of antiplatelet therapy

Eugène P McFadden, Eugenio Stabile, Evelyn Regar, Edouard Cheneau, Andrew T L Ong, Timothy Kinnaird, William O Suddath, Neil J Weissman, Rebecca Torguson, Kenneth M Kent, August D Pichard, Lowell F Satler, Ron Waksman, Patrick W Serruys

Although the safety profiles of coronary stents eluting sirolimus or paclitaxel do not seem to differ from those of bare metal stents in the short-to-medium term, concern has arisen about the potential for late stent thromboses related to delayed endothelialisation of the stent struts. We report four cases of angiographically-confirmed stent thrombosis that occurred late after elective implantation of polymer-based paxlitaxel-eluting (343 and 442 days) or sirolimus-eluting (335 and 375 days) stents, and resulted in myocardial infarction. All cases arose soon after antiplatelet therapy was interrupted. If confirmed in systematic long-term follow-up studies, our findings have potentially serious clinical implications.

Lancet 2004; 364:1519-21

A new issue with DES: Late thrombosis

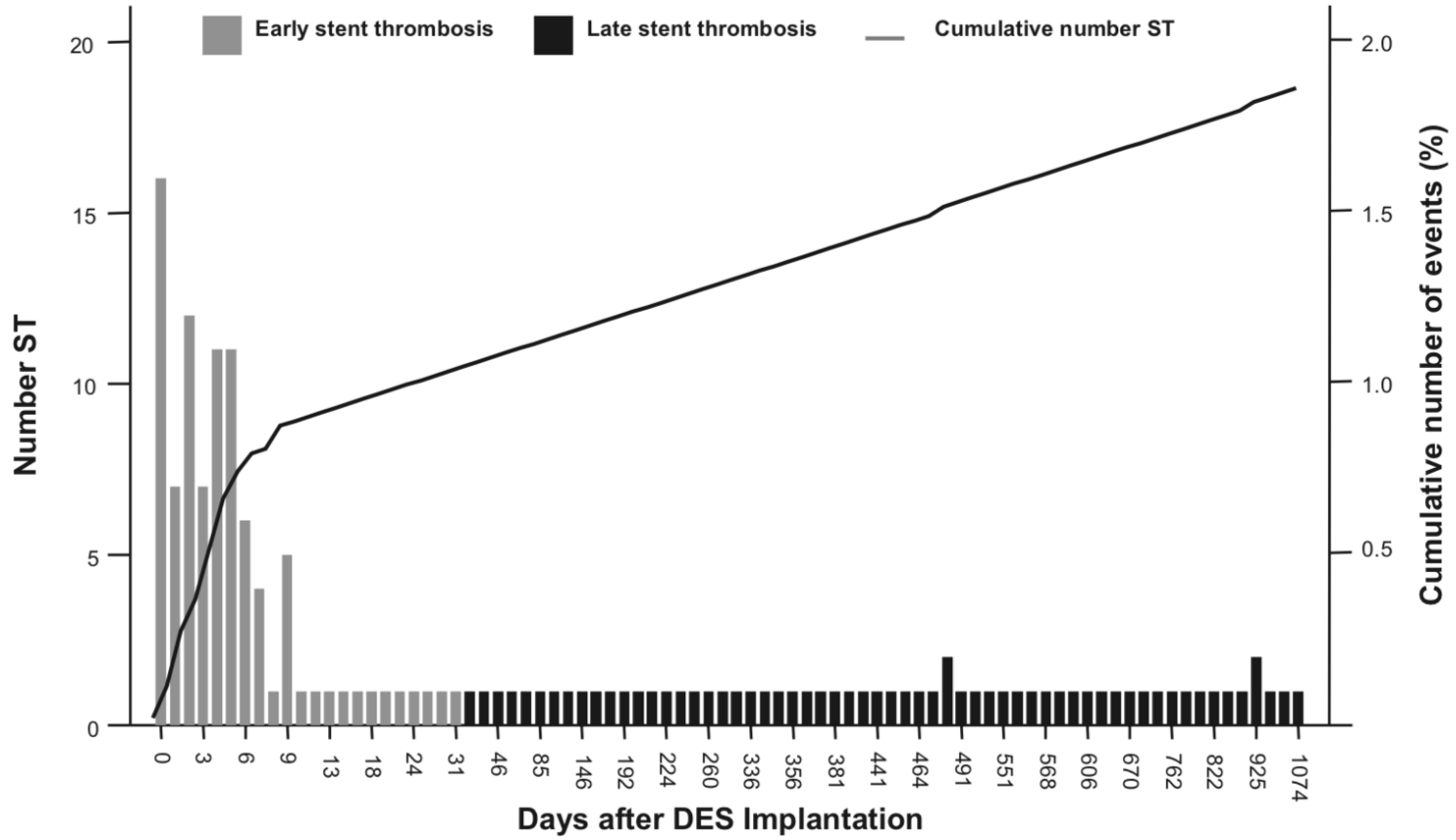


Figure 5. Frequency distribution over time of ST in 152 of 8146 consecutive DES patients. Early ST cases are gray (91 patients); late ST cases (61 patients) are black. The line shows the cumulative number of events over time. Reproduced from Daemen et al,[11] copyright © 2007, with permission from Elsevier.

Circulation. 2007;116:1952-1965

Most Late ST patients NOT on DAPT

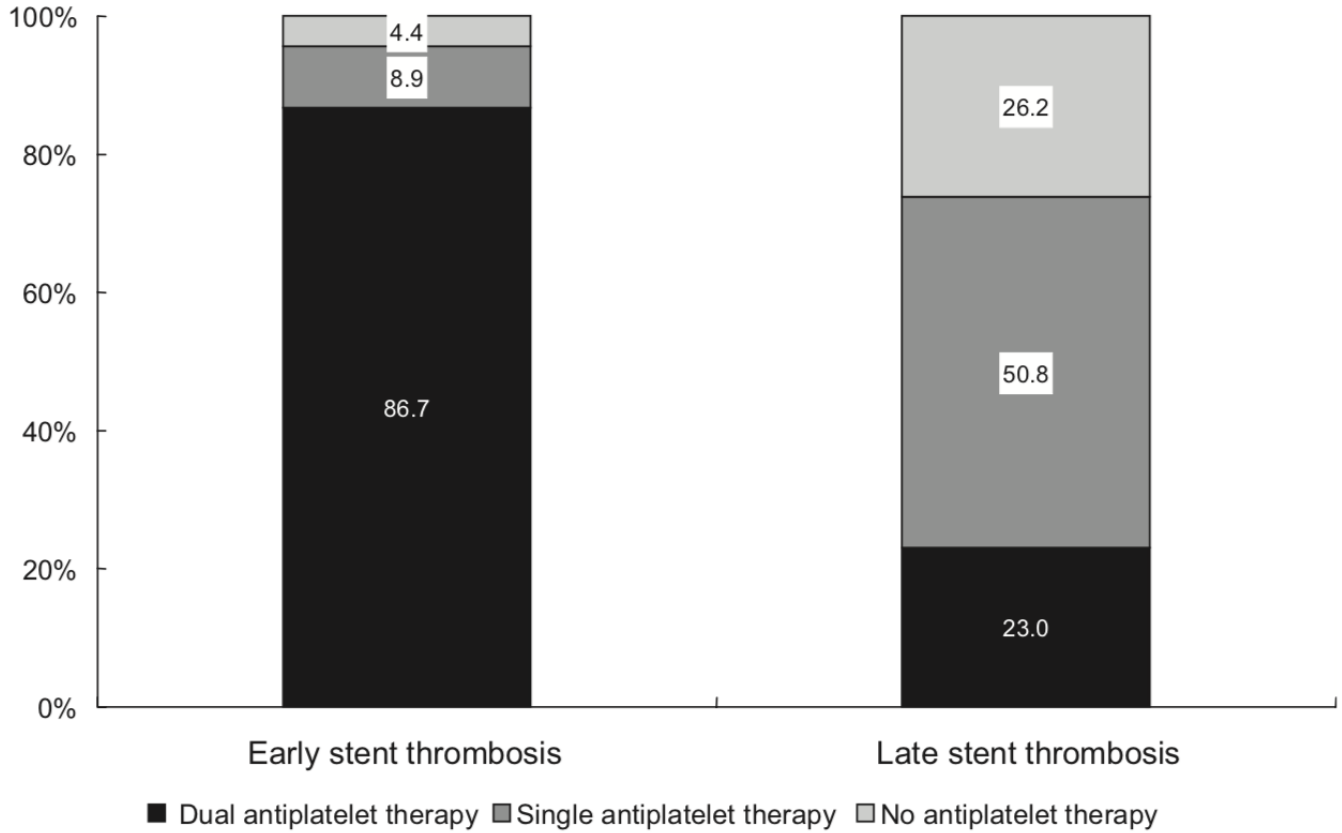
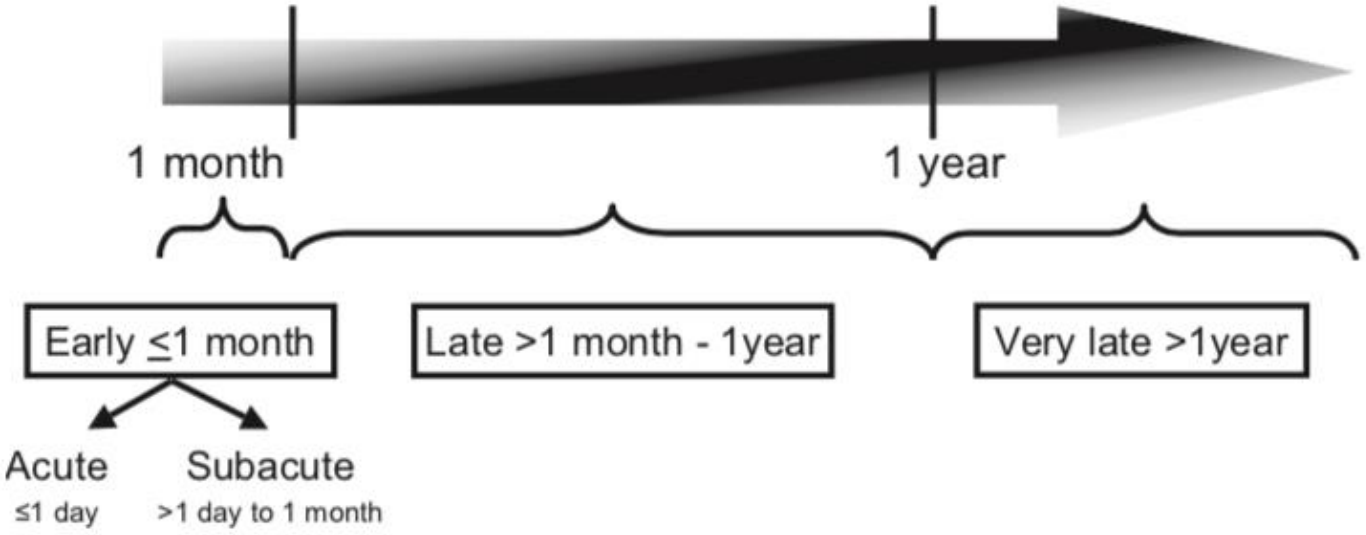


Figure 7. Antiplatelet treatment at the time of DES thrombosis in 152 patients. Proportion of patients with early (left column; 91 patients) and late (right column; 61 patients) ST, respectively, treated with dual, single, or no antiplatelet therapy. Data from Daemen et al.[11]

Circulation. 2007;116:1952-1965

Time Frame of Stent Thrombosis

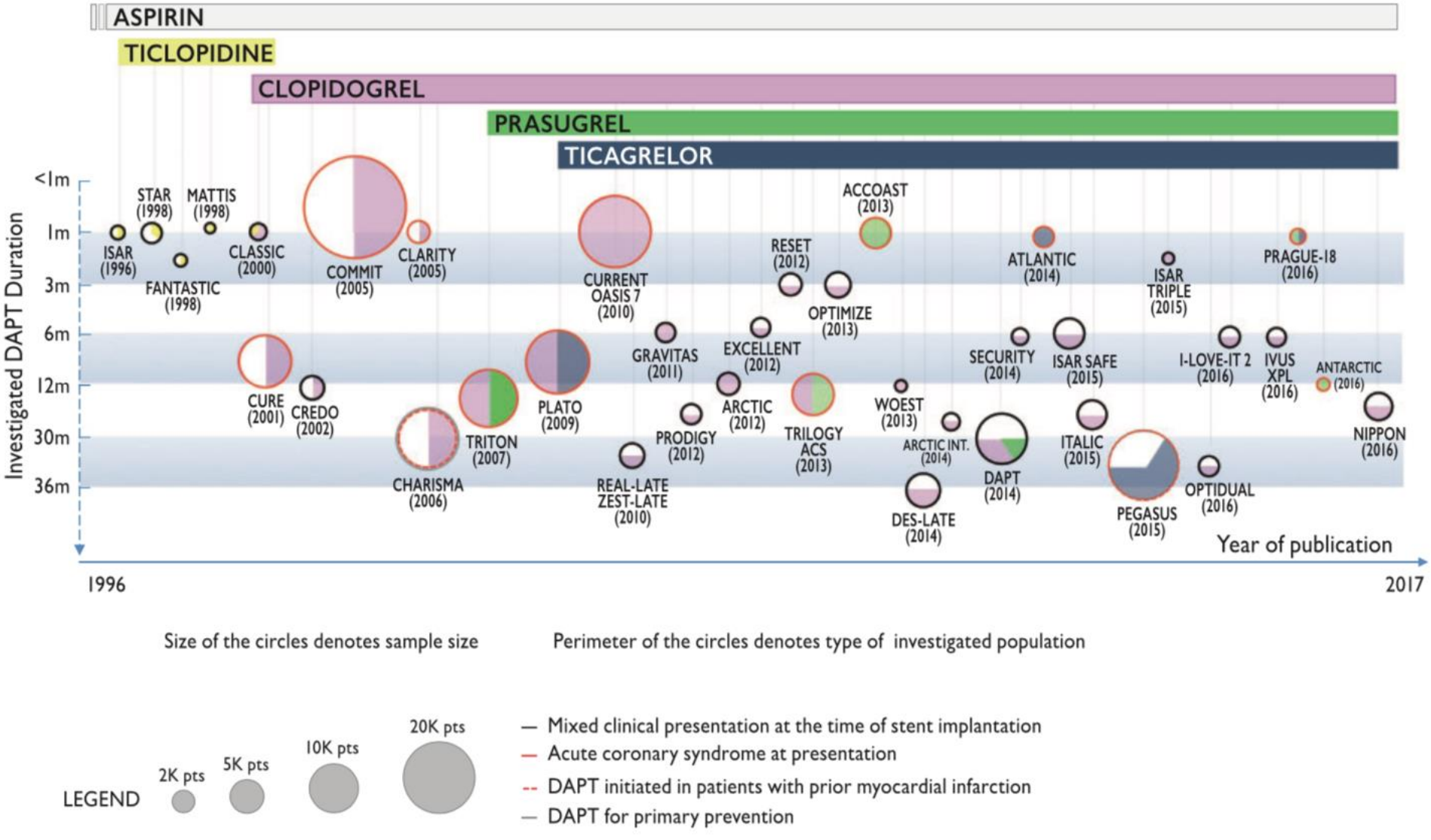


≤1 day		Acute stent thrombosis
>1 day	to 1 month	Subacute stent thrombosis
>1 month	to 1 year	Late stent thrombosis
>1 year		Very late stent thrombosis

Circulation. 2007;116:1952-1965

Further $P2Y_{12}$ development

- Clopidogrel: better than Ticlopidine with fewer side effects
- Ticagrelor: better than Clopidogrel
- Prasugrel: better than Clopidogrel
- Cangrelor: iv and ultrashort acting



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ACC/AHA FOCUSED UPDATE

2016 ACC/AHA Guideline Focused Update on Duration of Dual Antiplatelet Therapy in Patients With Coronary Artery Disease

A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines

An Update of the 2011 ACCF/AHA/SCAI Guideline for Percutaneous Coronary Intervention, 2011 ACCF/AHA Guideline for Coronary Artery Bypass Graft Surgery, 2012 ACC/AHA/ACP/AATS/PCNA/SCAI/STS Guideline for the Diagnosis and Management of Patients With Stable Ischemic Heart Disease, 2013 ACCF/AHA Guideline for the Management of ST-Elevation Myocardial Infarction, 2014 AHA/ACC Guideline for the Management of Patients With Non–ST-Elevation Acute Coronary Syndromes, and 2014 ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery

JACC 2016;68:1082-1115

ESC
European Society of Cardiology
European Heart Journal (2018) **39**, 213–254
doi:10.1093/eurheartj/ehx419

ESC GUIDELINES

2017 ESC focused update on dual antiplatelet therapy in coronary artery disease developed in collaboration with EACTS

The Task Force for dual antiplatelet therapy in coronary artery disease of the European Society of Cardiology (ESC) and of the European Association for Cardio-Thoracic Surgery (EACTS)

Authors/Task Force Members: Marco Valgimigli* (Chairperson) (Switzerland), Héctor Bueno (Spain), Robert A. Byrne (Germany), Jean-Philippe Collet (France), Francesco Costa (Italy), Anders Jeppsson[1] (Sweden), Peter Jüni (Canada), Adnan Kastrati (Germany), Philippe Kolh (Belgium), Laura Mauri (USA), Gilles Montalescot (France), Franz-Josef Neumann (Germany), Mate Petricevic[1] (Croatia), Marco Roffi (Switzerland), Philippe Gabriel Steg (France), Stephan Windecker (Switzerland), and Jose Luis Zamorano (Spain)

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Canadian Journal of Cardiology 34 (2018) 214–233

Society Guidelines

2018 Canadian Cardiovascular Society/Canadian Association of Interventional Cardiology Focused Update of the Guidelines for the Use of Antiplatelet Therapy

Shamir R. Mehta, MD, MSc (co-chair),[a] Kevin R. Bainey, MD,[b] Warren J. Cantor, MD,[c] Marie Lordkipanidzé, BPharm, PhD,[d] Guillaume Marquis-Gravel, MD,[d] Simon D. Robinson, MBChB, MD,[e] Matthew Sibbald, MD, PhD,[a] Derek Y. So, MD,[f] Graham C. Wong, MD, MPH,[g] Joseph G. Abunassar, MD,[f] Margaret L. Ackman, PharmD,[b] Alan D. Bell, MD,[h] Raymond Cartier, MD,[d] James D. Douketis, MD,[i] Patrick R. Lawler, MD, MPH,[j] Michael S. McMurtry, MD,[b] Jacob A. Udell, MD,[j] Sean van Diepen, MD,[b] Subodh Verma, MD,[k] G.B. John Mancini, MD,[g] John A. Cairns, MD,[g] and Jean-François Tanguay, MD (co-chair);[d] and members of the Secondary Panel

General considerations

- Balancing thrombotic events with bleeding events
- Liberal use of risk estimating scores
- All aspirin doses are 81mg
- Choice of $P2Y_{12}$ depends on the balance
  - Clopidogrel less effect on platelets
  - Ticagrelor more effect on platelets
  - Prasugrel more effect, but risk in prior CVA
- Clinical syndrome class effect: Stable (SIHD) or acute coronary syndrome (STEMI, NSTEMI)

Risk Estimators

- Precise DAPT: "balanced score" for duration of DAPT only
- **C**HA_2DS_2-VASc : "thrombosis score" for afib
- HAS-BLED: "bleeding score" for OAC

"Balanced" Risk Scores: DAPT duration

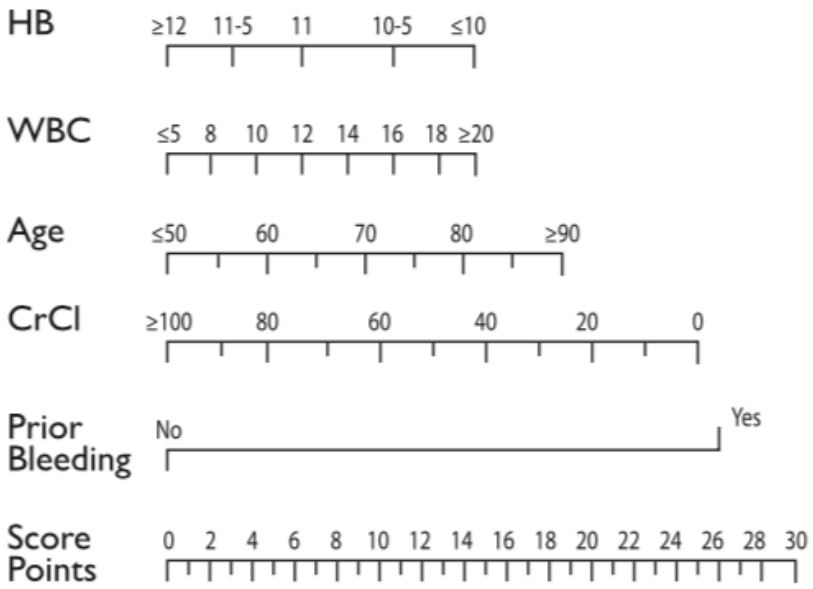
	PRECISE-DAPT score[18]
Time of use	At the time of coronary stenting
DAPT duration strategies assessed	Short DAPT (3–6 months) vs. Standard/long DAPT (12–24 months)
Score calculation[a]	
Score range	0 to 100 points
Decision making cut-off suggested	Score ≥25 → Short DAPT Score <25 → Standard/long DAPT
Calculator	www.precisedaptscore.com

Table 3. Published risk assessment tools for determining duration of DAPT

Score name	Online calculator	Patient population	Score description
PRECISE-DAPT[22]	www.precisedaptscore.com/predapt/index.html	PCI with or without ACS	Estimates 1-year rates of ischemic and bleeding events for patients treated with PCI. Patients with PRECISE-DAPT score > 25 have higher predicted rates of bleeding events and similar rates of ischemic events with shortened DAPT (3-6 months vs 12-24 months)
CALIBER[17]	https://farr-data-lab.shinyapps.io/caliber-prolonged_dapt_benefits_harms_risks	Patients surviving 1 year after MI including those treated with or without PCI	Estimates ischemic and bleeding events 2-6 years after MI with and without prolonged DAPT
DAPT[19]	http://tools.acc.org/DAPTriskapp/#!/content/calculator	Patients 1 year after PCI without bleeding or ischemic events	Estimates the net benefit between ischemic and bleeding events with prolonged DAPT. Patients with DAPT score ≥ 2 had fewer ischemic and bleeding events with prolonged DAPT (>12 months)

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Thrombosis risk score for afib: CHA_2DS_2-VASc

(b) Risk factor-based approach expressed as a point based scoring system, with the acronym CHA_2DS_2-VASc (Note: maximum score is 9 since age may contribute 0, 1, or 2 points)	
Risk factor	**Score**
Congestive heart failure/LV dysfunction	1
Hypertension	1
Age ≥75	2
Diabetes mellitus	1
Stroke/TIA/thrombo-embolism	2
Vascular disease[a]	1
Age 65–74	1
Sex category (i.e. female sex)	1
Maximum score	**9**

a = Prior myocardial infarction, peripheral artery disease, aortic plaque.

Bleeding Risk Scores: HAS-BLED

HAS-BLED score

Condition	Points
H - Hypertension	1
A - Abnormal renal or liver function (1 point each)	1 or 2
S - Stroke	1
B - Bleeding	1
L - Labile INRs	1
E - Elderly (> 65 years)	1
D - Drugs or alcohol (1 point each)	1 or 2

HAS-BLED score	Bleeds per 100 patient-years
0	1.13
1	1.02
2	1.88
3	3.74
4	8.70
5	12.5

Note: HAS-BLED has been validated for warfarin, but not for the new anticoagulants.

Smartphone calculator apps:

CHA_2DS_2-VASc

HAS-BLED

Balancing Ischemia vs. Bleeding

Table 1. High-risk clinical and angiogra
events

Feature
Clinical[14]
Before myocardial infarction or troponin-
Diabetes mellitus treated with oral hypog
Chronic kidney disease (creatinine clearar
Previous stent thrombosis
Current smoker
Angiographic
Multiple stents (≥3 stents implanted, ≥ biodegradable vascular scaffold
Long lesion length (>60 mm total stent length)[15]
Complex lesions (bifurcation treated with 2 stents, stenting of chronic occlusion)[15]
Left main or proximal LAD stenting[16]
Multivessel PCI[17]

LAD, left anterior descending artery; PCI, percutaneous coronary intervention.

Table 5 High-risk features of stent-driven recurrent ischaemic events

• Prior stent thrombosis on adequate antiplatelet therapy
• Stenting of the last remaining patent coronary artery
• Diffuse multivessel disease especially in diabetic patients
• Chronic kidney disease (i.e. creatinine clearance <60 mL/min)
• At least three stents implanted
• At least three lesions treated
• Bifurcation with two stents implanted
• Total stent length >60 mm
• Treatment of a chronic total occlusion

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Balancing Ischemia vs. Bleeding

Table 2. Factors associated with increased bleeding risk

Need for OAC in addition to DAPT
Advanced age (older than 75 years)
Frailty
Anemia with hemoglobin < 110 g/L
Chronic renal failure (creatinine clearance < 40 mL/min)
Low body weight (<60 kg)
Hospitalization for bleeding within past year
Previous stroke/intracranial bleed
Regular need for NSAIDs or prednisone

DAPT, dual antiplatelet therapy; NSAIDs, nonsteroidal anti-inflammatory drugs; OAC, oral anticoagulation.

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TABLE 4 Clinical and Procedural Factors Associated With Increased Ischemic Risk (Including Stent Thrombosis) or Increased Bleeding Risk (62-70)

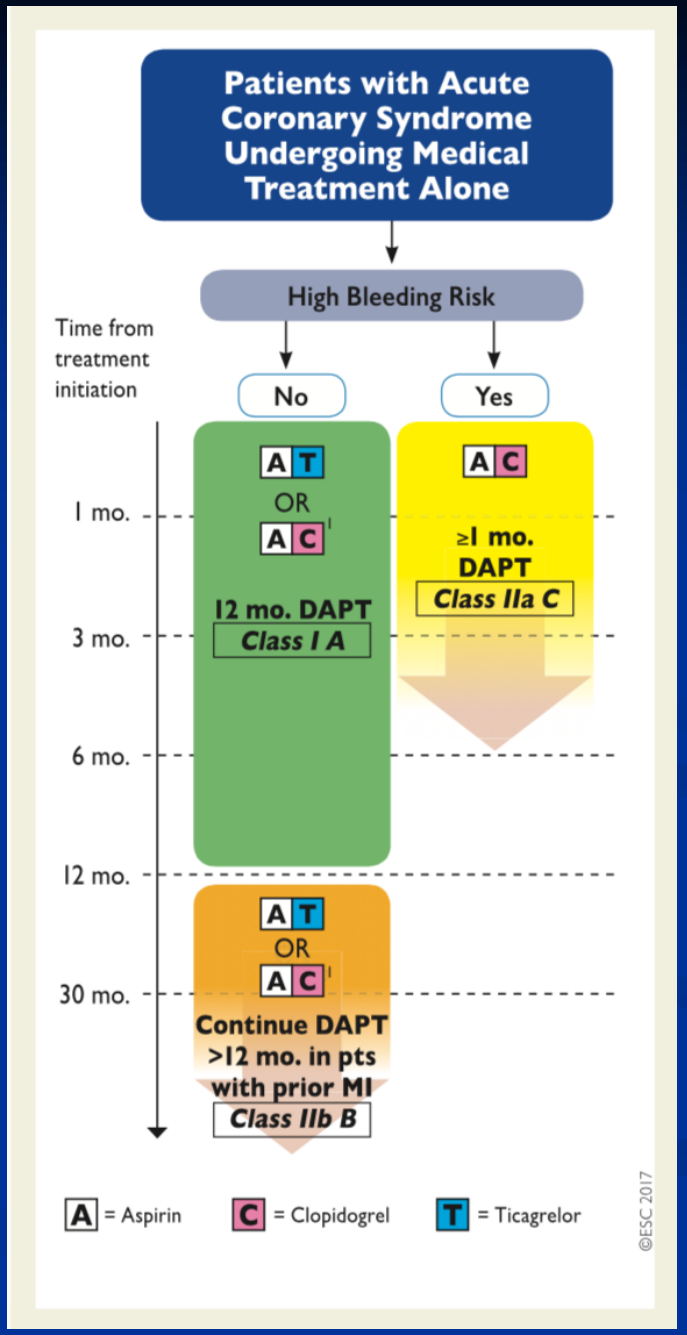
Increased Ischemic Risk/Risk of Stent Thrombosis (may favor longer-duration DAPT)	Increased Bleeding Risk (may favor shorter-duration DAPT)
Increased ischemic risk	History of prior bleeding
Advanced age	Oral anticoagulant therapy
ACS presentation	Female sex
Multiple prior MIs	Advanced age
Extensive CAD	Low body weight
Diabetes mellitus	CKD
CKD	Diabetes mellitus
Increased risk of stent thrombosis	Anemia
ACS presentation	Chronic steroid or NSAID therapy
Diabetes mellitus	
Left ventricular ejection fraction <40%	
First-generation drug-eluting stent	
Stent undersizing	
Stent underdeployment	
Small stent diameter	
Greater stent length	
Bifurcation stents	
In-stent restenosis	

ACS indicates acute coronary syndrome; CAD, coronary artery disease; CKD, chronic kidney disease; DAPT, dual antiplatelet therapy; MI, myocardial infarction; and NSAID, nonsteroidal anti-inflammatory drug.

JACC 2016;68:1082-1115

Medical treatment: NO stent

12 months DAPT
Unless high bleeding risk (HBR)



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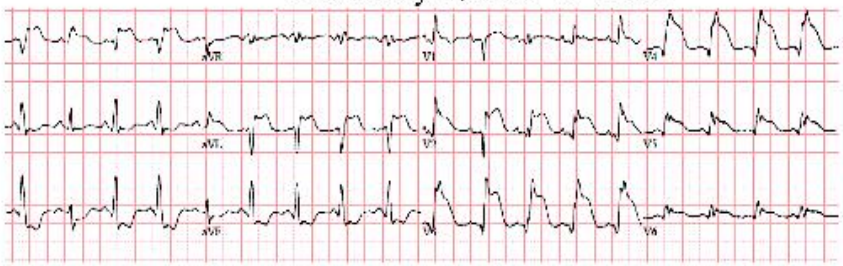
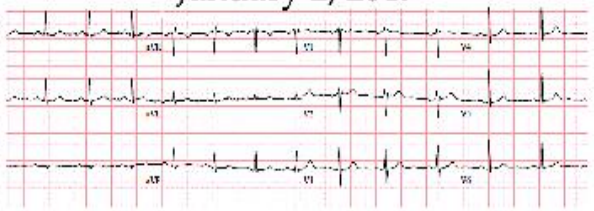
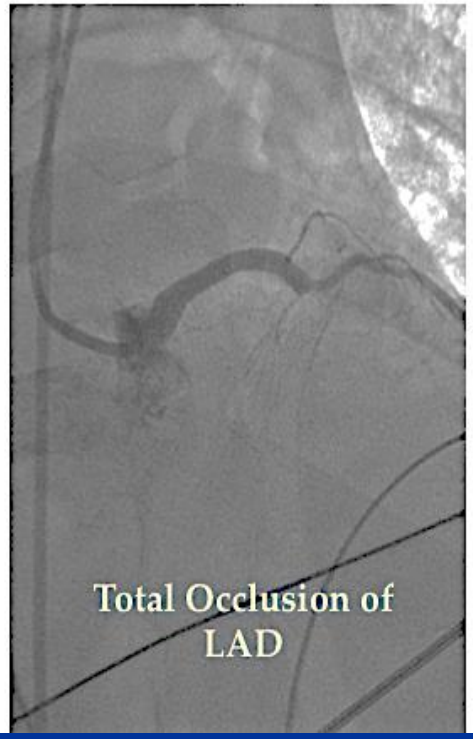
Simple Stent Case: STEMI

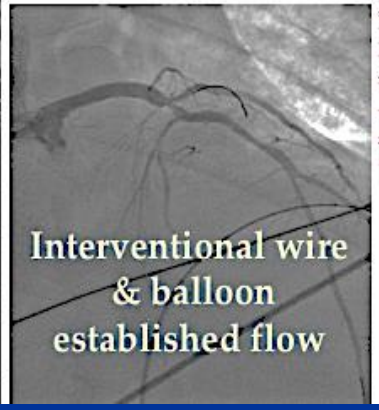
February 5, 2017 @ 18:22

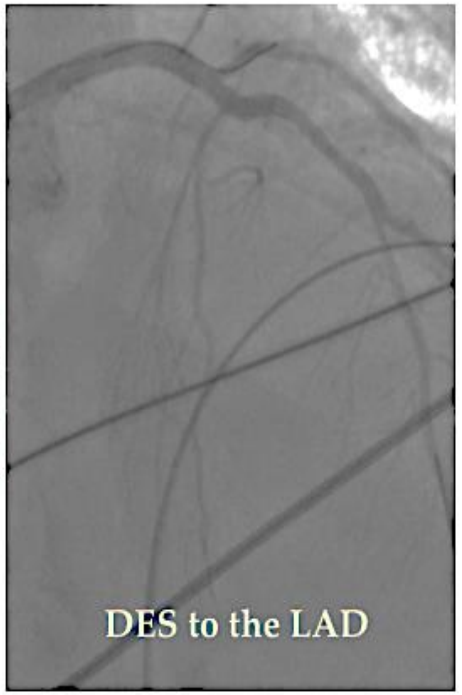


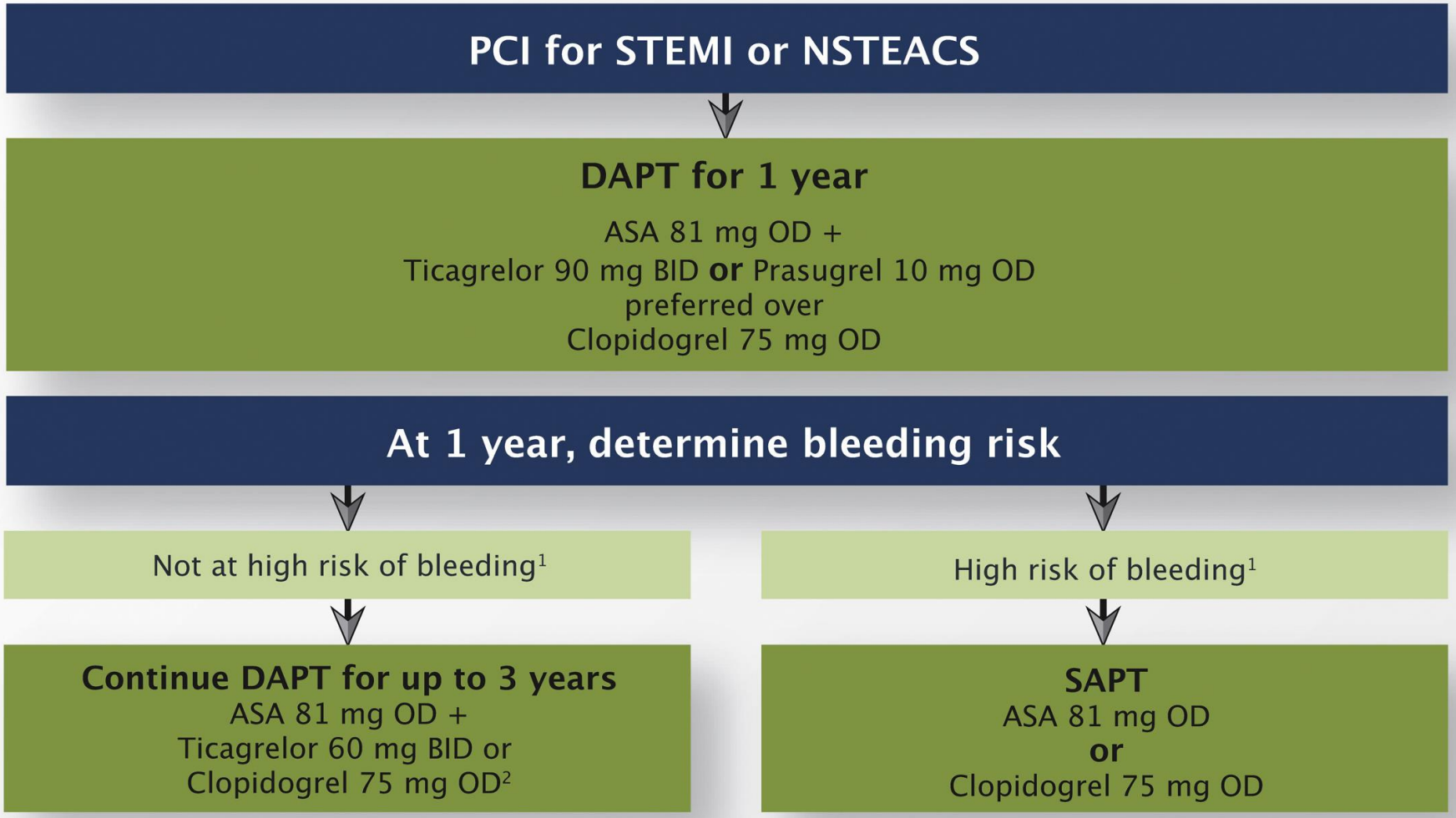
January 2, 2017











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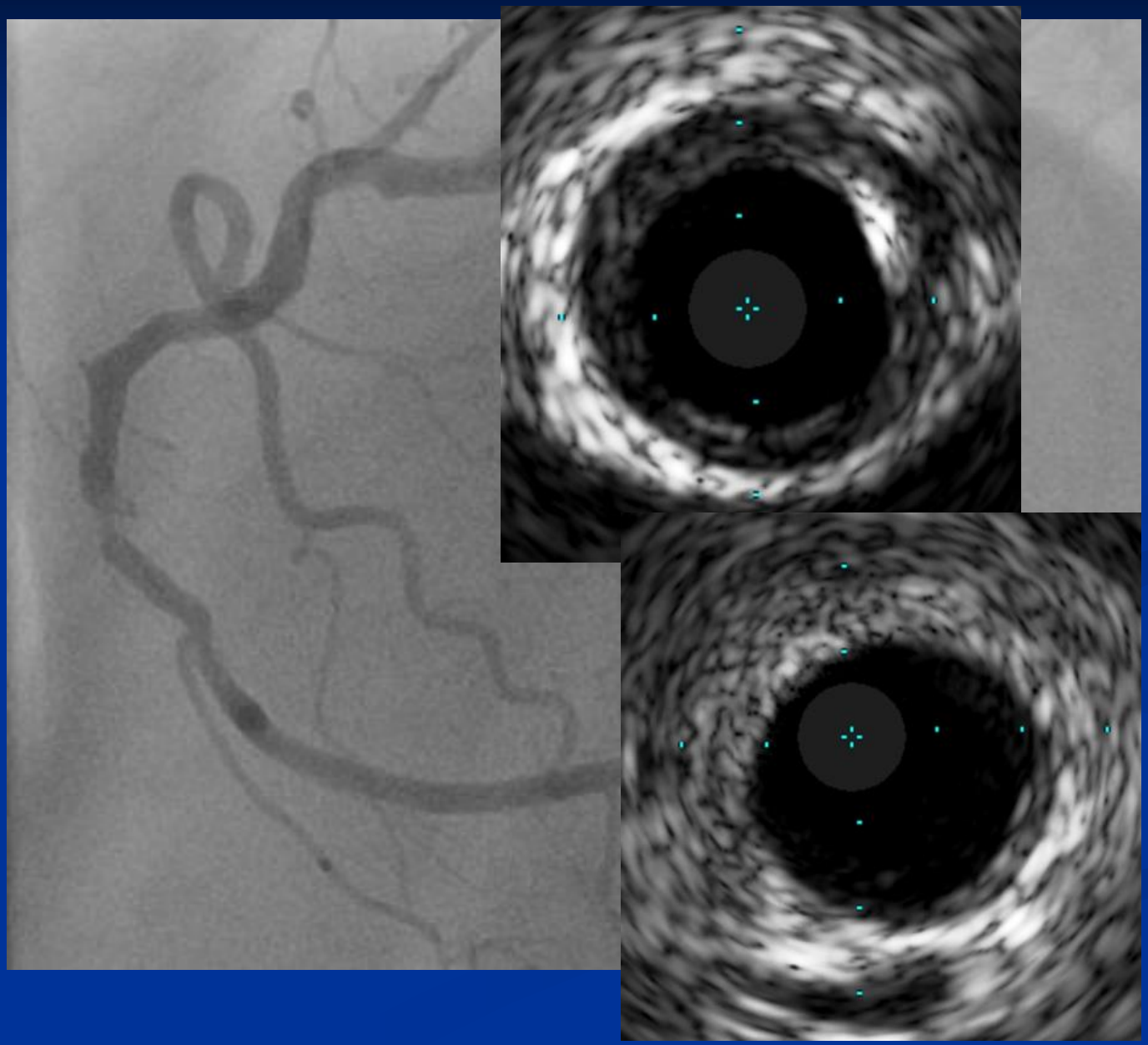
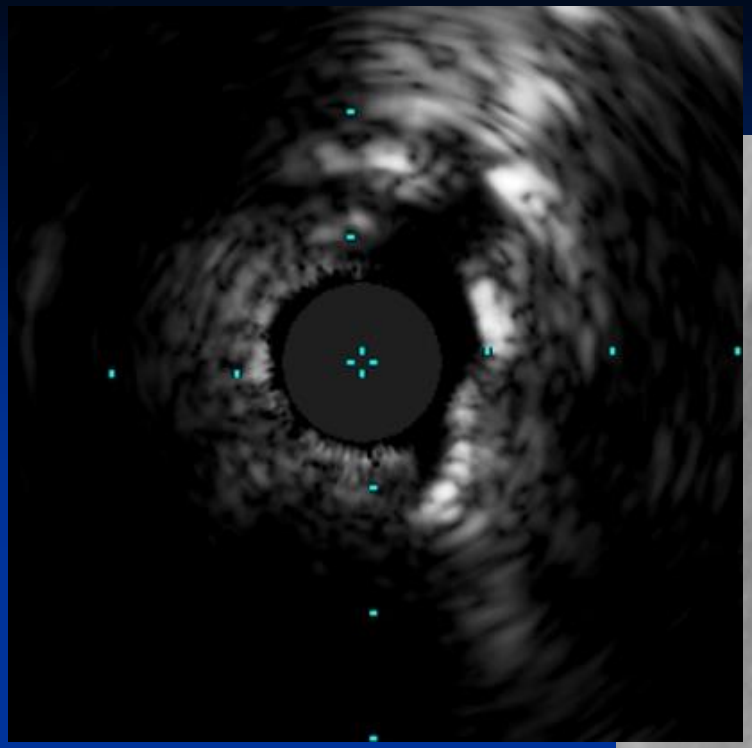
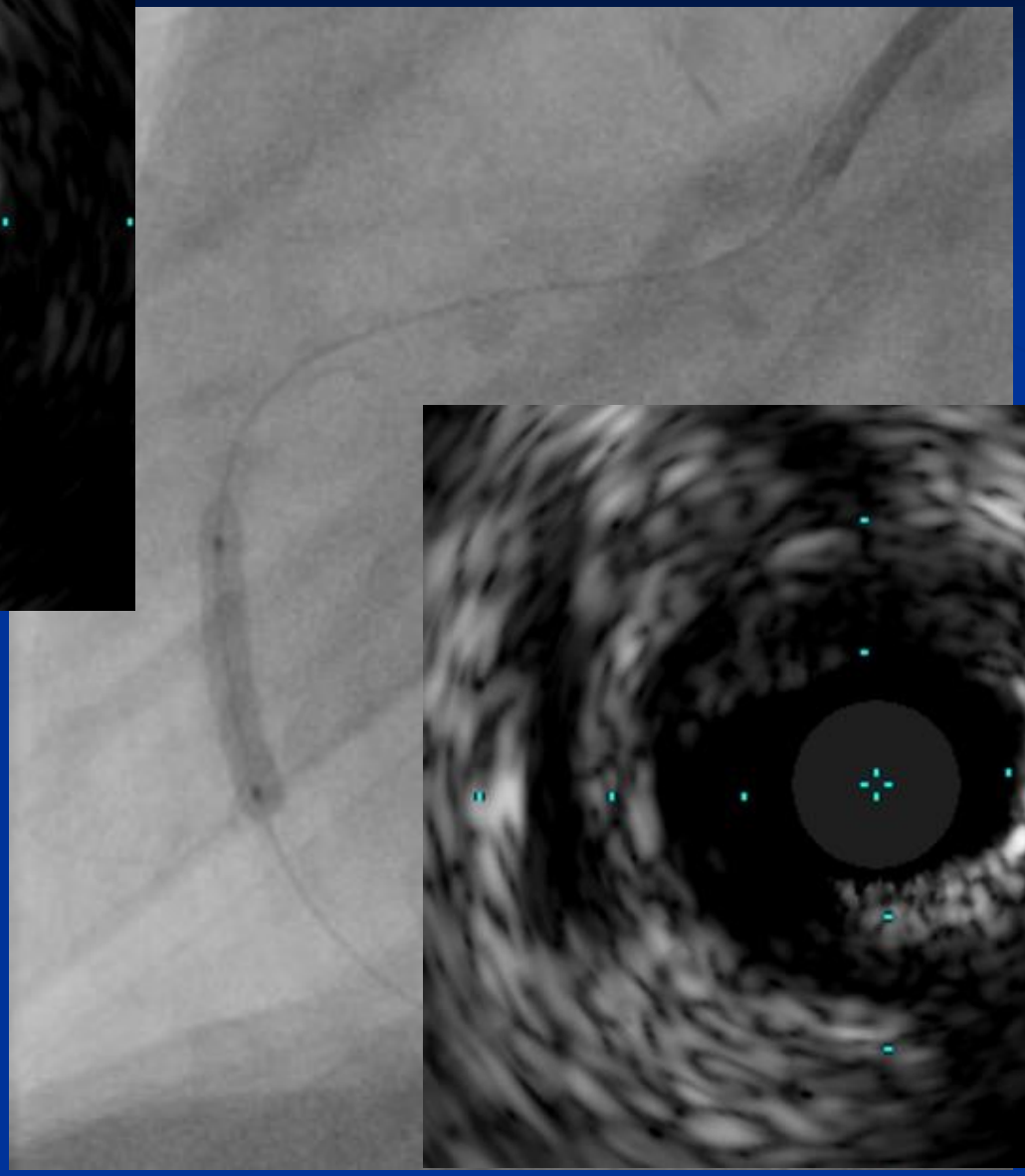
Elective PCI: some nuances



IVUS will not pass lesion

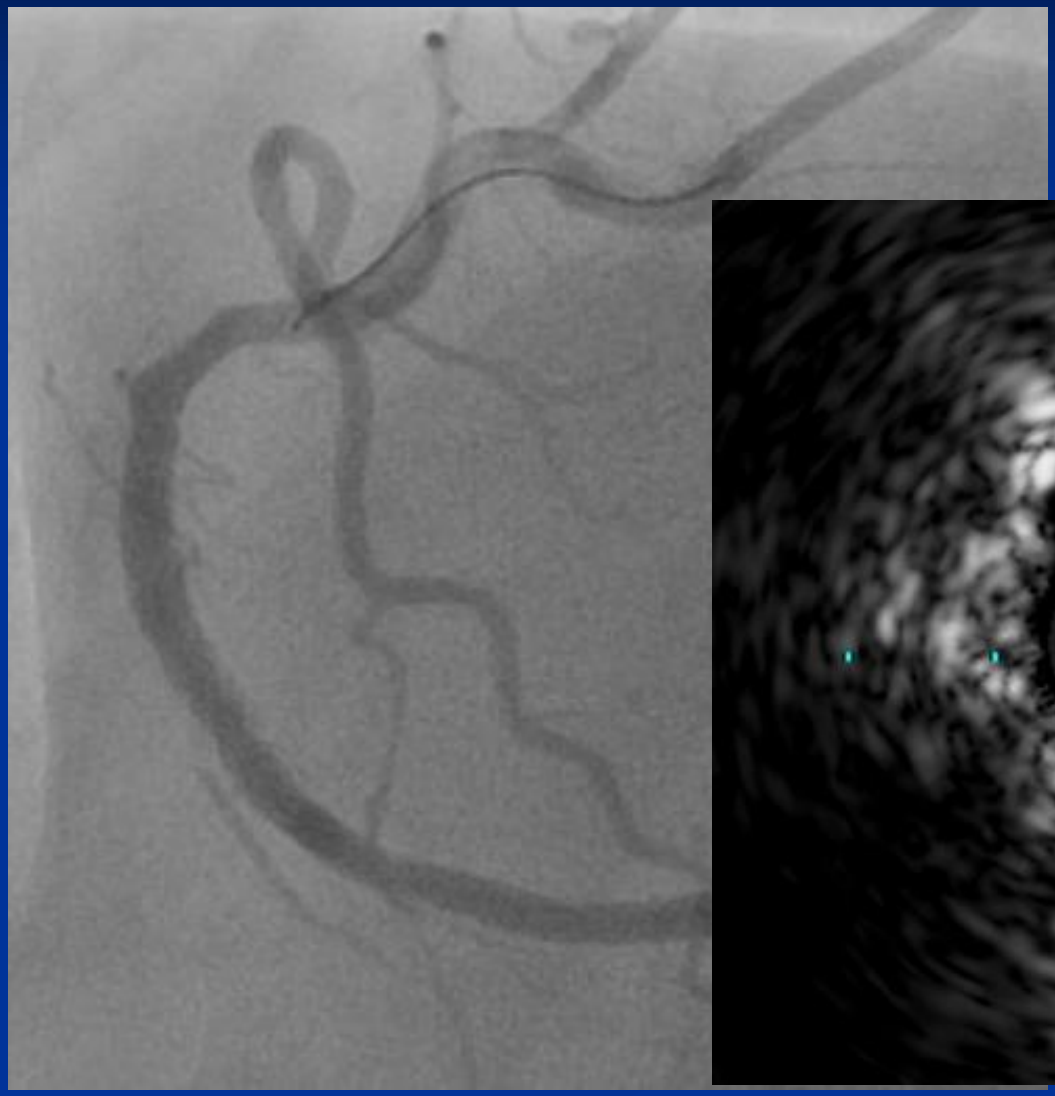
Reference diameter: 2.9mm



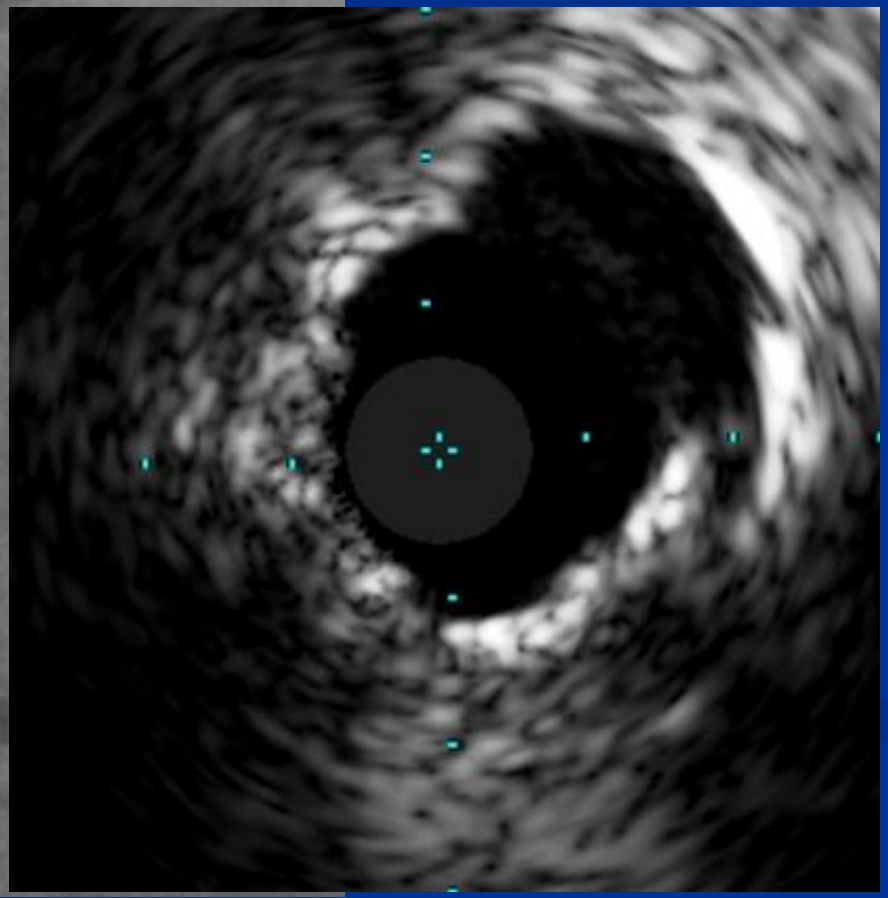


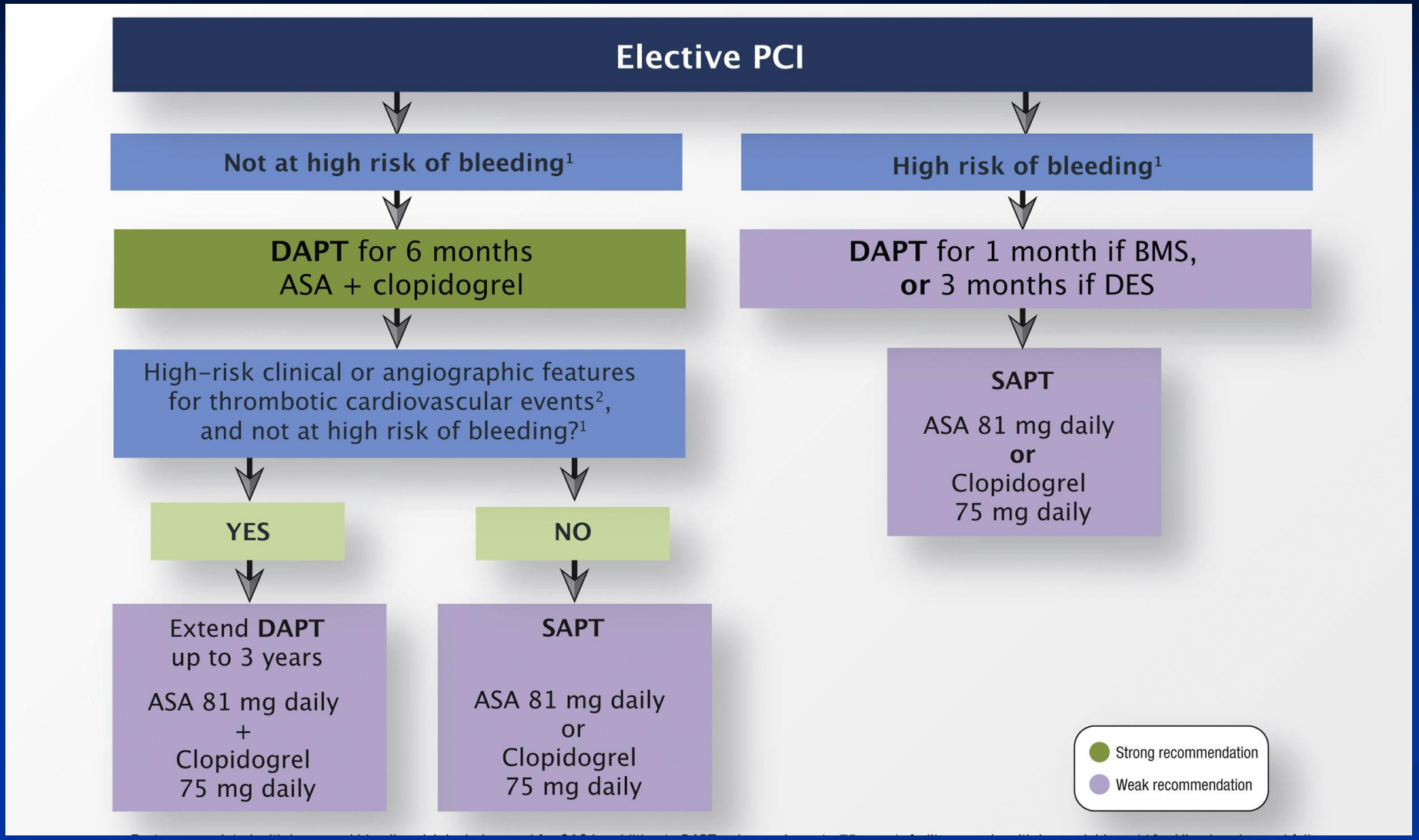
Pre-dilate with 3.0 noncompliant balloon, then re-check IVUS: dissections seen

After 3.5mm post-dilation @ 26 atm



6.2 mm^2





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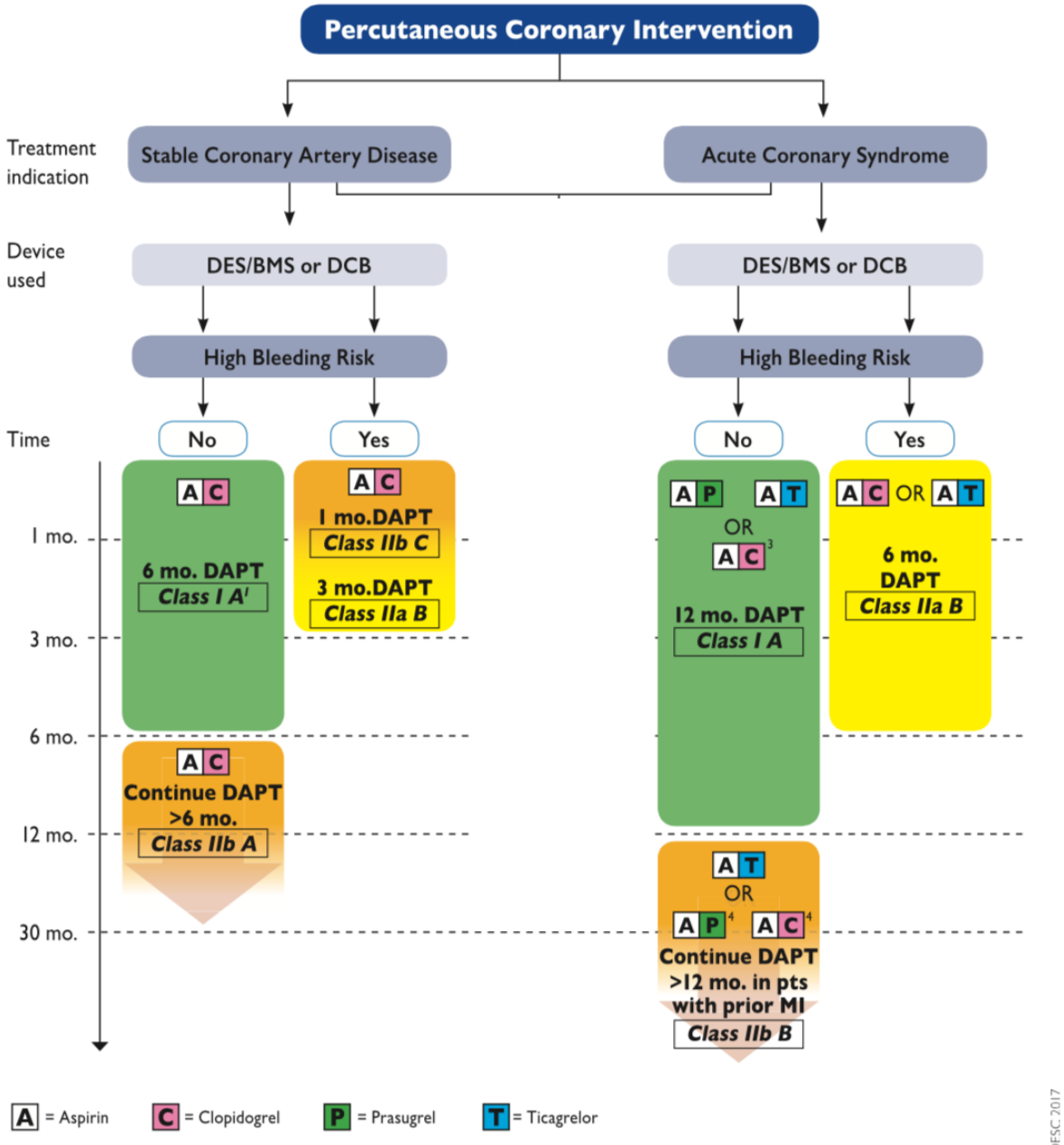

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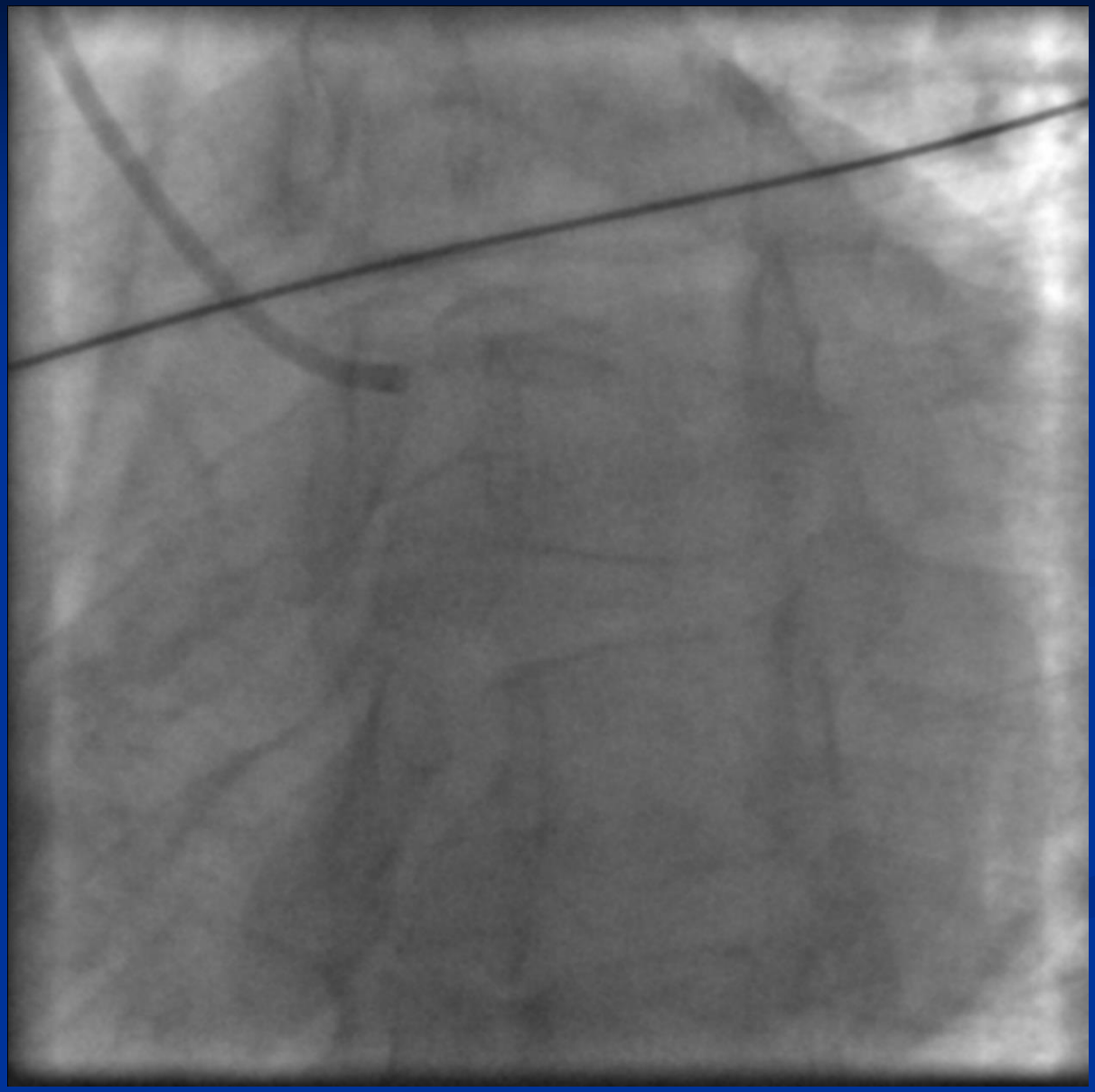
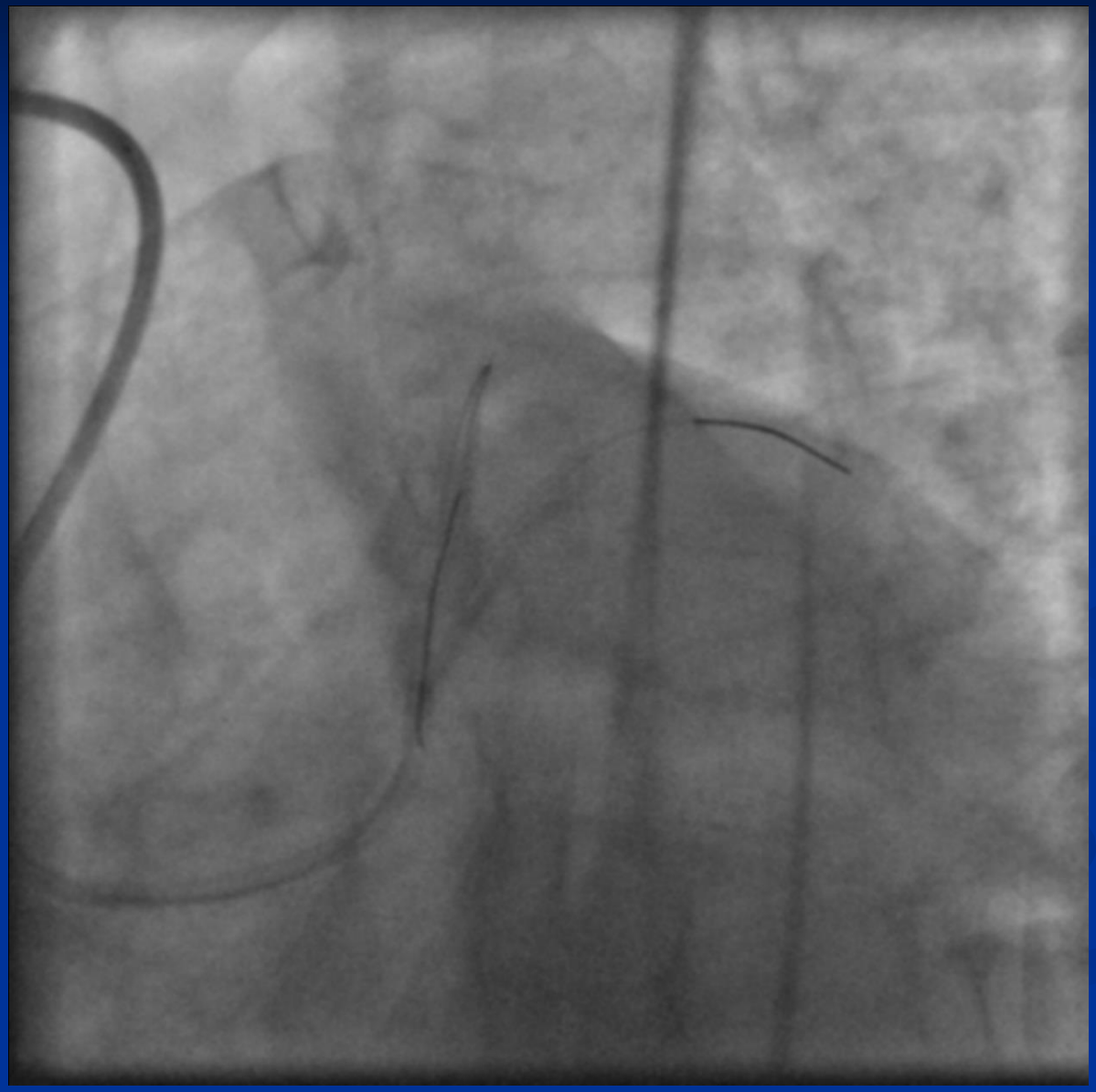
Acute anterior STEMI

In ED:
ASA 325
Ticagrelor 180 mg

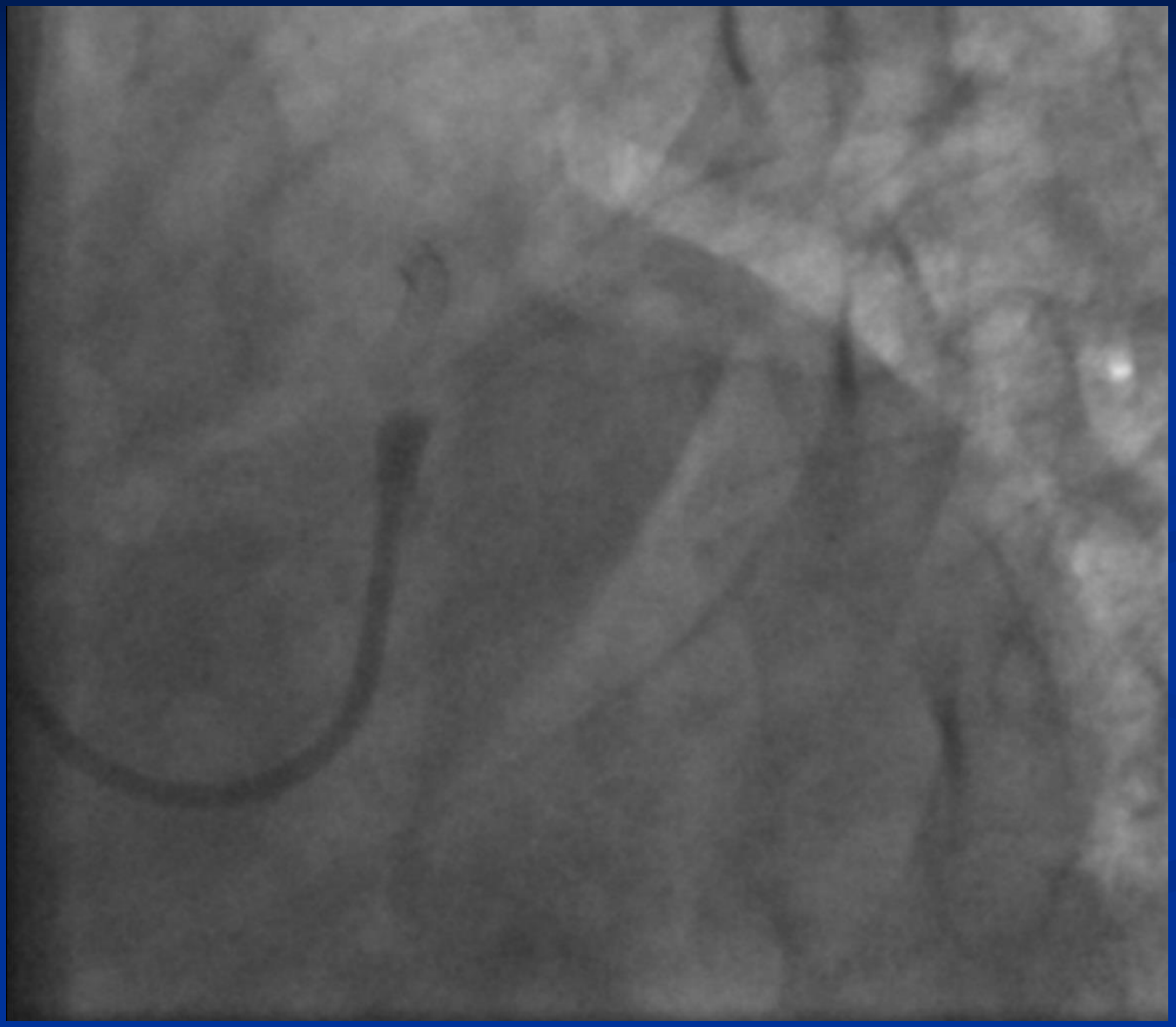
In Lab:
Bivaliruden



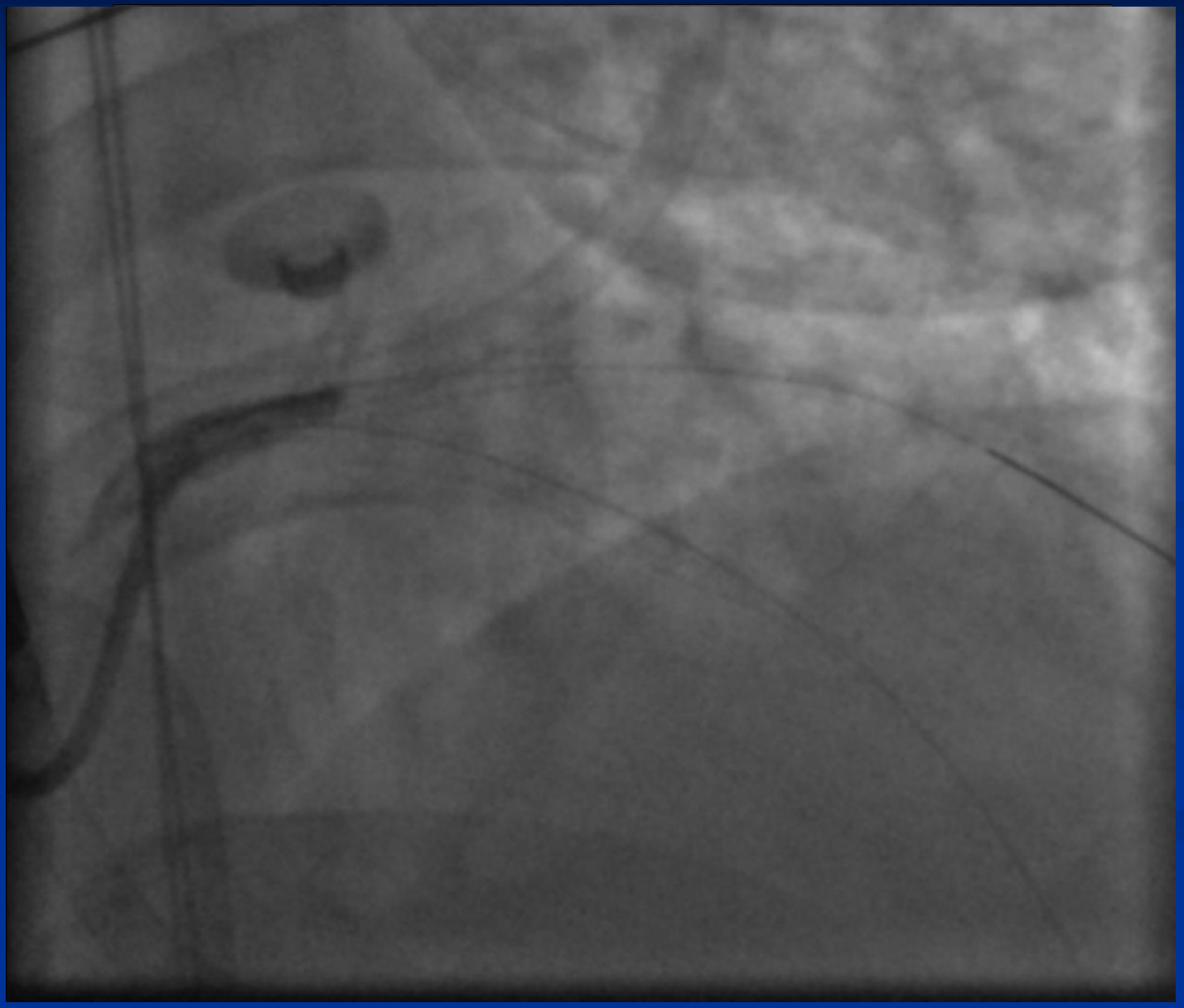
After DES to LAD and also of non-culprit D1



Four hours later: recurrent pain and shock

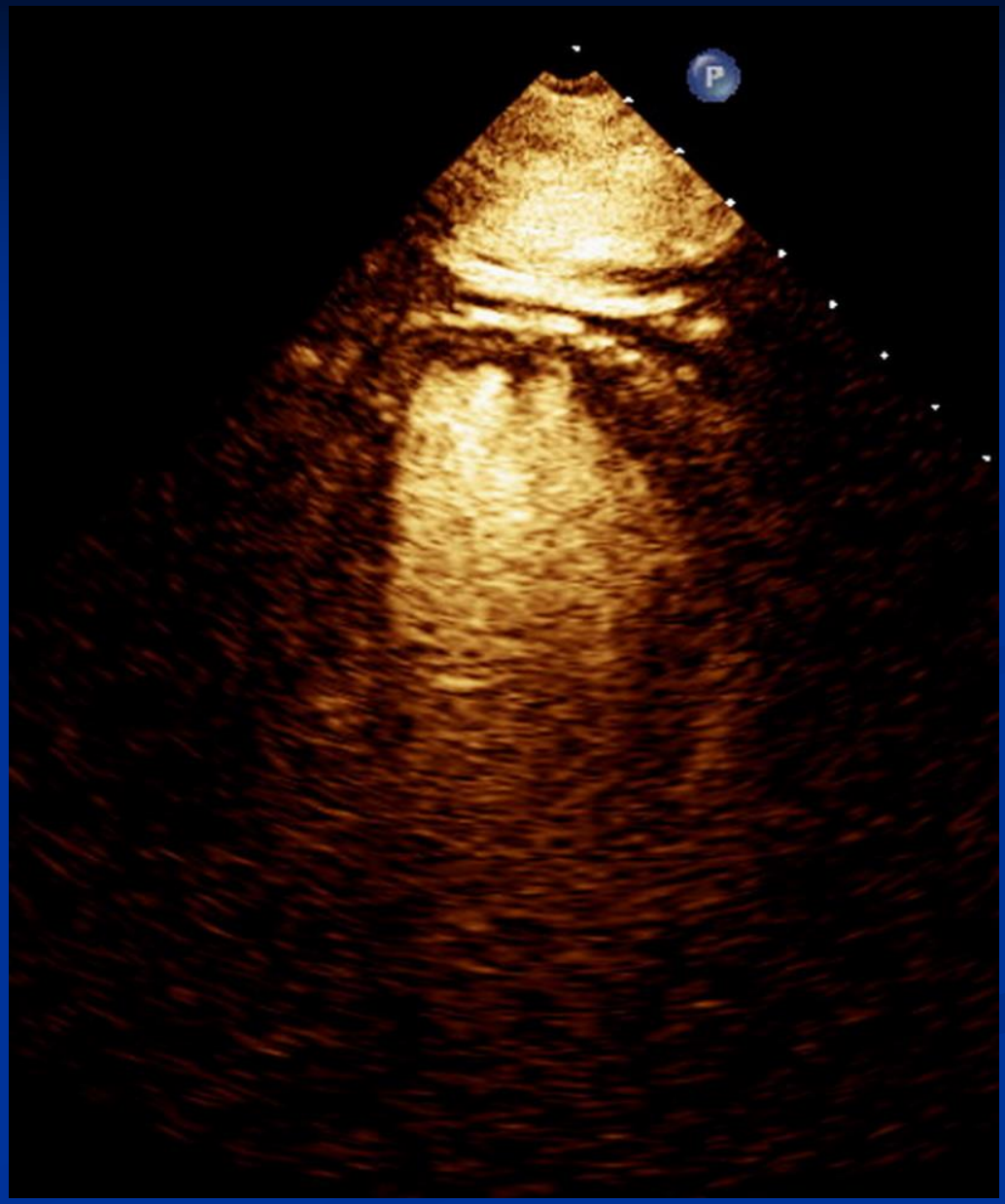


After Impella and re-opening



Persistent shock

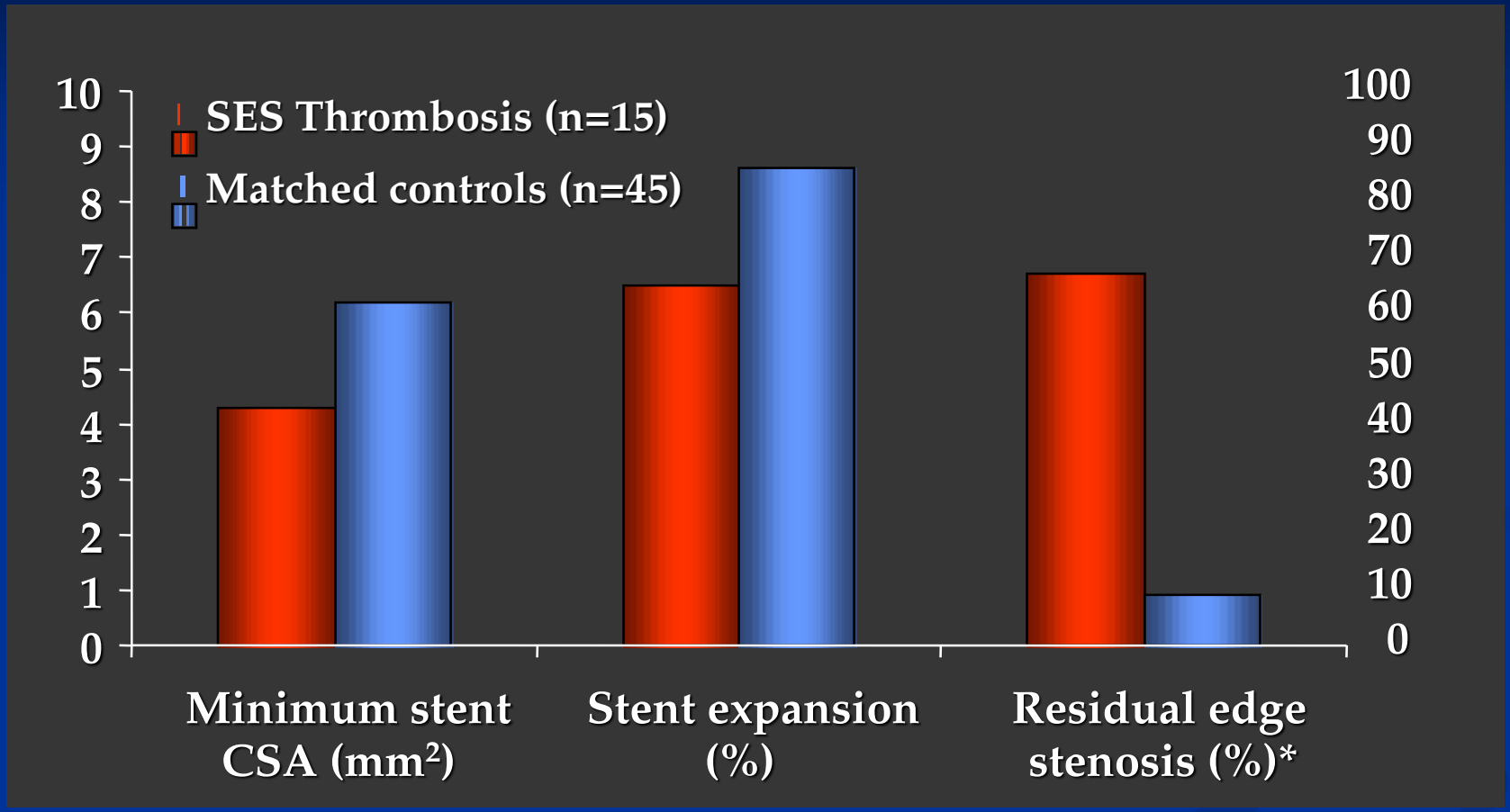
Upgrade to Impella 5L
Move to transplant center
Spent 10 days on Impella



What if my patient has stent thrombosis?

- Consider timing
- Acute: inadequate $P2Y_{12}$ level; mechanical stent issue
  - Solution: use "crush and chew" strategy; use IVUS guidance; use coverage with IIbIIIa inhibitor
- Subacute: ineffective $P2Y_{12}$; mechanical stent issue
  - Solution: upgrade to ticagrelor or prasugrel; use IVUS guidance
- Late: unclear
  - Recommendation: upgrade to ticagrelor or prasugrel; use IVUS guidance

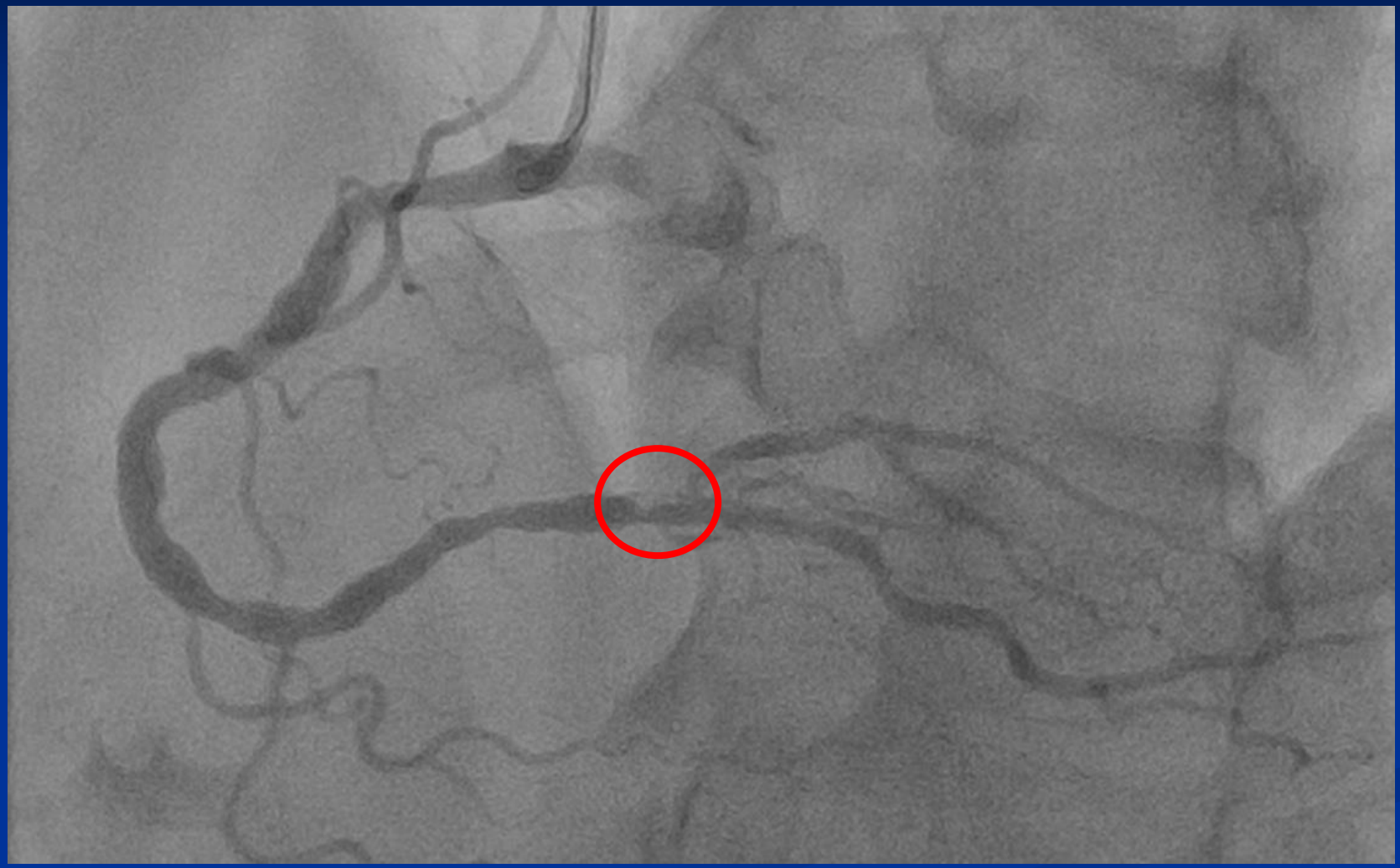
IVUS Predictors of DES Thrombosis (within 30 days)

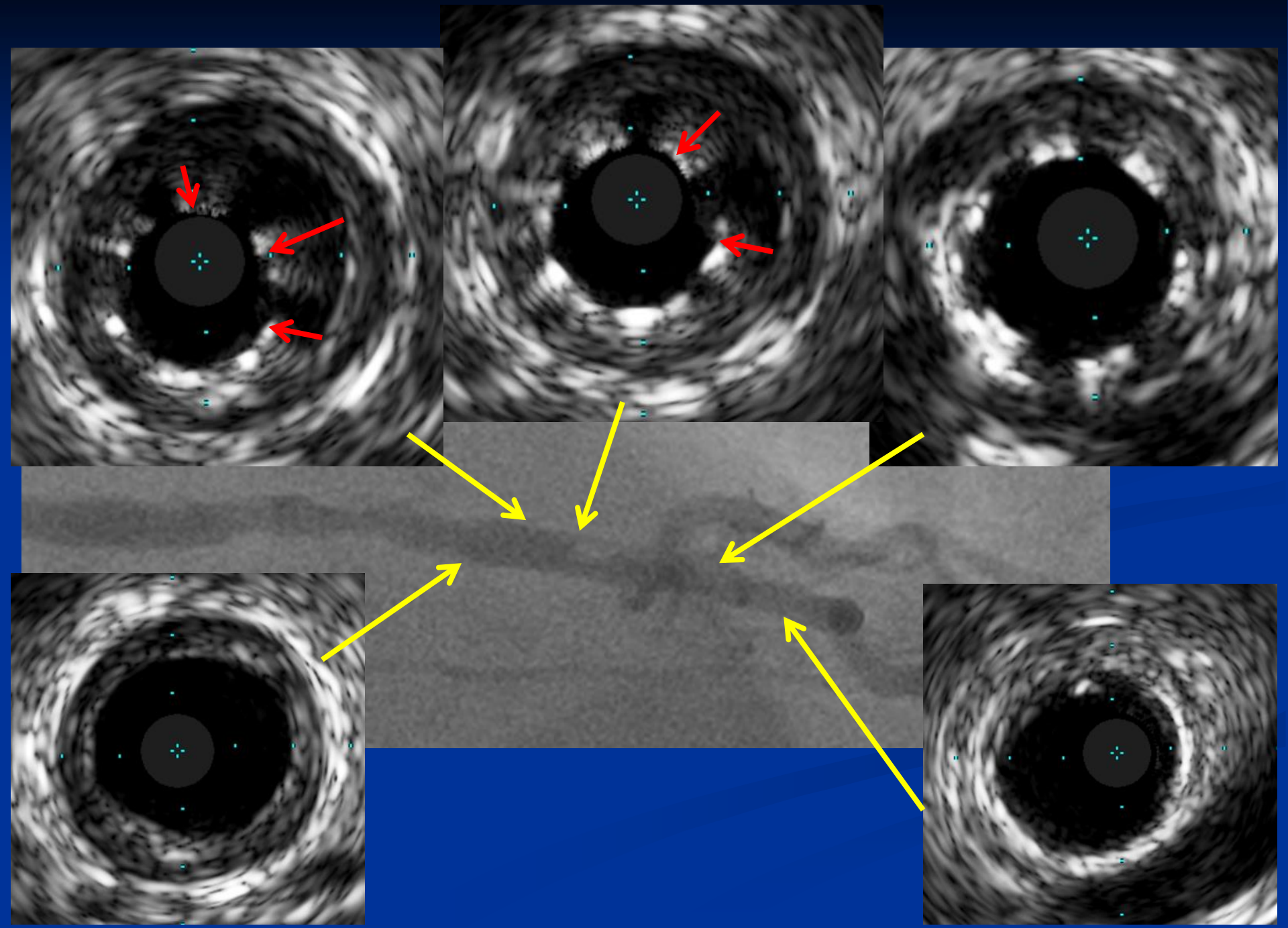


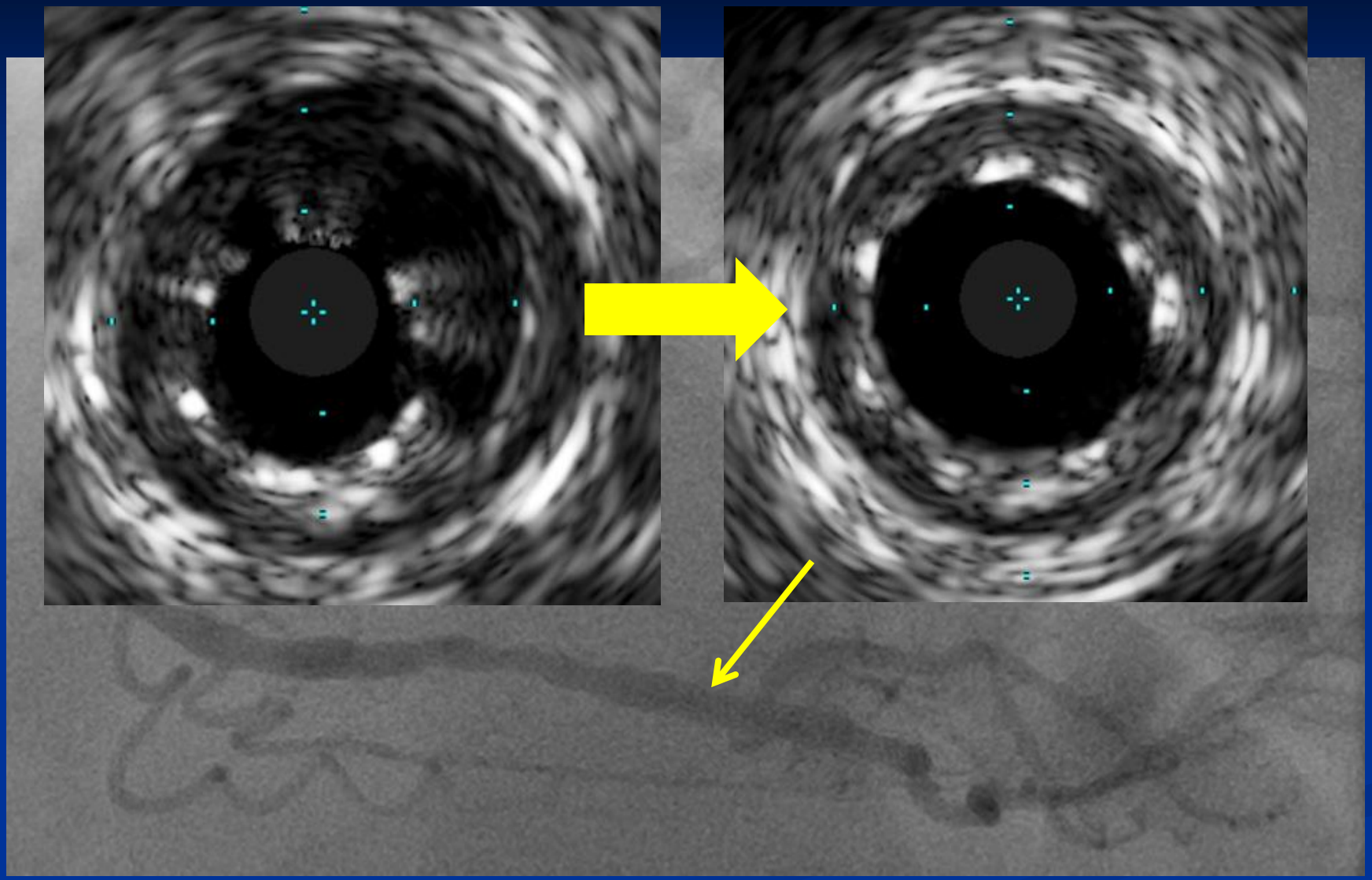
*Residual edge stenosis = edge lumen CSA <4.0mm² & plaque burden >70%.

(Fujii et al. J Am Coll Cardiol 2005;45:995-8)

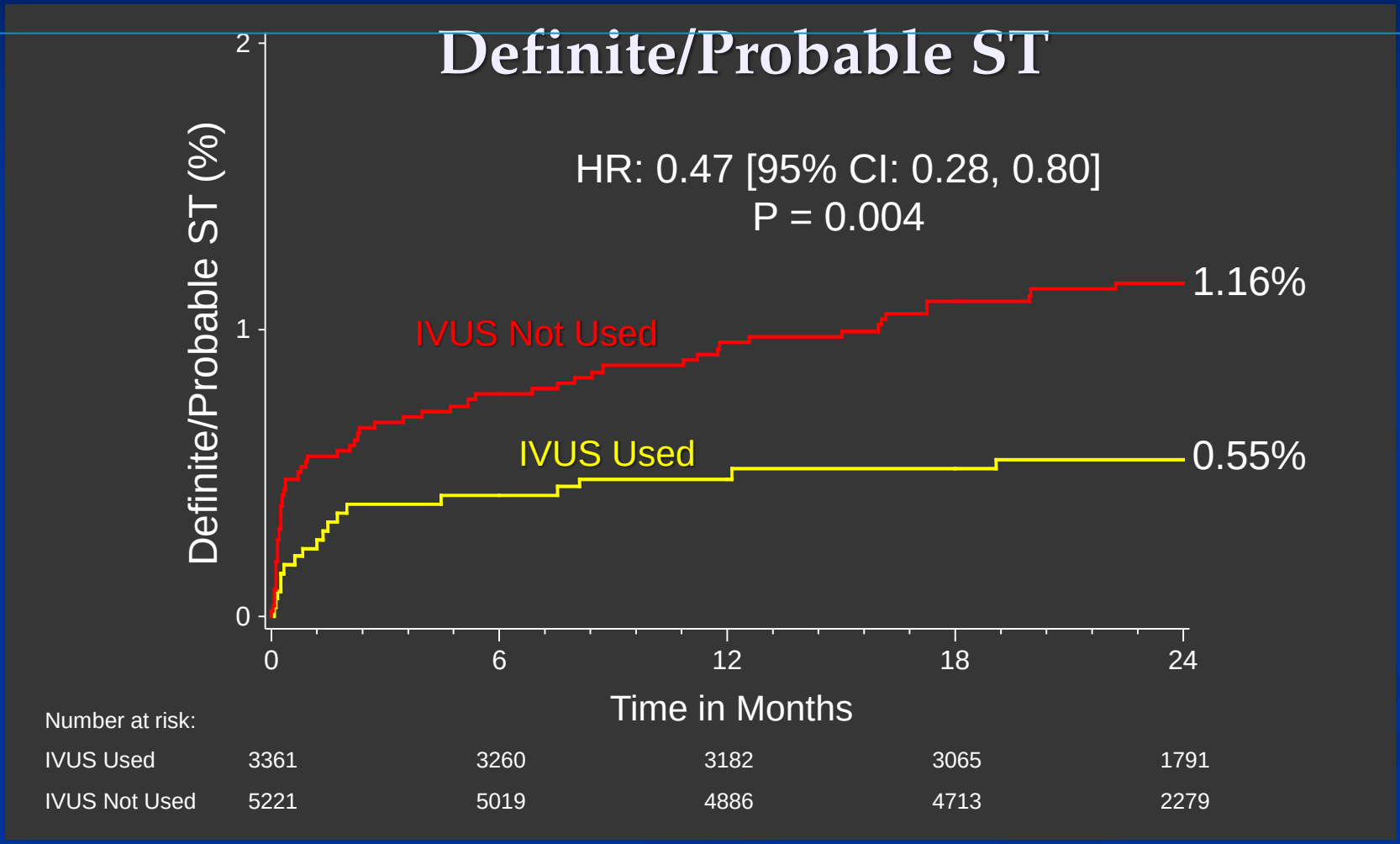
Mal apposition resulting in SAT







ADAPT-DES (3361 pts treated with IVUS-guidance vs 5221 pts treated with angiographic guidance)



Maehara et al. J Am Coll Cardiol 2013;62:B21-B22

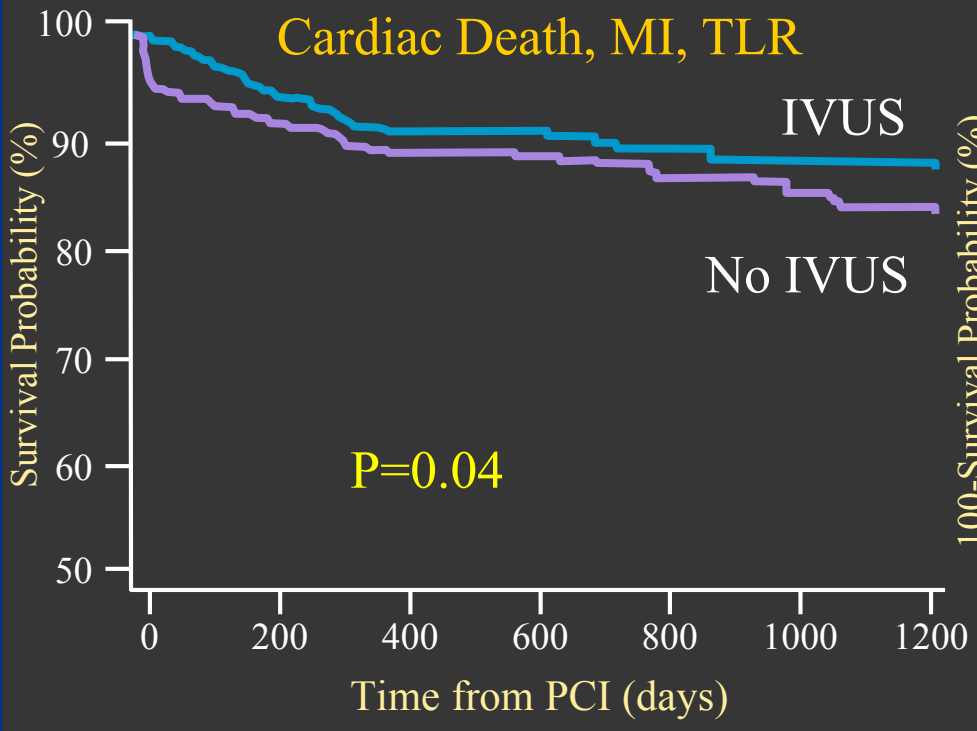
Target Lesion Stent Thrombosis at 2 Years

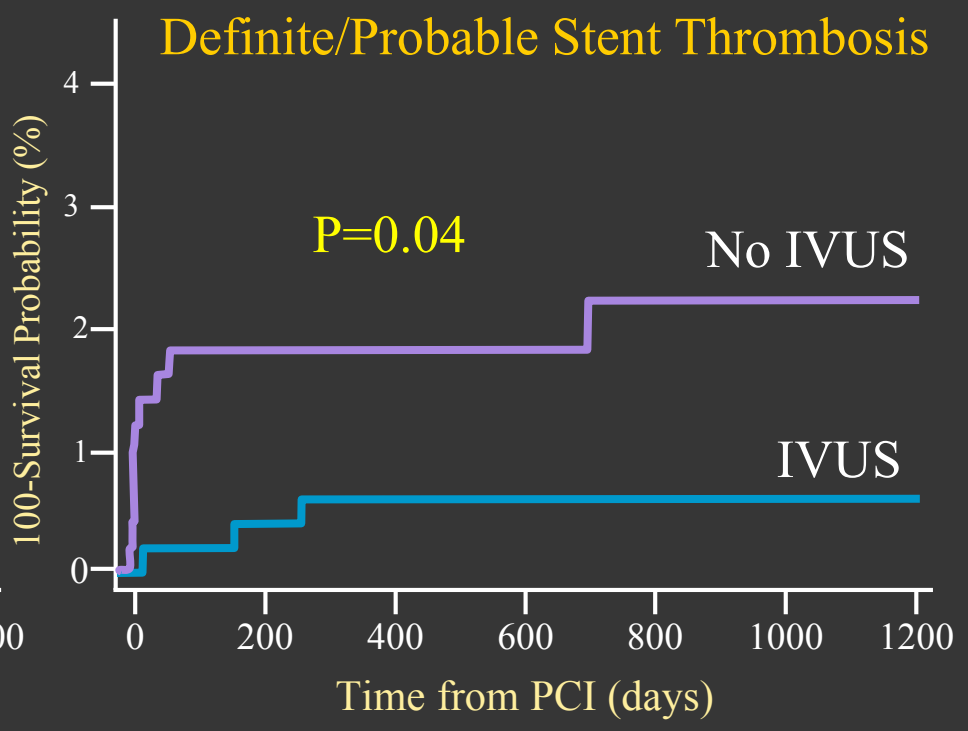
	IVUS Use n = 3361	No IVUS n = 5221	P Value
Definite ST	0.46% (15)	0.85% (43)	0.036
Definite/probable ST	0.55% (18)	1.16% (59)	0.004
- Acute <1day	0.00% (0)	0.04% (2)	0.26
- Subacute (1-30 days)	0.24% (8)	0.52% (27)	0.047
- Late (>30 days to 1 yr)	0.24% (8)	0.40% (20)	0.24
- Very late (1 yr to 2 yrs)	0.06% (2)	0.21% (10)	0.11

Maehara et al. J Am Coll Cardiol 2013;62:B21-B22

Impact of IVUS Guidance of Unprotected LM Propensity Matched 1010 pts in 4 Registries

- Distal LM lesion ~60%, 2 stent technique ~13%
- IVUS guidance was an independent predictor of MACE





De la Torre Hernandez et al. JACC Cardiovasc Interv 2014;7:244-54

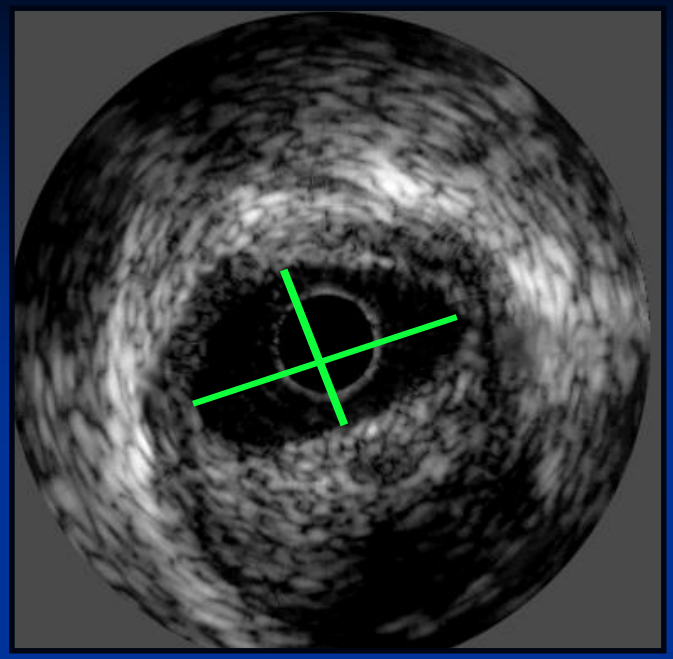
Post stent thrombosis: ESC suggests

- The number of recurrent events is significantly decreased by treatment with ticagrelor or prasugrel as compared to clopidogrel. Hence, the use of clopidogrel after stent thrombosis cannot be regarded as an effective treatment option.
- Considering the long-term risk of recurrence after first stent thrombosis, it may be reasonable to make every effort to maintain DAPT for a very long-term period in this highly selected high-risk patient population, if tolerated.

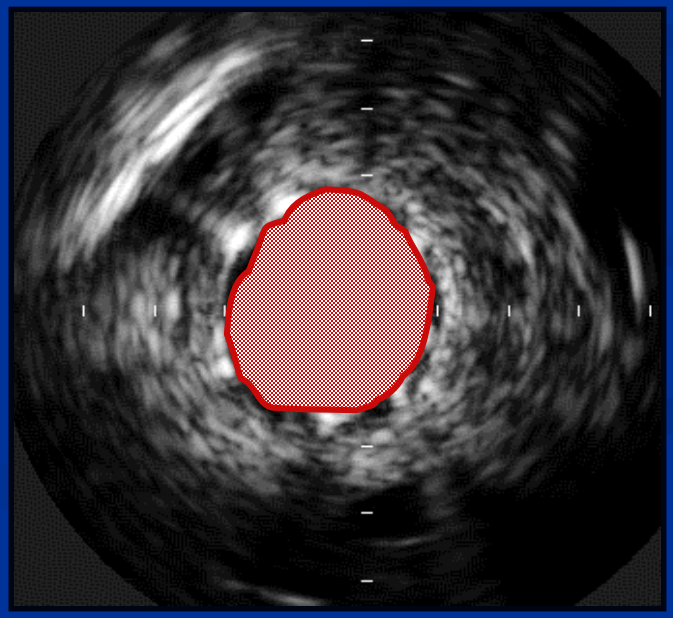
Eur Heart J 2018;39:213-254

Routine Stenting

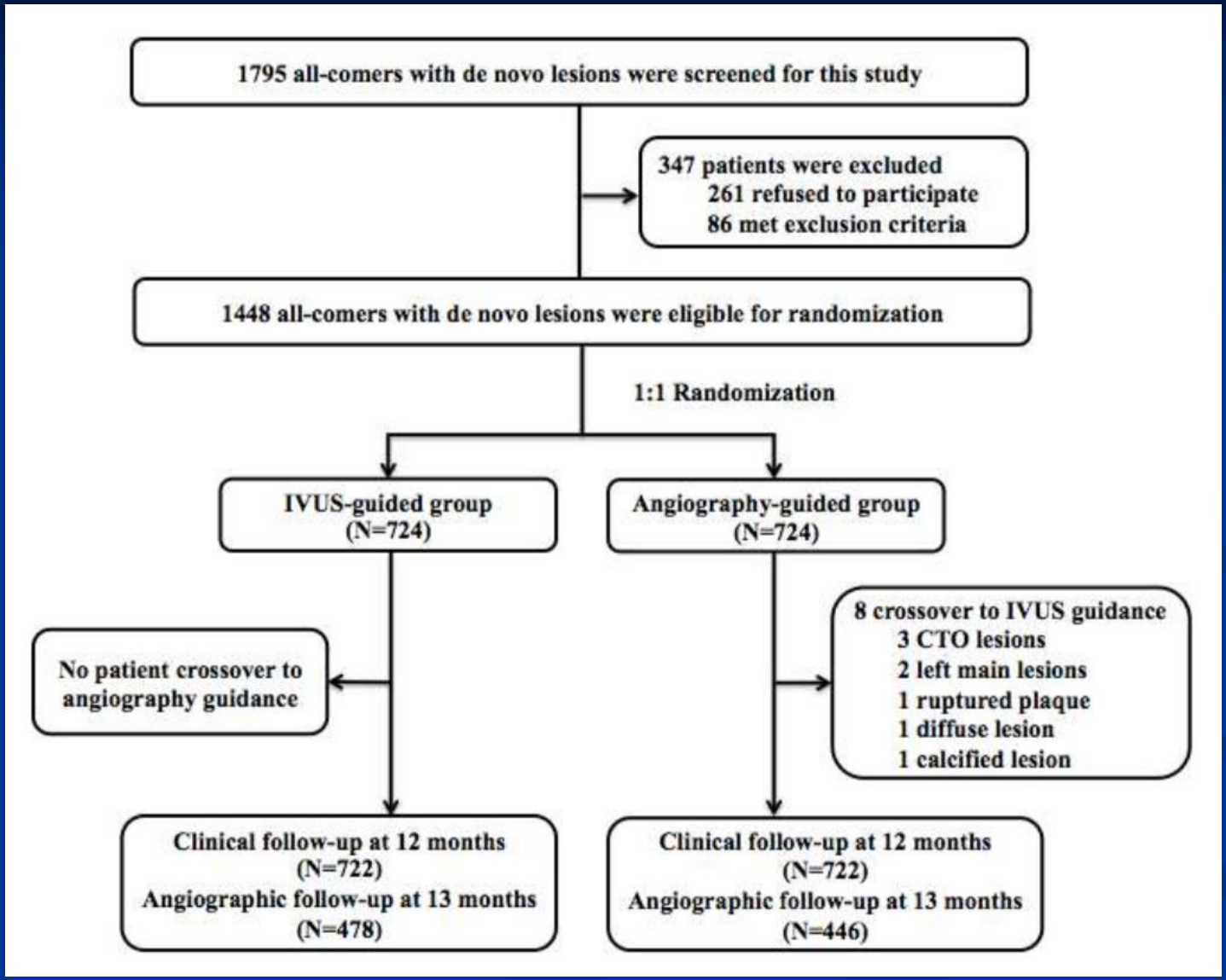
Stent size selection:
Reference lumen diameter
(package size)



Result optimization:
Stent lumen
cross sectional area
> 80% of reference
(Bernoulli)



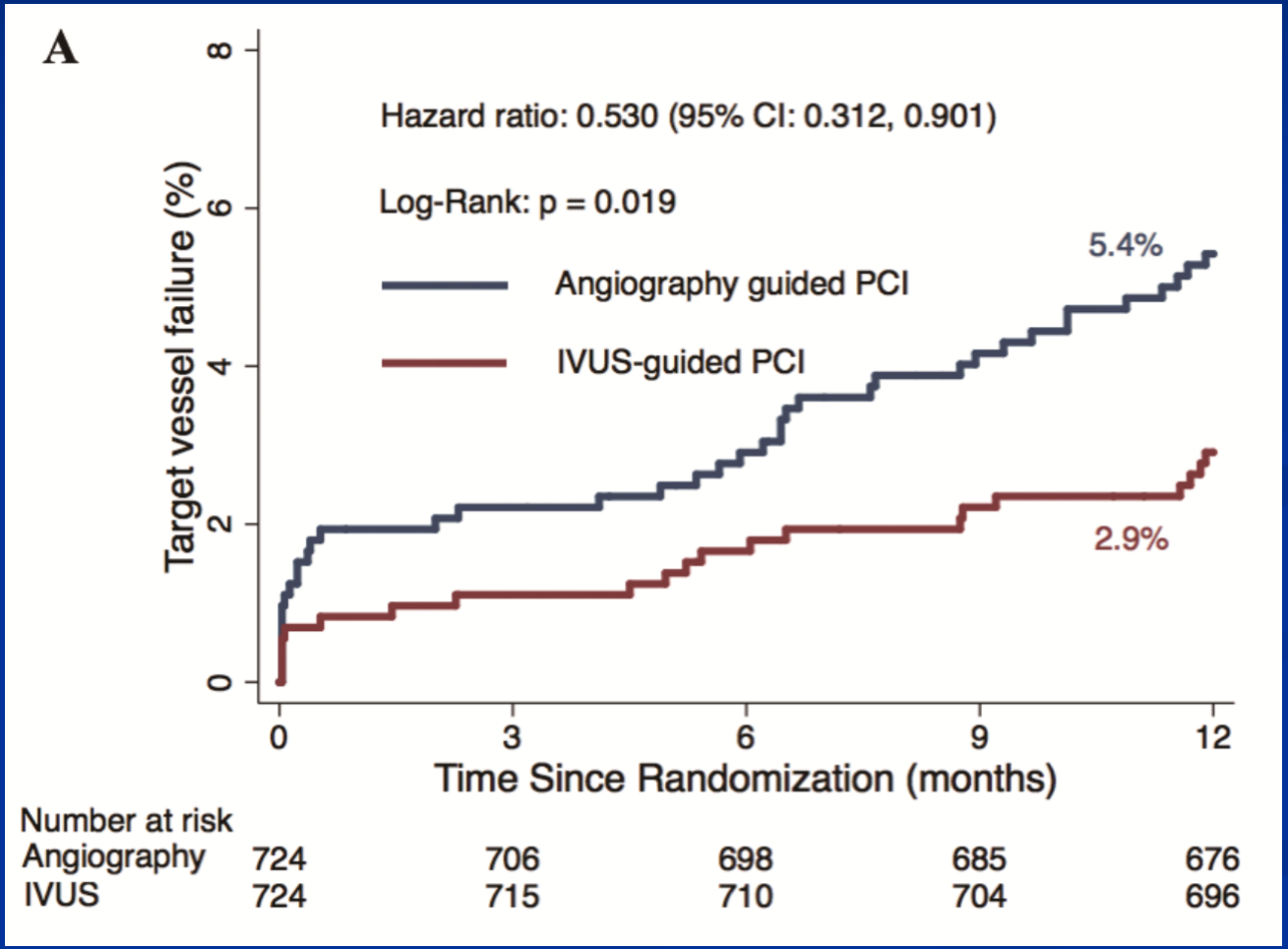
Ultimate trial: IVUS vs Angio Guidance of DES



JACC Intervent 2018; September: epub

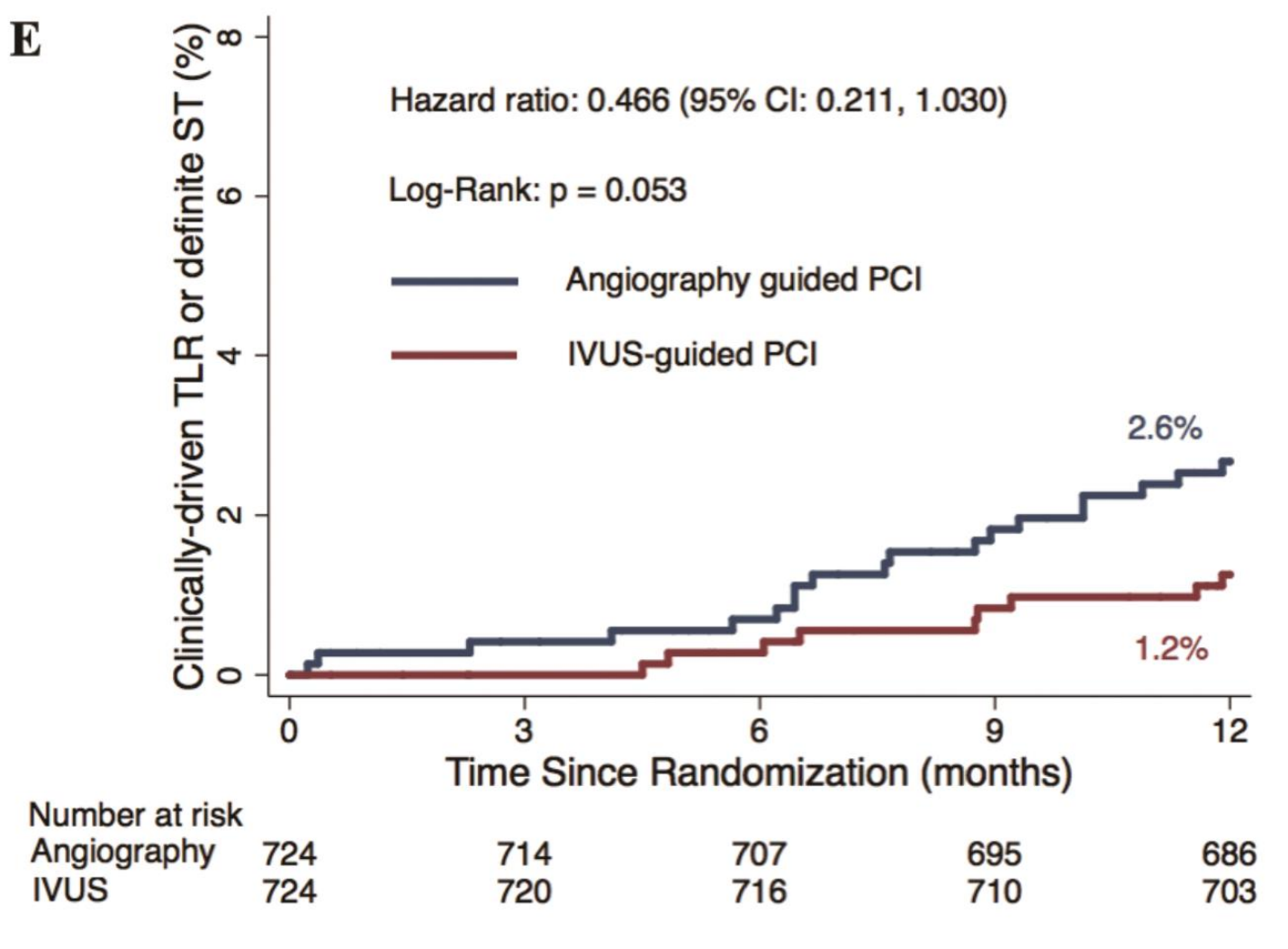
Ultimate: all comer population

Diameter: 67% B2/C, diameter 3 mm, length 50 mm, Post dilate to 19 atm



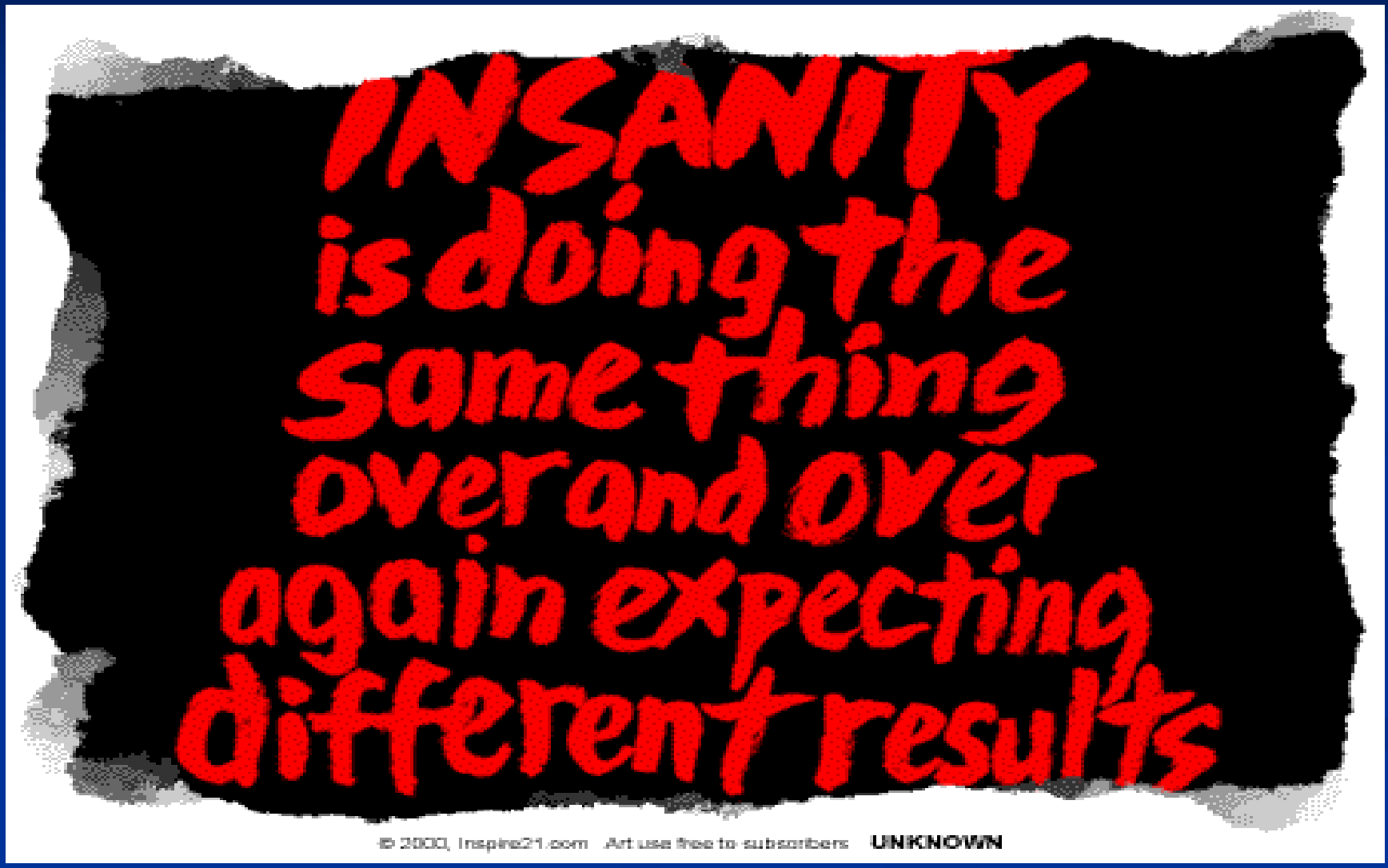
JACC Intervent 2018; September: epub

Of the 6 stent thrombosis cases, only 1 was IVUS guided:
Patient received 5 stents, 150mm, thrombosed @ 16 d



JACC Intervent 2018; September: epub

PCI without IVUS:



What if my patient also needs antithrombin therapy, or oral anticoagulants (OAC)

- Most common is atrial fibrillation
- Also applies to recent VTE, heart valves
- Key is to assess both bleeding and thrombosis risk and then craft a strategy that will allow discontinuing “triple therapy” at the earliest possible safe interval.
- Consider new “low dose” OAC combinations
- Risk estimating scores must be utilized.

Triple therapy: DAPT and OAC

Table 6 **Unfavourable patient profile for a combination of oral anticoagulant and antiplatelet therapy**

• Short life expectancy
• Ongoing malignancy
• Poor expected adherence
• Poor mental status
• End stage renal failure
• Advanced age
• Prior major bleeding/prior haemorrhagic stroke
• Chronic alcohol abuse
• Anaemia
• Clinically significant bleeding on dual antithrombotic therapy

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Table 4 **Strategies to avoid bleeding complications in patients treated with oral anticoagulant**

• Assess ischaemic and bleeding risks using validated risk predictors (e.g. CHA_2DS_2-VASc, ABC, HAS-BLED) with a focus on modifiable risk factors.
• Keep triple therapy duration as short as possible; dual therapy after PCI (oral anticoagulant and clopidogrel) to be considered instead of triple therapy.
• Consider the use of NOACs instead of VKA.
• Consider a target INR in the lower part of the recommended target range and maximize time in therapeutic range (i.e. > 65–70%) when VKA is used.
• Consider the lower NOAC regimen tested in approval studies and apply other NOAC regimens based on drug-specific criteria for drug accumulation.[a]
• Clopidogrel is the $P2Y_{12}$ inhibitor of choice.
• Use low-dose (≤ 100 mg daily) aspirin.
• Routine use of PPIs.

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Table 4. Dual pathway and triple therapy regimens evaluated in clinical trials

Dual pathway

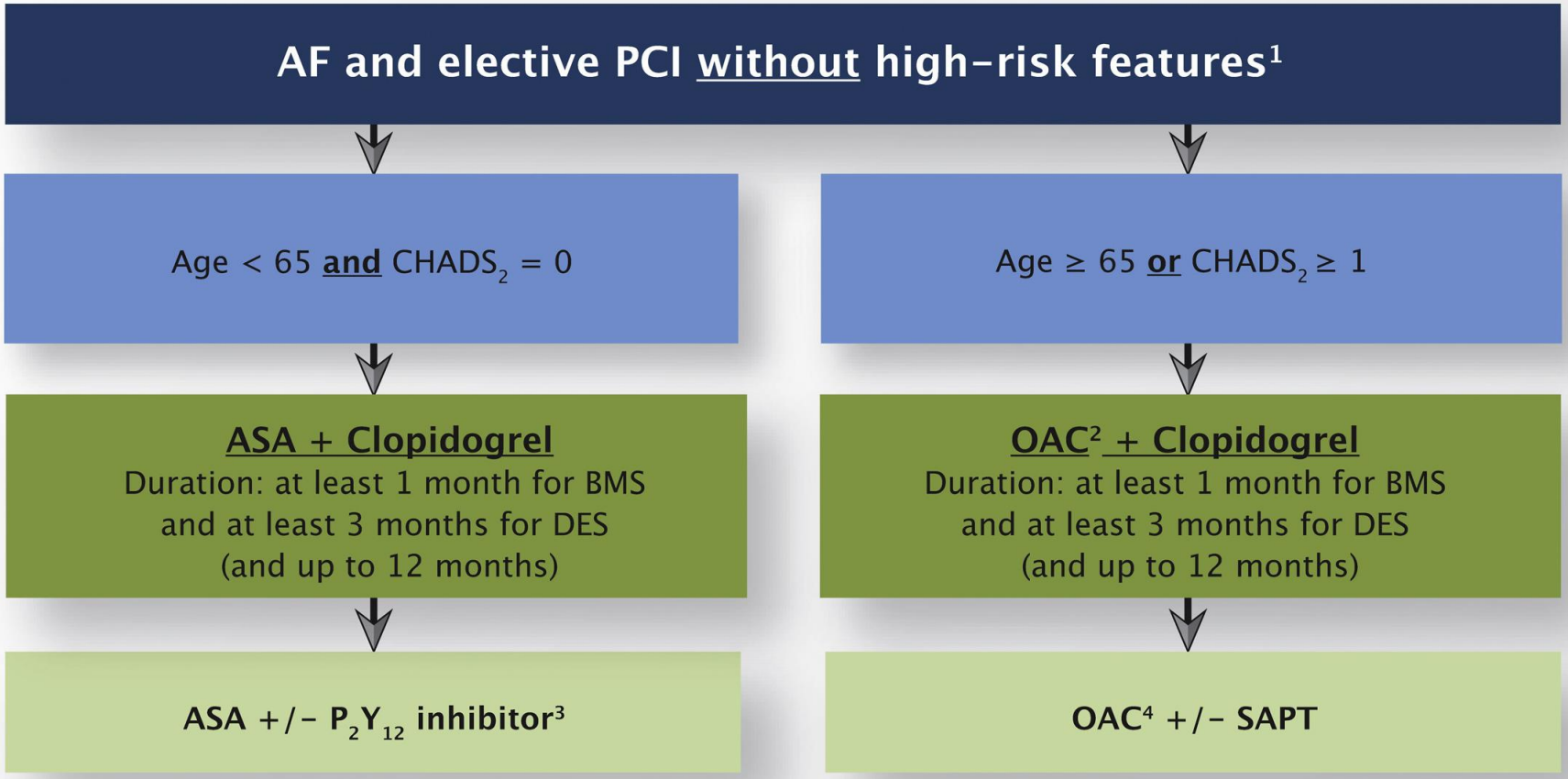
1. Rivaroxaban 15 mg OD with clopidogrel 75 mg OD[99]
2. Dabigatran 110* or 150 mg BID with clopidogrel 75 mg OD[101]
3. Warfarin with clopidogrel 75 mg OD[97]

Triple therapy

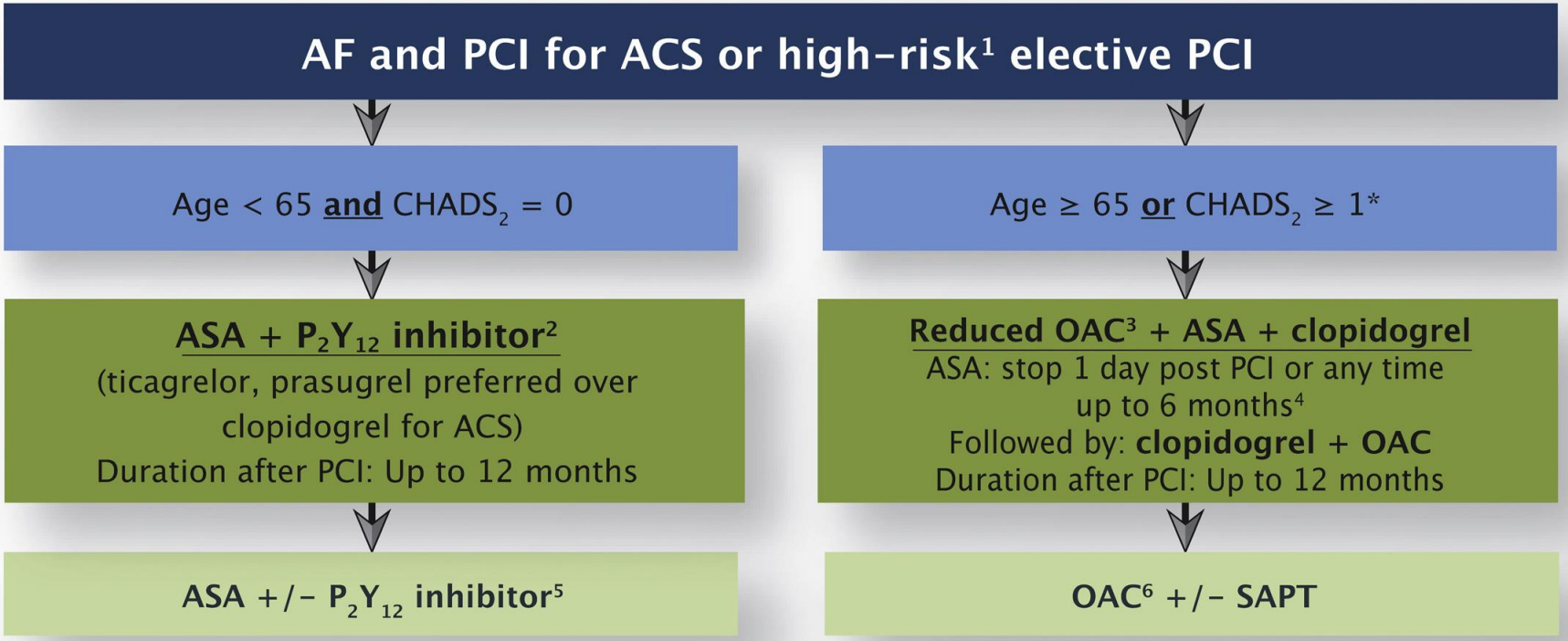
1. Rivaroxaban 2.5 mg BID with ASA 81 mg OD and clopidogrel 75 mg OD[99]
2. Warfarin (INR, 2.0-2.5) with ASA 81 mg OD and clopidogrel 75 mg OD[98]

ASA, acetylsalicylic acid; BID, twice daily; INR, international normalized ratio; OD, every day.

Canadian Journal of Cardiology 2018 34, 214-233DOI: (10.1016/j.cjca.2017.12.012)

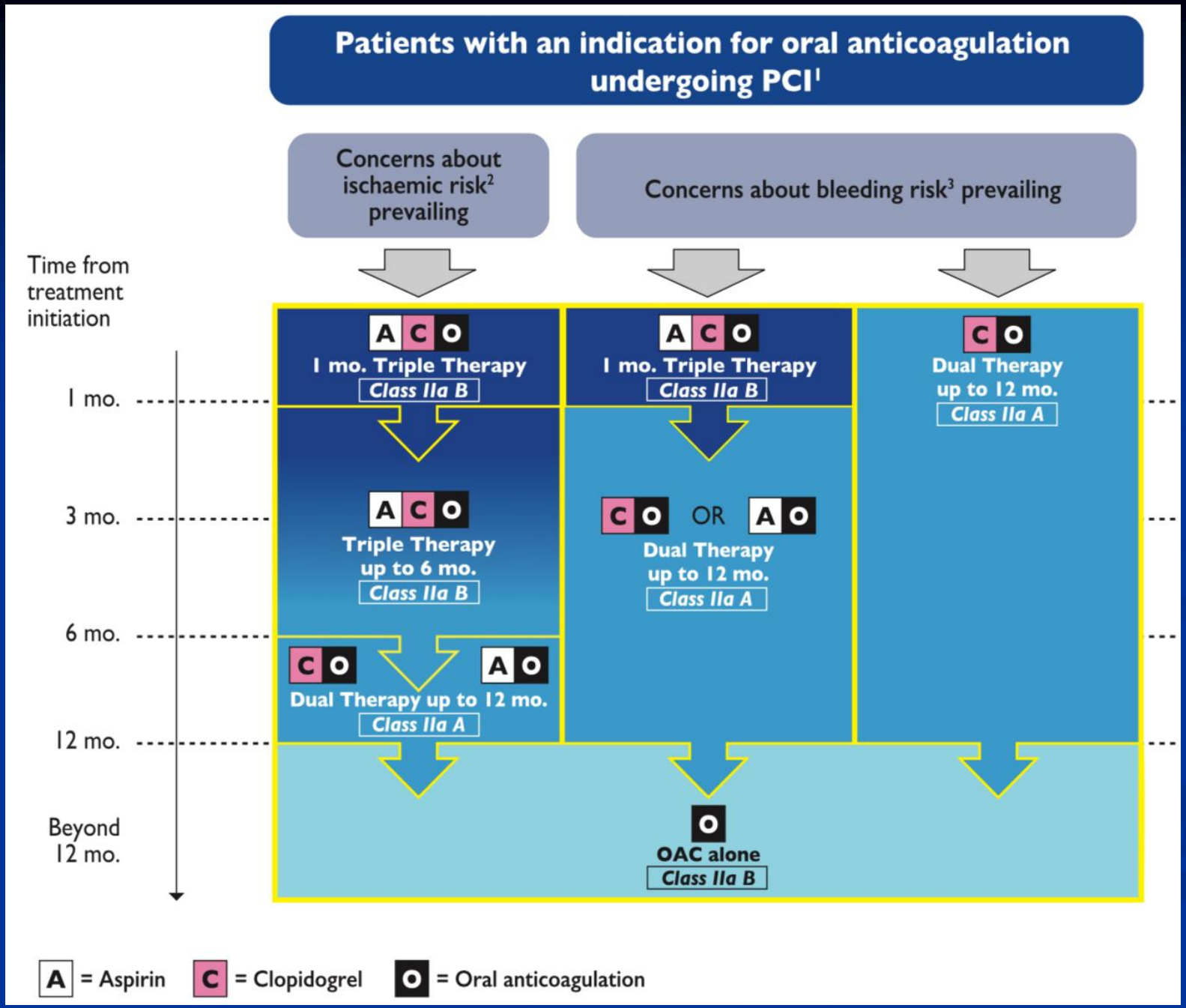


Canadian Journal of Cardiology 2018 34, 214-233DOI: (10.1016/j.cjca.2017.12.012)



*If CHADS2 =1 and Age< 65 another option for initial treatment (especially if high-risk for ischemic events) is DAPT alone using ASA+ticagrelor or ASA+prasugrel, similar to the recommendation for the CHADS2=0 patient

Canadian Journal of Cardiology 2018 34, 214-233DOI: (10.1016/j.cjca.2017.12.012)



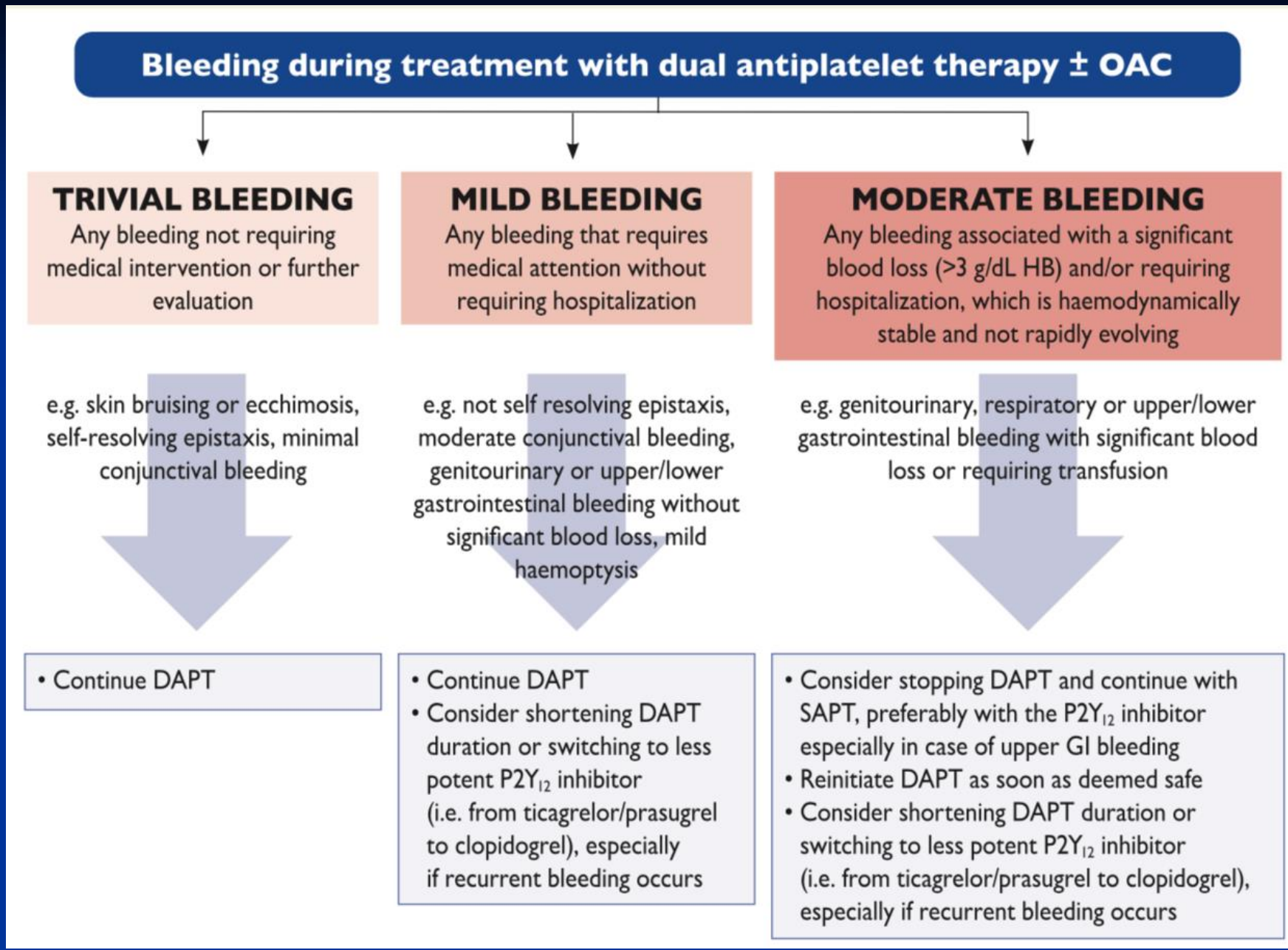
Eur Heart J 2018;39:213-254

Triple therapy: key takeaways

- Always calculate risk scores
- P2Y12 is always Clopidogrel
- ASA is always 81mg
- PPI should be used
- If ischemia risk > bleeding risk use triple therapy for 3-6 months
- If bleeding risk > ischemia risk use one month triple therapy
- De-escalate by removing ASA

What if my patient bleeds?

- Specific details matter:
  - Clinical indication for stent: stable or ACS
  - Type of stent: DES or BMS
  - How severe is bleeding
  - What are the risk scores
- Let's process two examples



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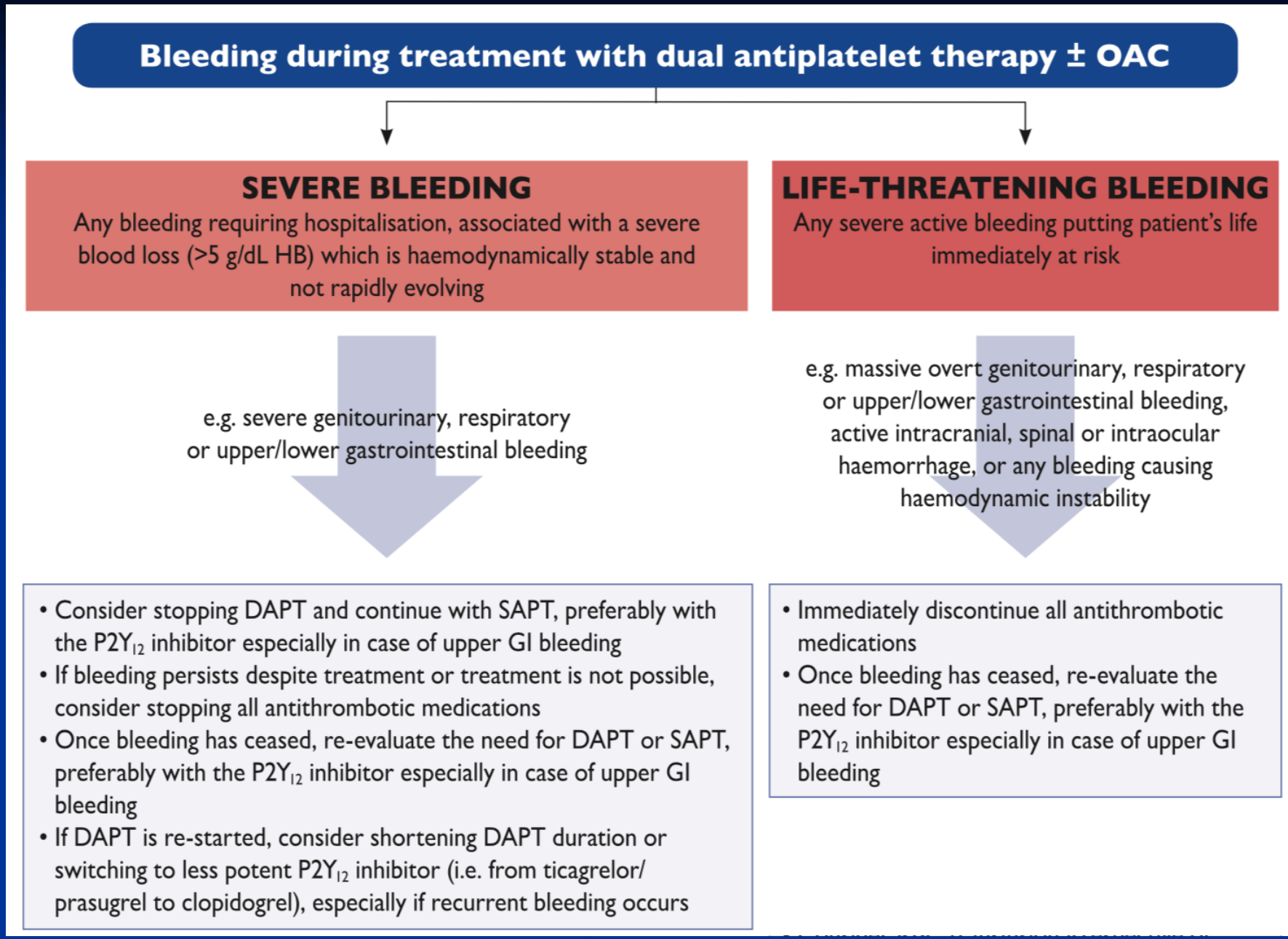

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Case Example 1

- 50 yo man presents with anterior STEMI
- Acute PCI performed with DES to proximal LAD with TIMI II-III flow post; no IVUS
- EF 30% acutely
- Smoker, DM, HBg 13.5, WBC 8.5, Creat 0.8

(GFR =90)

- NSR, no prior bleed or TIA/CVA
- Discharged on Ticagerlor and ASA
- No PPI prescribed

TABLE 4 Clinical and Procedural Factors Associated With Increased Ischemic Risk (Including Stent Thrombosis) or Increased Bleeding Risk (62-70)

Increased Ischemic Risk/Risk of Stent Thrombosis (may favor longer-duration DAPT)	Increased Bleeding Risk (may favor shorter-duration DAPT)
Increased ischemic risk	History of prior bleeding
Advanced age	Oral anticoagulant therapy
ACS presentation	Female sex
Multiple prior MIs	Advanced age
Extensive CAD	Low body weight
Diabetes mellitus	CKD
CKD	Diabetes mellitus
Increased risk of stent thrombosis	Anemia
ACS presentation	Chronic steroid or NSAID therapy
Diabetes mellitus	
Left ventricular ejection fraction <40%	
First-generation drug-eluting stent	
Stent undersizing	
Stent underdeployment	
Small stent diameter	
Greater stent length	
Bifurcation stents	
In-stent restenosis	

ACS indicates acute coronary syndrome; CAD, coronary artery disease; CKD, chronic kidney disease; DAPT, dual antiplatelet therapy; MI, myocardial infarction; and NSAID, nonsteroidal anti-inflammatory drug.

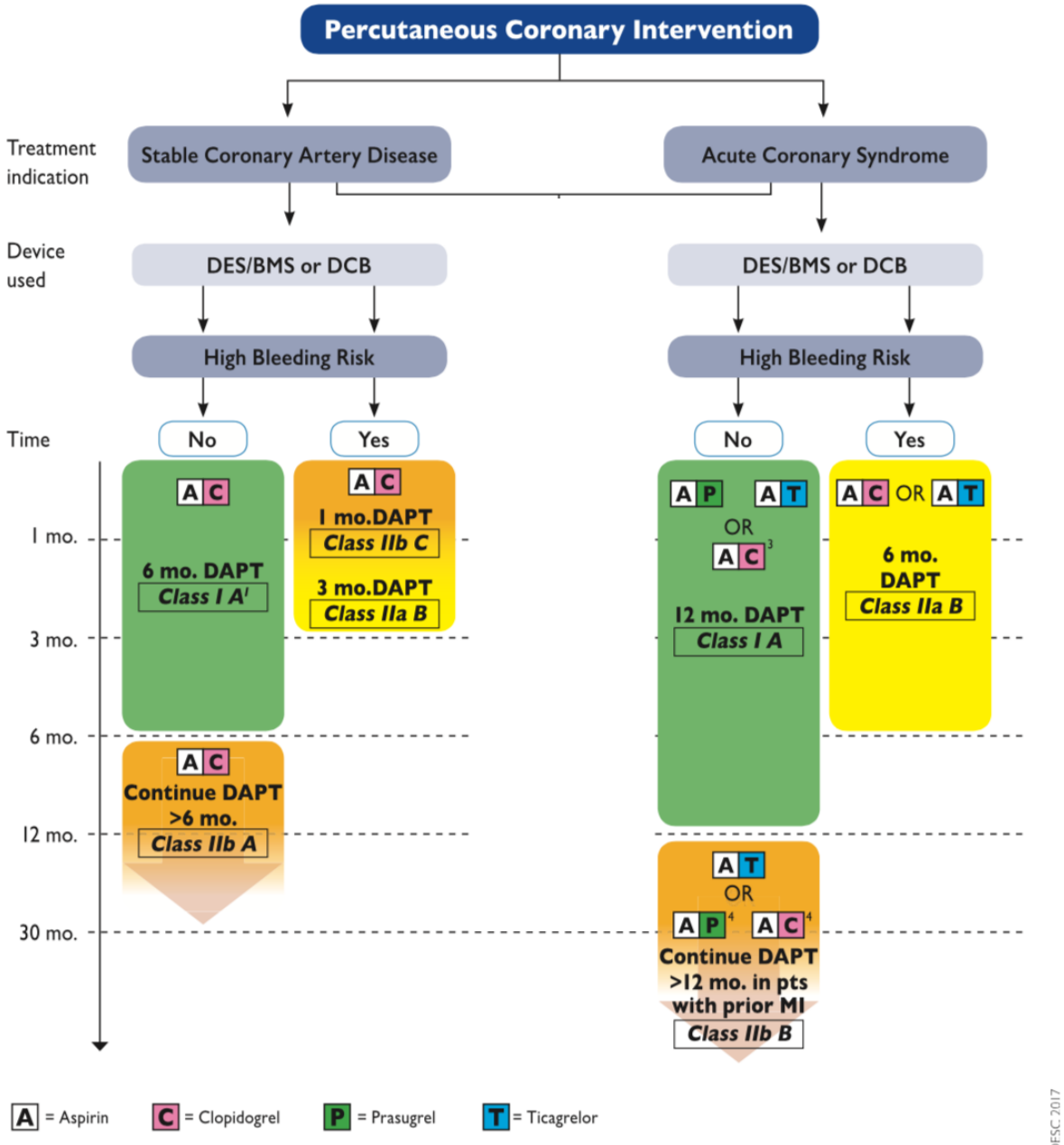
JACC 2016;68:1082-1115

Case example 1

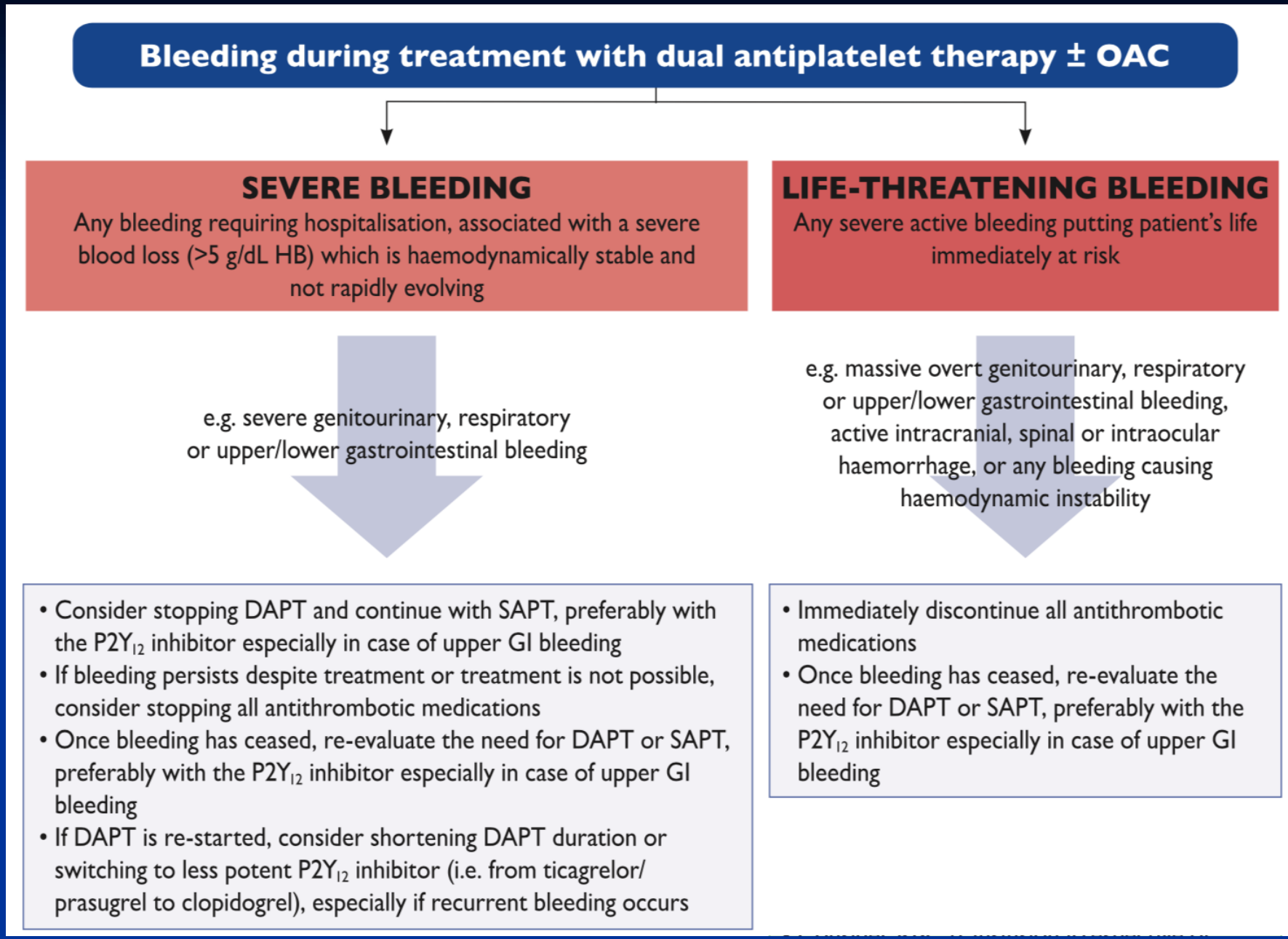
- Calculate Risk scores:
- Precise DAPT: 6. “low risk” 1 yr bleed: 0.45%
- Stent thrombosis risk factors: prox LAD, smoker, DM, low EF, no IVUS guidance

Case example 1

- Presents 90 days post PCI with LGI bleed and hemoglobin down to 6.5. Transfused 3 u PRBC. Hemodynamically stable
- Presents 30 days post PCI with same bleeding as above
- Presents 11 months post PCI with same bleeding as above.



Eur Heart J 2018;39:213-254



Eur Heart J 2018;39:213-254

Case example 1

- Presents 90 days post PCI with LGI bleed and hemoglobin down to 6.5. Transfused 3 u PRBC. Hemodynamically stable
  - Stop ASA, de-escalate to clopidogrel; try to make it 6 months. If IVUS guided: 3 months
- Presents 30 days post PCI with same bleeding as above
  - Stop ASA, continue ticagrelor, unless more bleeding, then de-escalate to clopidogrel; try to make it 6 months.
- Presents 11 months post PCI with same bleeding as above.
  - Stop both, if stabilizes, consider restart clopidogrel

Case example 2

- 85 yo woman with chronic stable angina
- Elective PCI with DES to OM2.
- Discharged on ASA and Clopidogrel
- Prior Hx of TIA, remote history of black stools and anemia, easy bruising in the past
- Non smoker, no DM, Hbg 10.2, WBC 5.3, GFR 45

Case example 2

- Calculate Risk scores:
- Precise DAPT: 70. “high risk” 1 yr bleed: > 4%
- Stent thrombosis risk factors: CKD

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Extensive CAD	Low body weight
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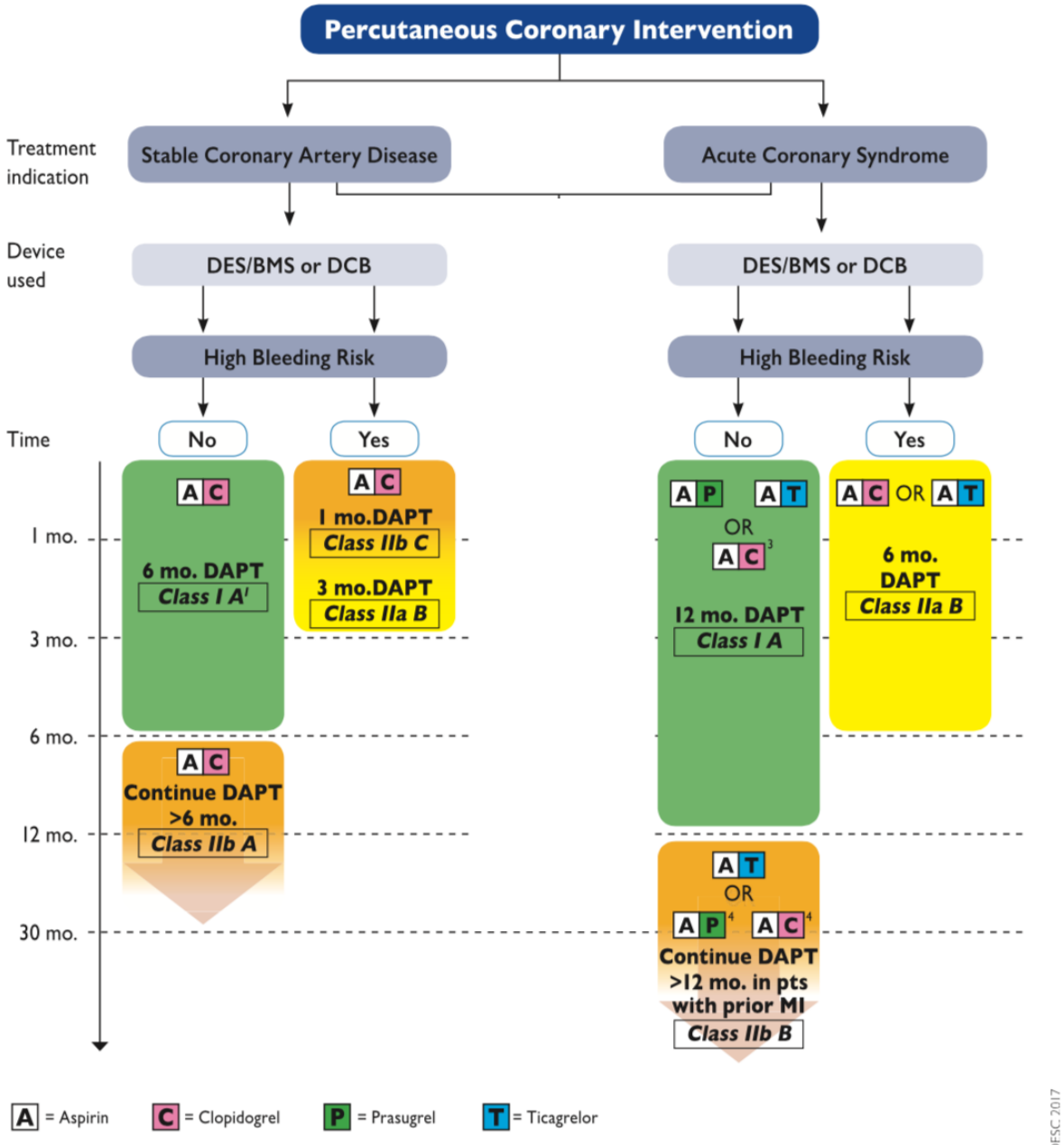
CKD	Diabetes mellitus
Increased risk of stent thrombosis	Anemia
ACS presentation	Chronic steroid or NSAID therapy
Diabetes mellitus	
Left ventricular ejection fraction <40%	
First-generation drug-eluting stent	
Stent undersizing	
Stent underdeployment	
Small stent diameter	
Greater stent length	
Bifurcation stents	
In-stent restenosis	

ACS indicates acute coronary syndrome; CAD, coronary artery disease; CKD, chronic kidney disease; DAPT, dual antiplatelet therapy; MI, myocardial infarction; and NSAID, nonsteroidal anti-inflammatory drug.

JACC 2016;68:1082-1115

Case example 2

- Presents 90 days post PCI with LGI bleed and hemoglobin down to 6.5. Transfused 3 u PRBC. Hemodynamically stable
- Presents 30 days post PCI with same bleeding as above
- Presents 11 months post PCI with same bleeding as above.



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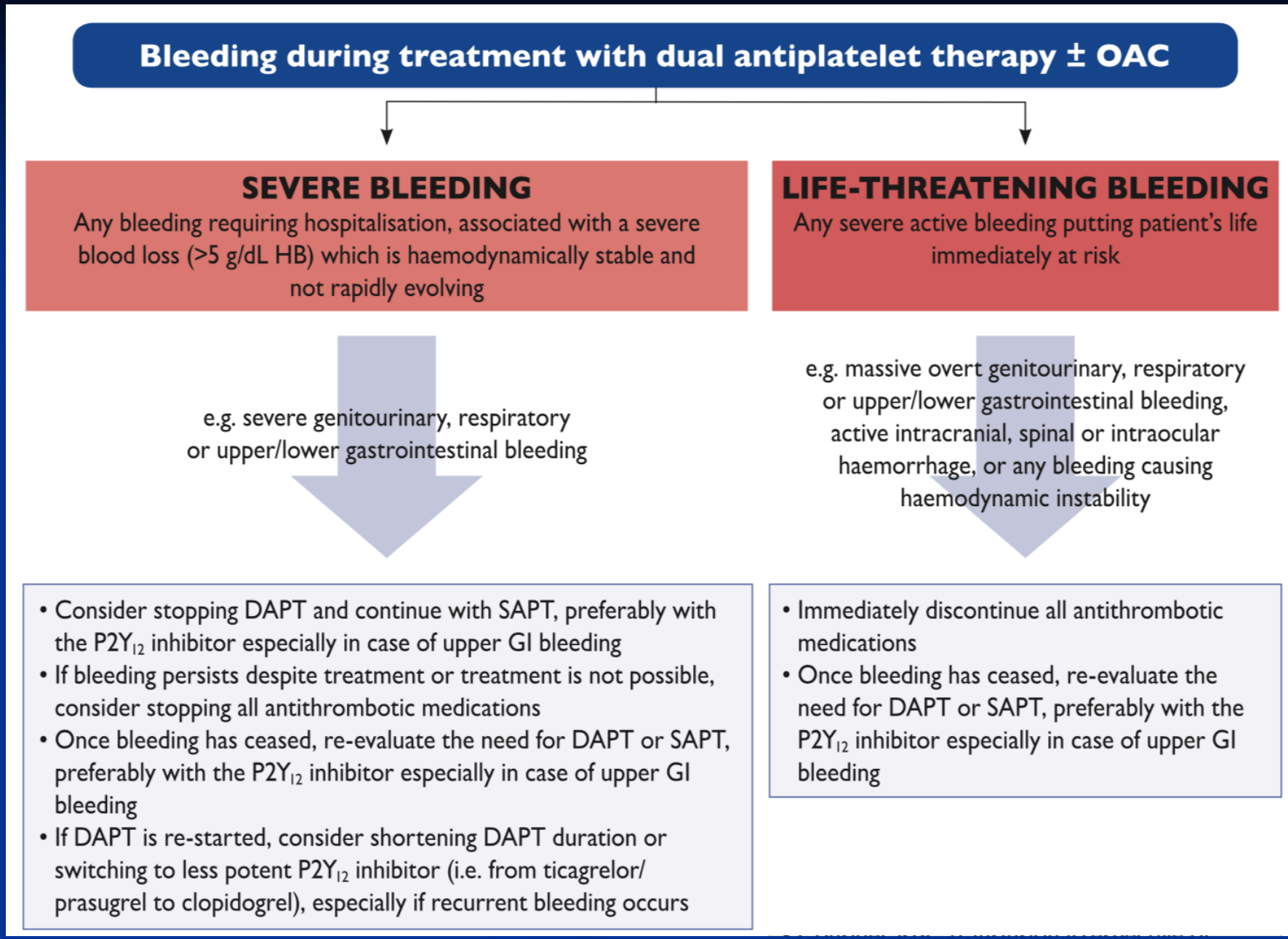

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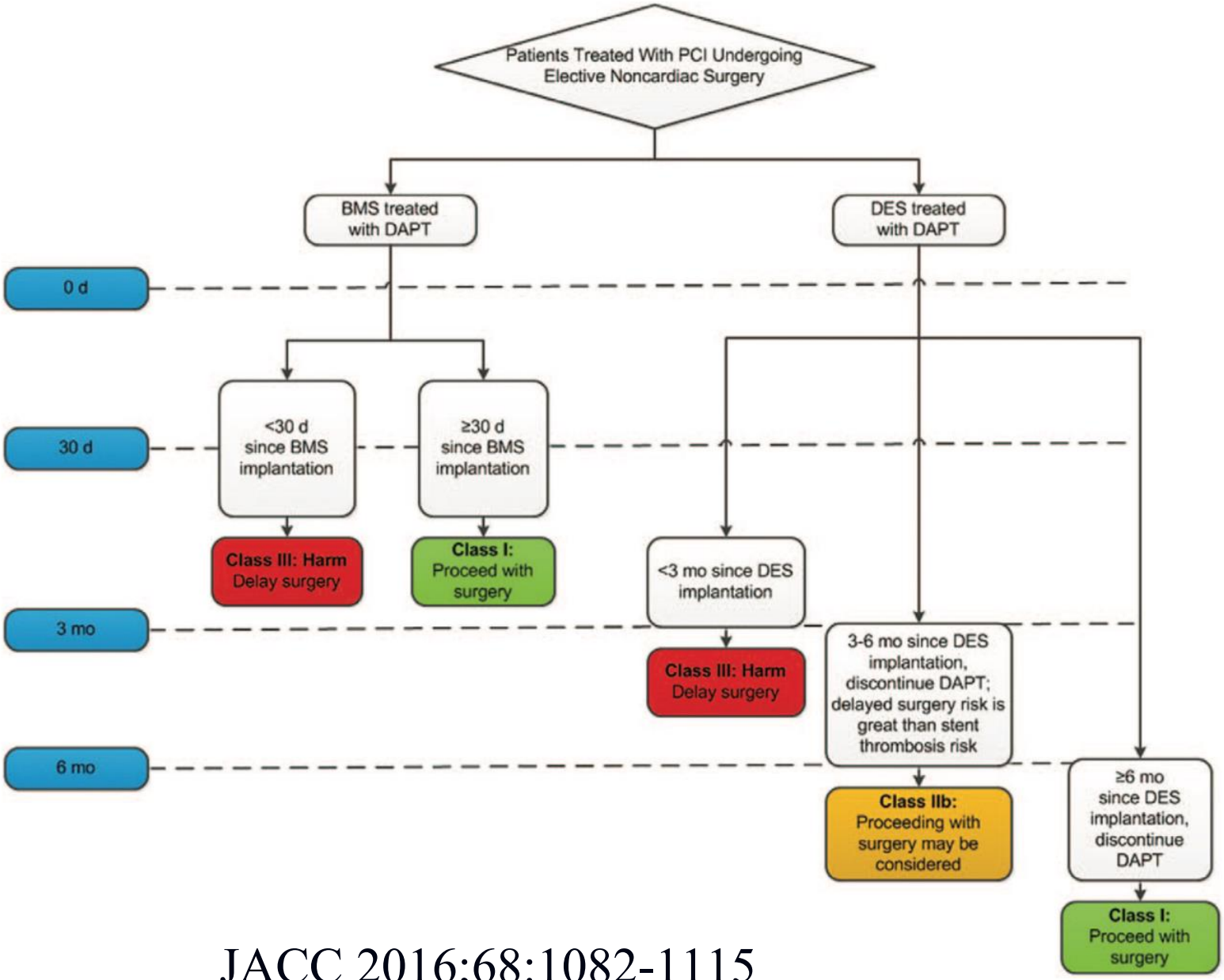
Case example 2

- Presents 90 days post PCI with LGI bleed and hemoglobin down to 6.5. Transfused 3 u PRBC. Hemodynamically stable
  - Stop ASA, stop clopidogrel;
- Presents 30 days post PCI with same bleeding as above
  - Stop ASA, stop clopidogrel; alternative try for 3 mo
- Presents 11 months post PCI with same bleeding as above.
  - Stop both. Should have had clopidogrel stopped prior

What if my patient needs surgery?

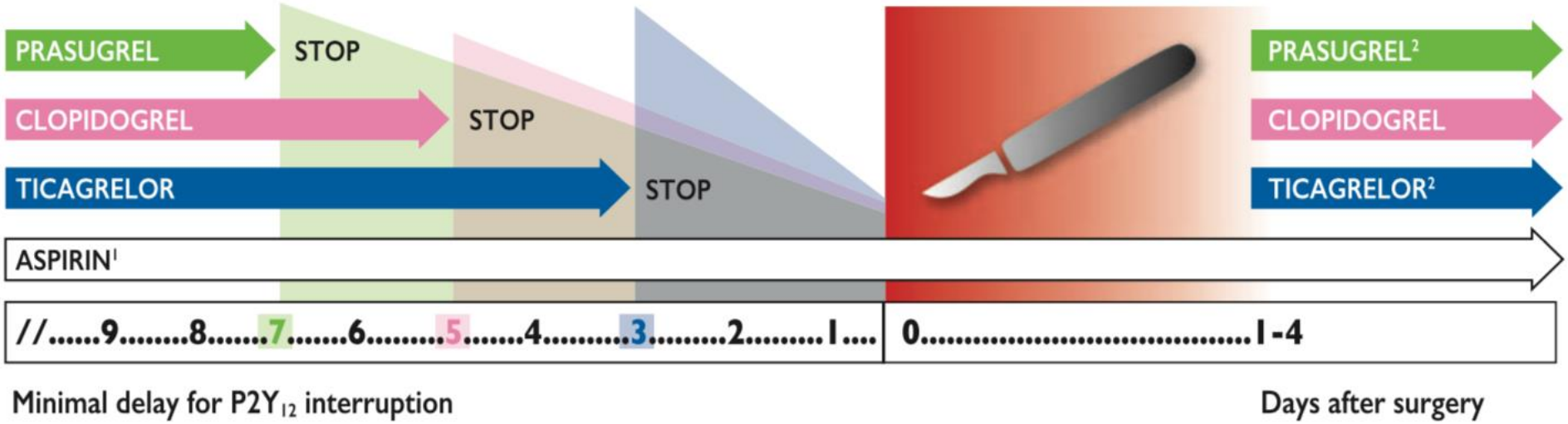
- Individualize
  - Type of surgery. Surgeons will ALWAYS want EVERYBODY off ALL anticoagulant/platelet drugs
  - Urgency, ability to wait
  - Type of DAPT used

FIGURE 6 Treatment Algorithm for the Timing of Elective Noncardiac Surgery in Patients With Coronary Stents



JACC 2016;68:1082-1115

Interruption schedules for surgery



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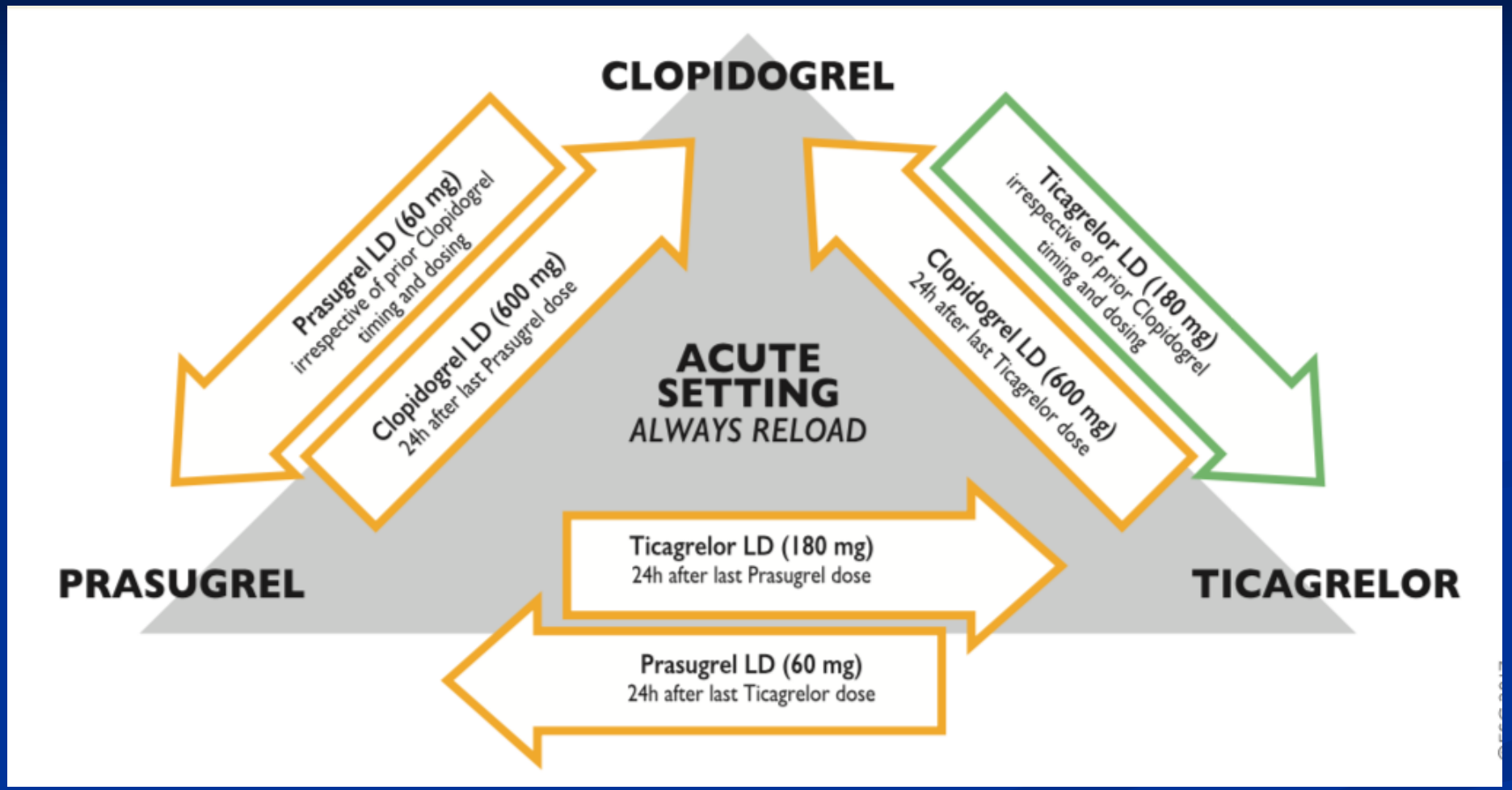
What if my patient needs to switch drugs

- Common reasons:
  - Cost of ticagrelor
  - Breathlessness with ticagrelor
  - Rash with clopidogrel
  - Change in insurance/finances



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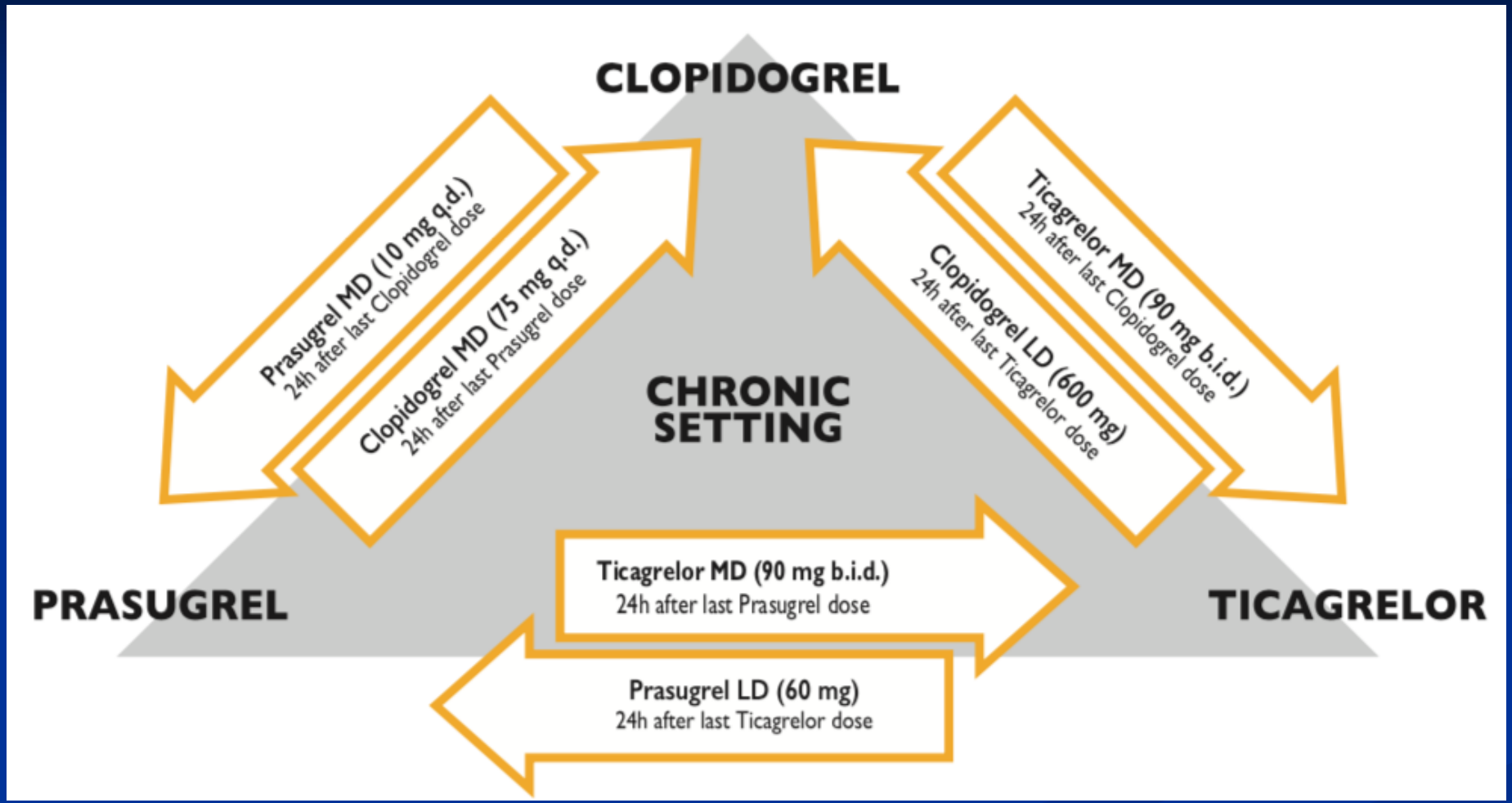

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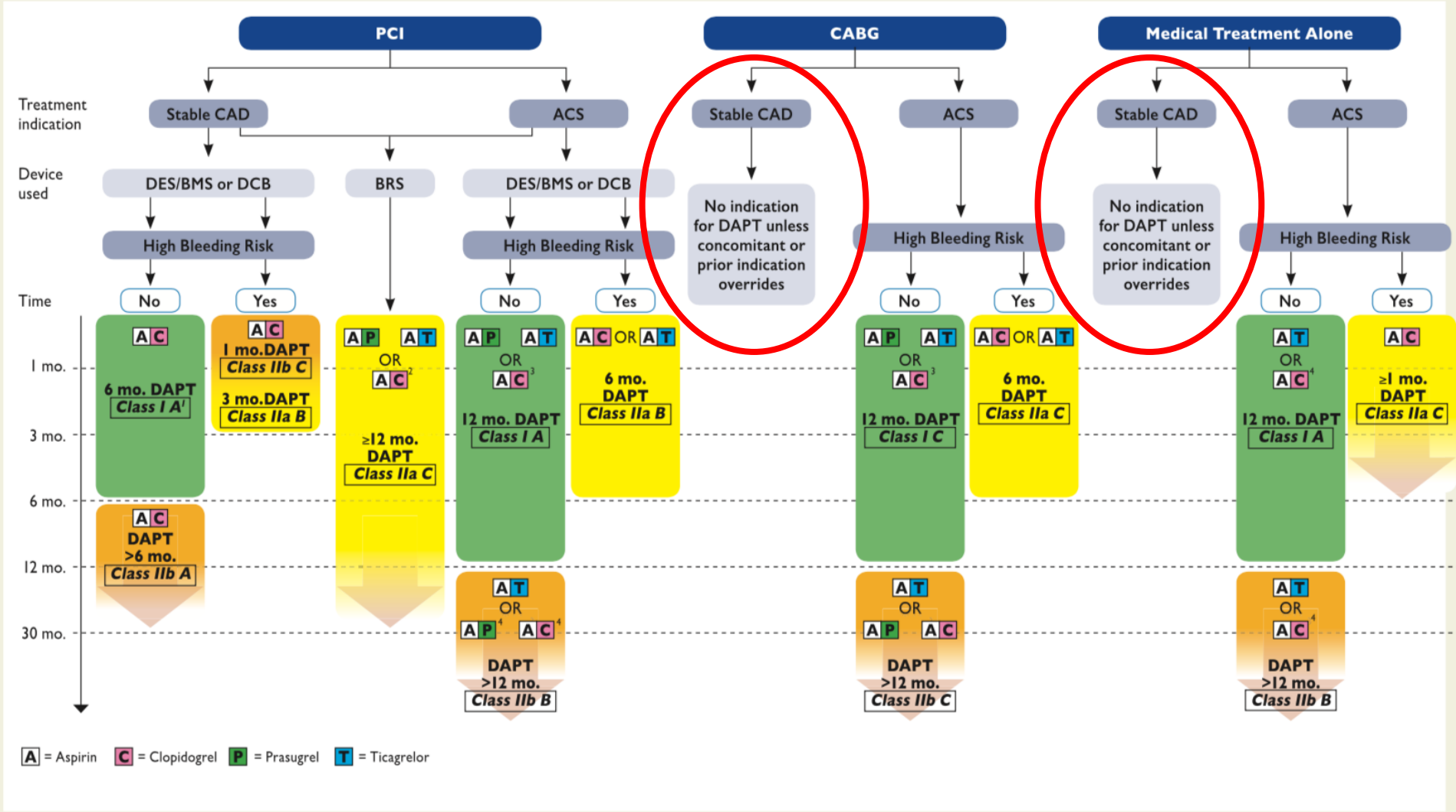
General considerations

- Balancing thrombotic events with bleeding events
- Liberal use of risk estimating scores
- All aspirin doses are 81mg
- Choice of $P2Y_{12}$ depends on the balance
  - Clopidogrel less effect on platelets
  - Ticagrelor more effect on platelets
  - Prasugrel more effect, but risk in prior CVA
- Clinical syndrome class effect: Stable (SIHD) or acute coronary syndrome (STEMI, NSTEMI)



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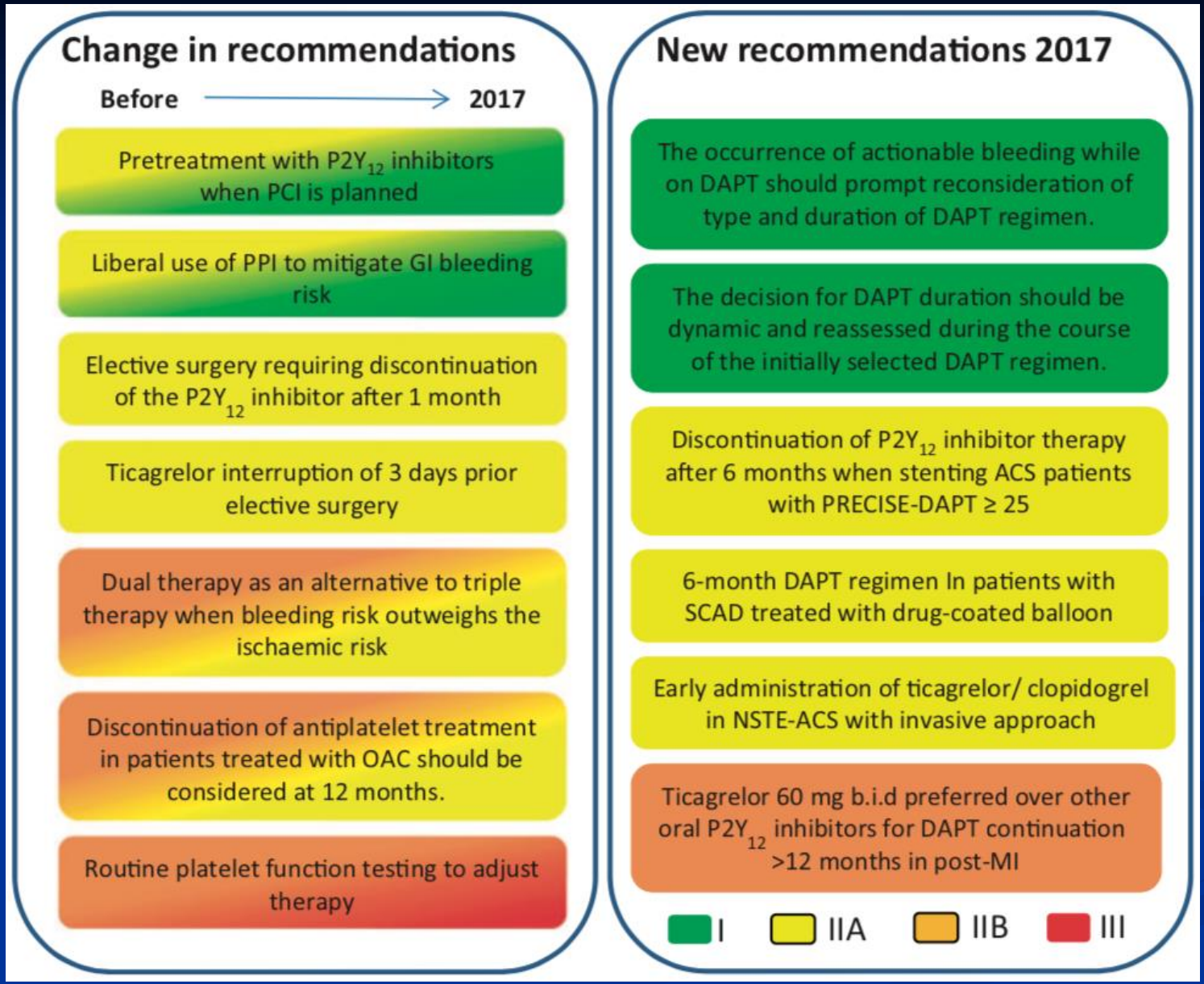

Eur Heart J 2018;39:213-254