State of the Art Antithrombotic Therapies for Coronary and Peripheral Atherosclerosis

A Personalized Approach to Antithrombotics

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Disclosures

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Equity, <1%	None	
Scientific Advisory Boards/Committees	Society of Cardiovascular CT	

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Question: What is your biggest challenge with thrombosis and antithrombotic therapies?

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3. Respond to activity

Join by Text

1. Text **KELLEYB111** to **22333**
2. Text in your message

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Pre-Test Questions

Please complete the 4 pre-test questions and save them for collection after this session.

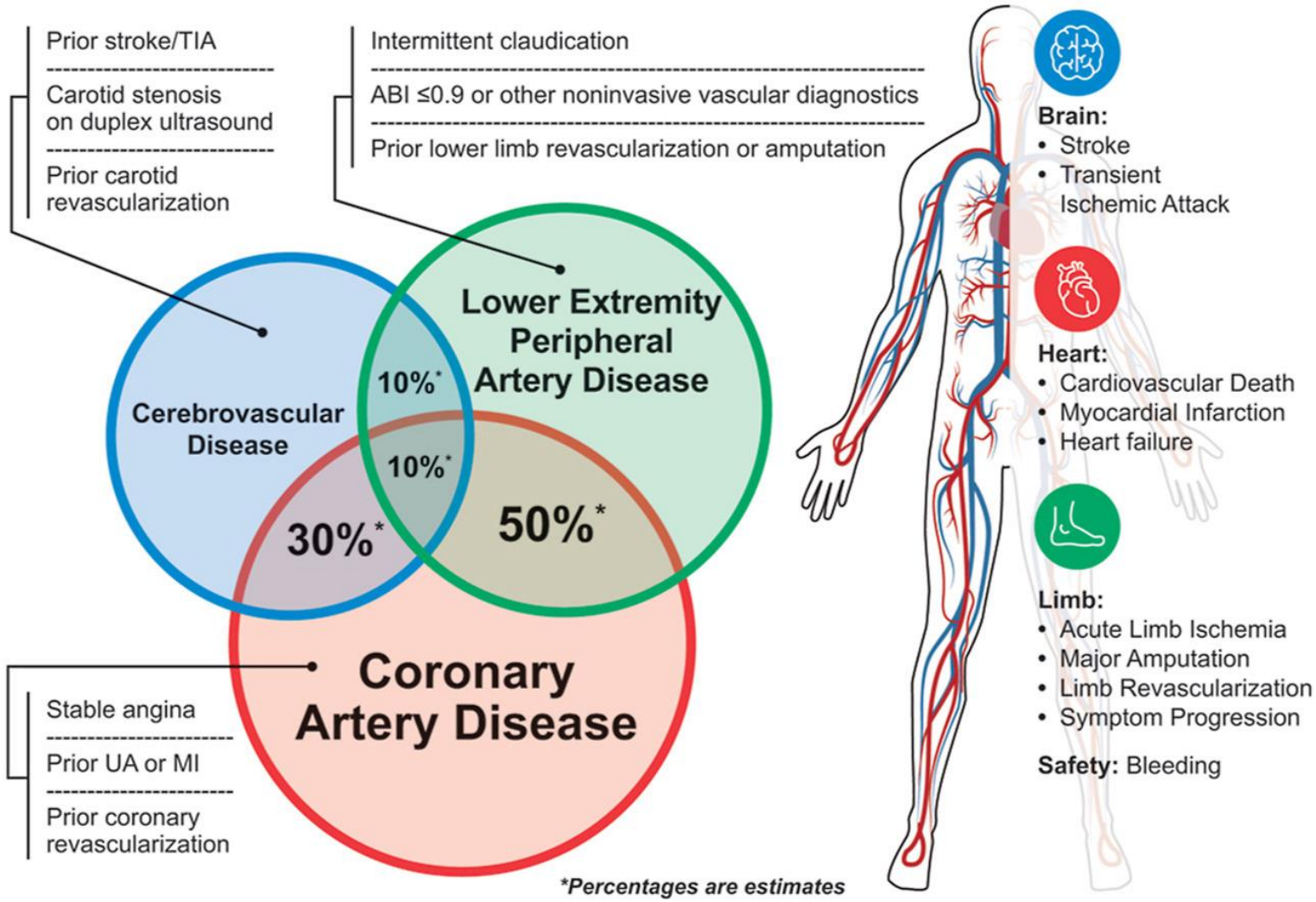
Learning Objectives

1. Review atherosclerosis and identify the differences between coronary and peripheral artery disease.
2. Describe thrombotic cascade and the effects of each component on atherosclerosis.
3. Compare the various antithrombotic therapies including mechanism of action and pharmacokinetics of antiplatelets and anticoagulants.
4. Evaluate clinical trial outcomes for various antithrombotic therapies for the treatment of coronary and peripheral atherosclerosis.

State of the Art Antithrombotic Therapies

1. Aspirin-Free Strategies
2. De-escalation Strategies
3. Native Disease Dual Therapy
4. Peripheral Arterial Disease

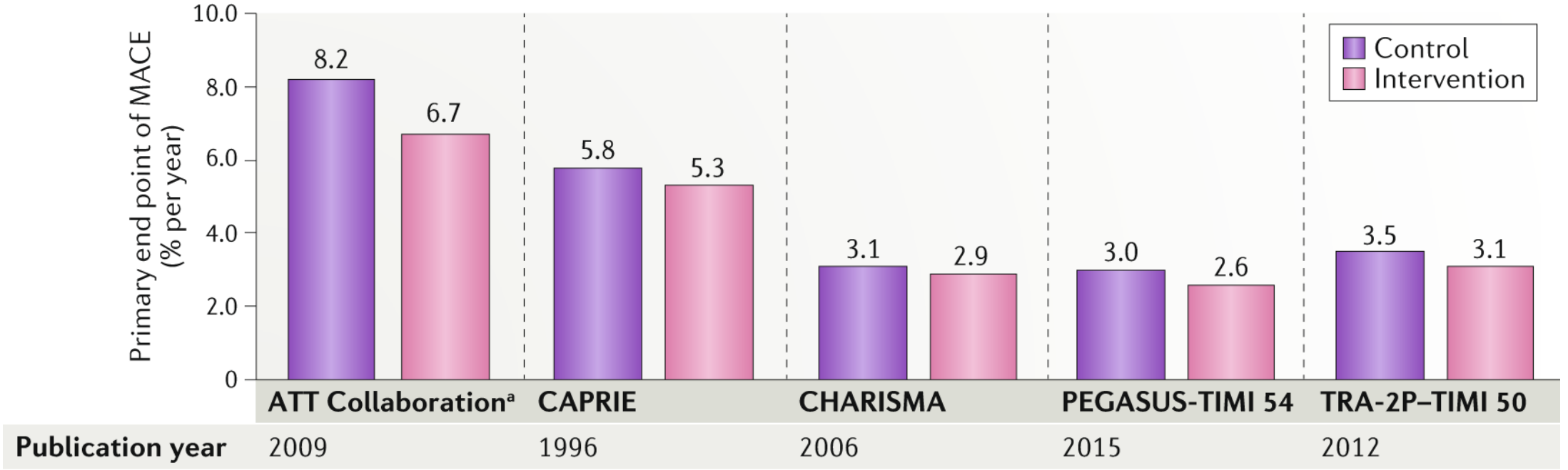
Atherosclerosis: A Polyvascular Disease



Weissler EH et al., Atherosclerosis. 2020 Dec;315:10-17.

Yearly Residual Risk of CV Events in Patients with CAD Receiving Medical Therapy

~3% MACE risk per year



Capodanno D et al. Nature Reviews Cardiology volume 17, pages242–257 (2020)

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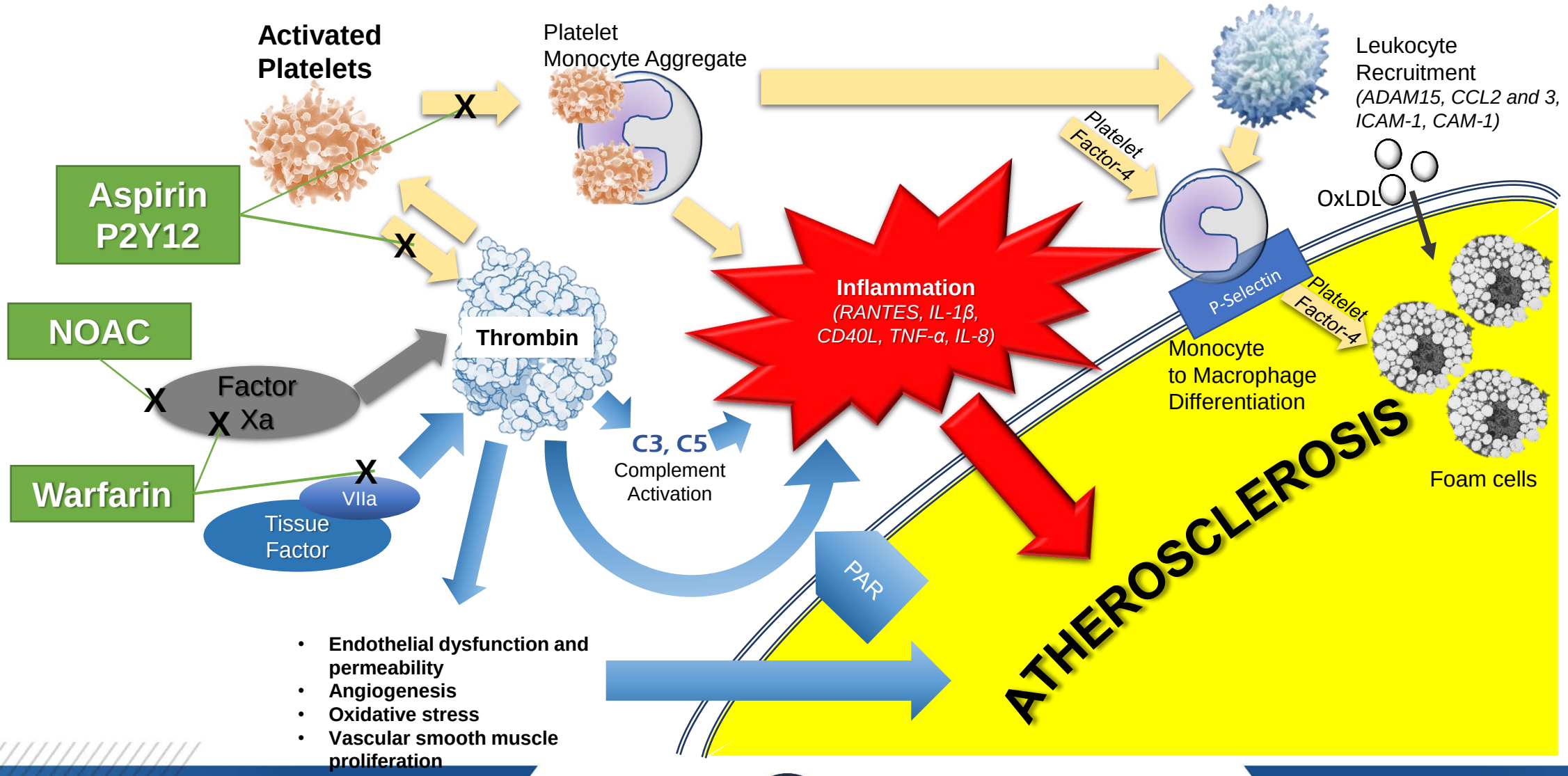
Thrombin and Platelets Promote Atherosclerosis



Thrombosis Generation in Acute and Chronic CAD/PAD

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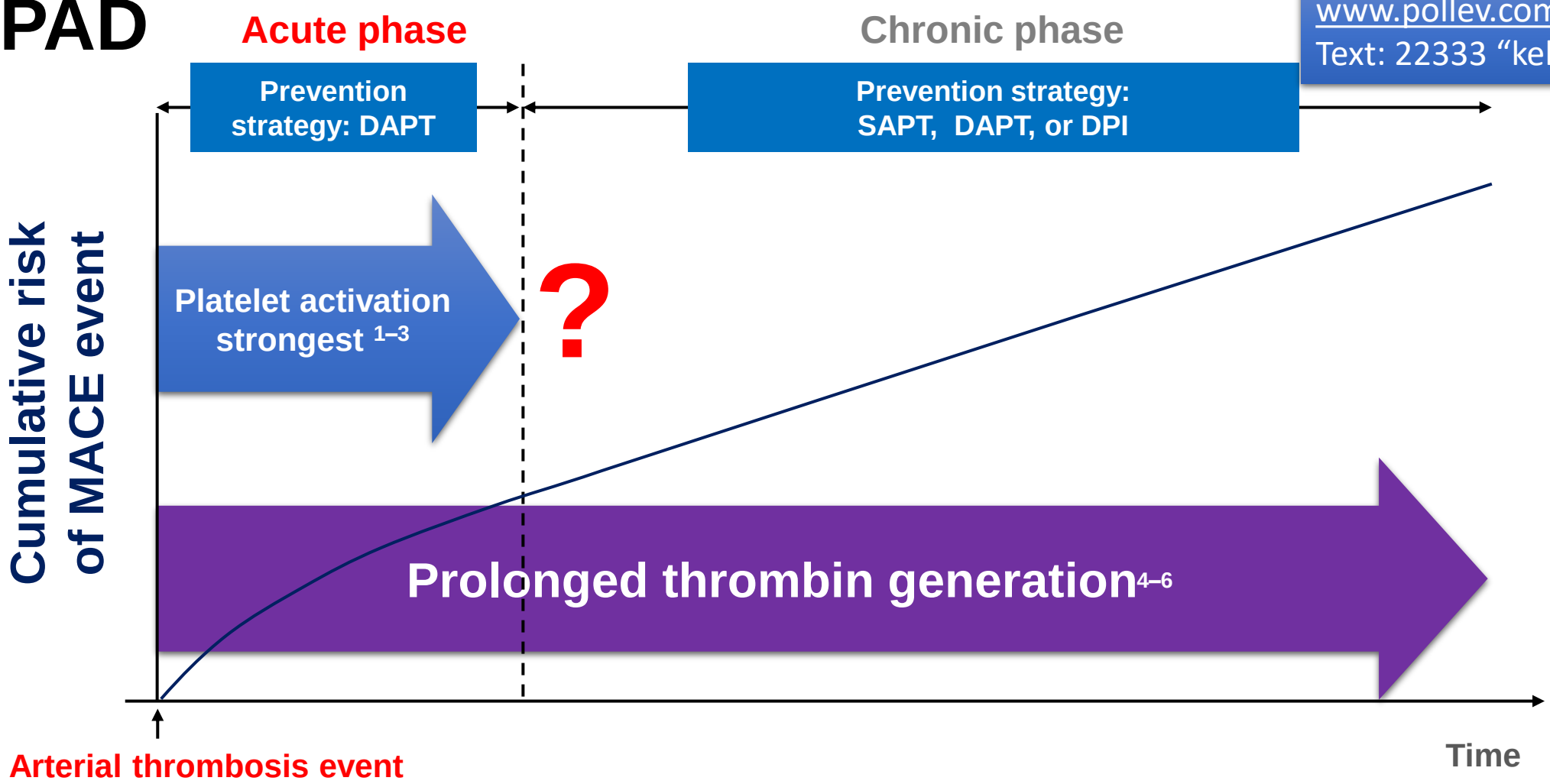

Mackman N. Nature 2008;451:914–918; 2. Franchi F and Angiolillo DJ. Nat Rev Cardiol 2015;12:30–47; 3. Trip MD et al, N Engl J Med 1990;322:1549–1554
Cohen M and Iyer D. Cardiovasc Ther 2014;32:224–232; 5. Merlini PA et al, Circulation 1994;90:61–68; 6. Ardissino D et al, Blood 2003;102:2731–2735

What is your biggest challenge with thrombosis and antithrombotic therapies?

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long

Patient A

Clinical Presentation

- 62 yo female presents for routine follow up after NSTEMI 3 mo ago
- Feels fine, no chest pain
- Some red bloody stools in past month

PMH:

- NSTEMI (3 mo)
  - Troponin I peak 0.45 ng/mL
  - Mid LAD 80% -> Synergy 3.0x12 mm stent, TIMI 3 flow. No other CAD
- Hypertension x 25 years
- Type II diabetes x 4 years
- Ulcerative colitis x 20 years

Medications:

- Aspirin, Ticagrelor, statin, ARB, Beta-blocker, SGLT2-inhibitor 81 mg daily, Mesalamine 2.4 g daily

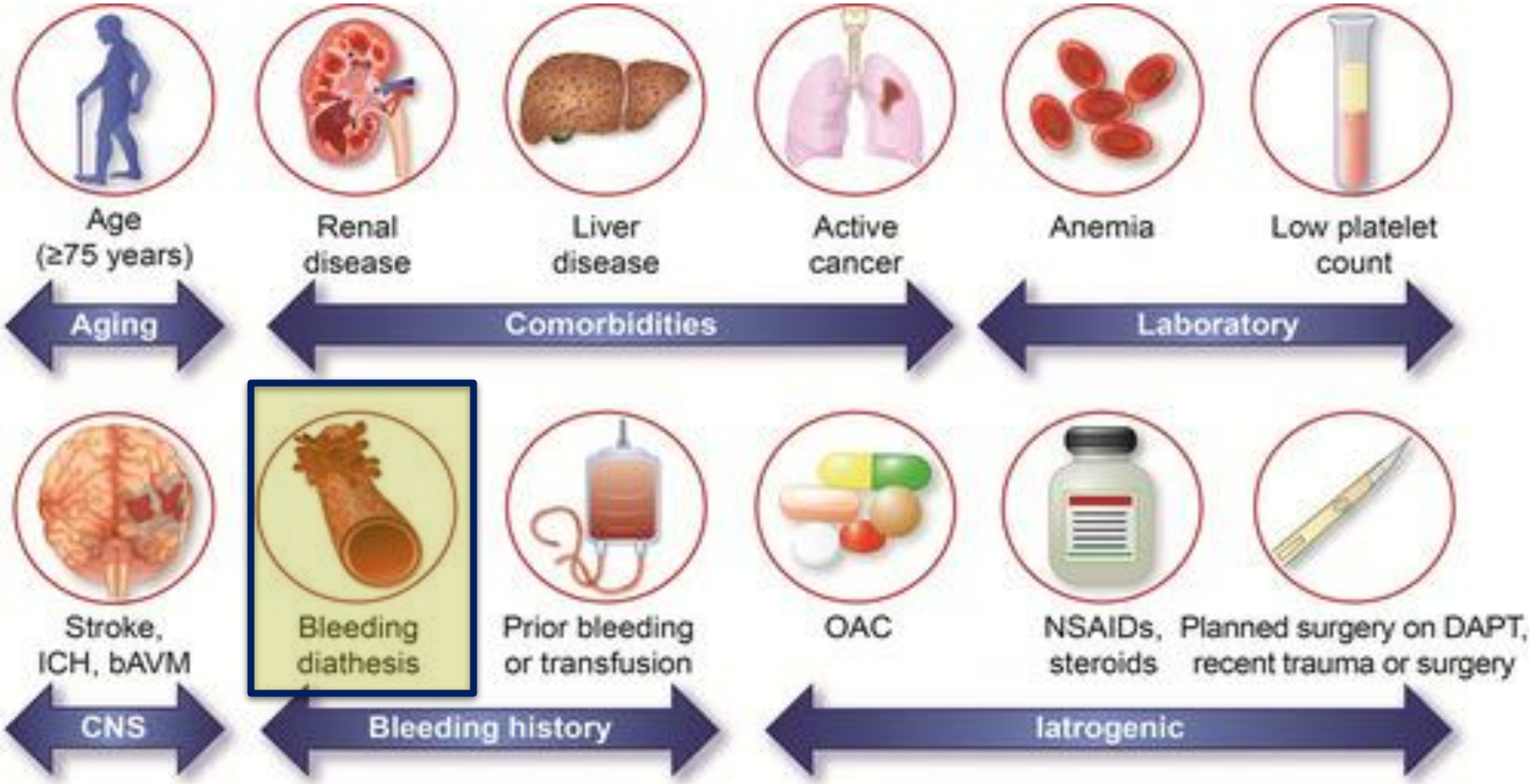
Physical Examination:

- BP 124/79 mmHg, HR 58 bpm, RR 12, BMI 29
- Unremarkable examination

Laboratory Studies:

- Hg 9.2 g/dL (prev 12.1 g/dL)
- Cr 0.8 mg/dL

High Bleeding Risk at PCI



Academic Research Consortium for High Bleeding Risk. Urban P, Mehran R, et al. Circulation. 2019;140:240–261

Which of the following DAPT strategies is the best for our patient?

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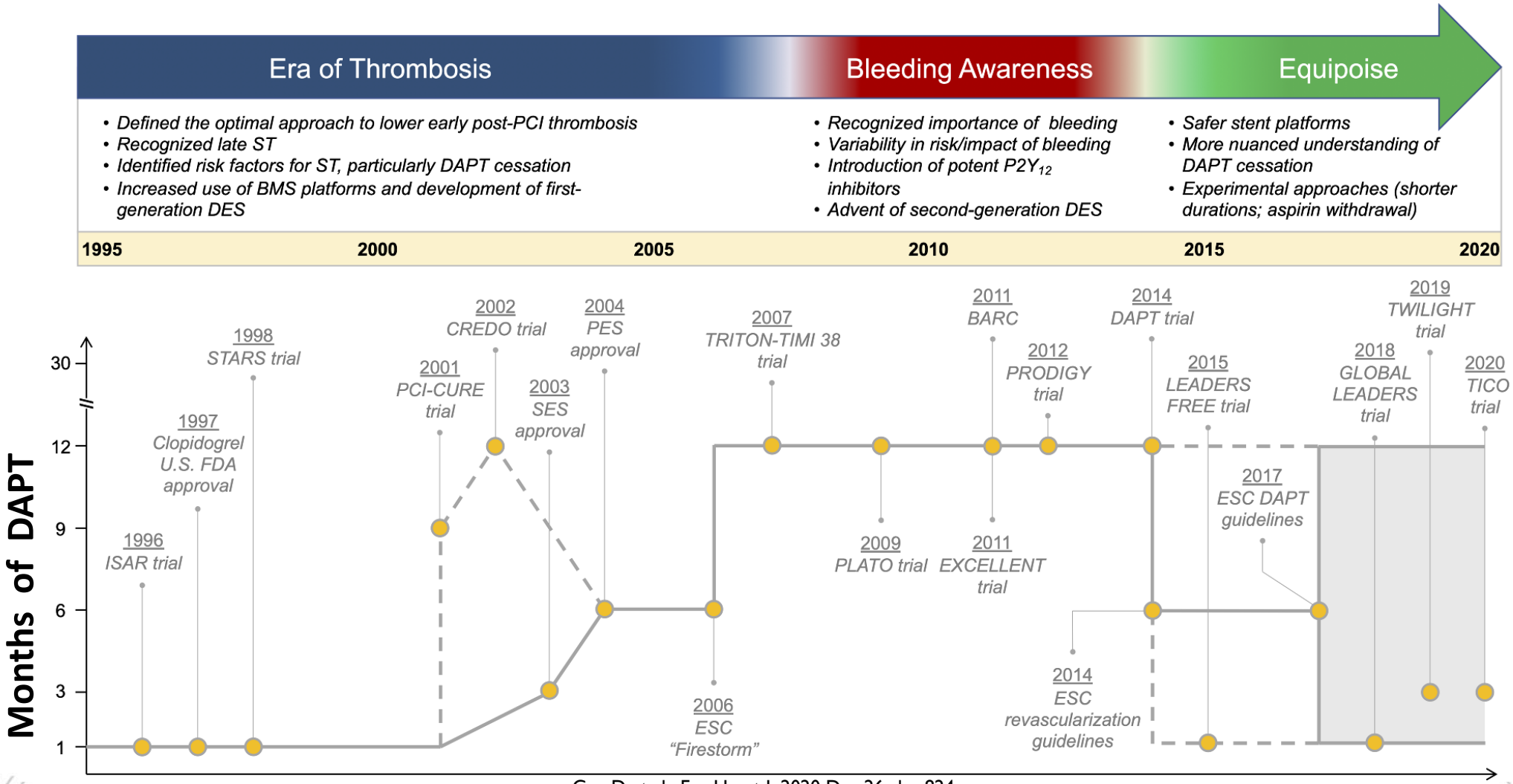
Continue current therapy

Shorten DAPT to aspirin 81 mg monotherapy

De-escalate to clopidogrel 75 mg daily with ASA

Shorten DAPT to ticagrelor 90 mg BID monotherapy

Evolving Duration of Antiplatelet Therapy After PCI



Cao D et al., Eur Heart J. 2020 Dec 26;ehaa824.

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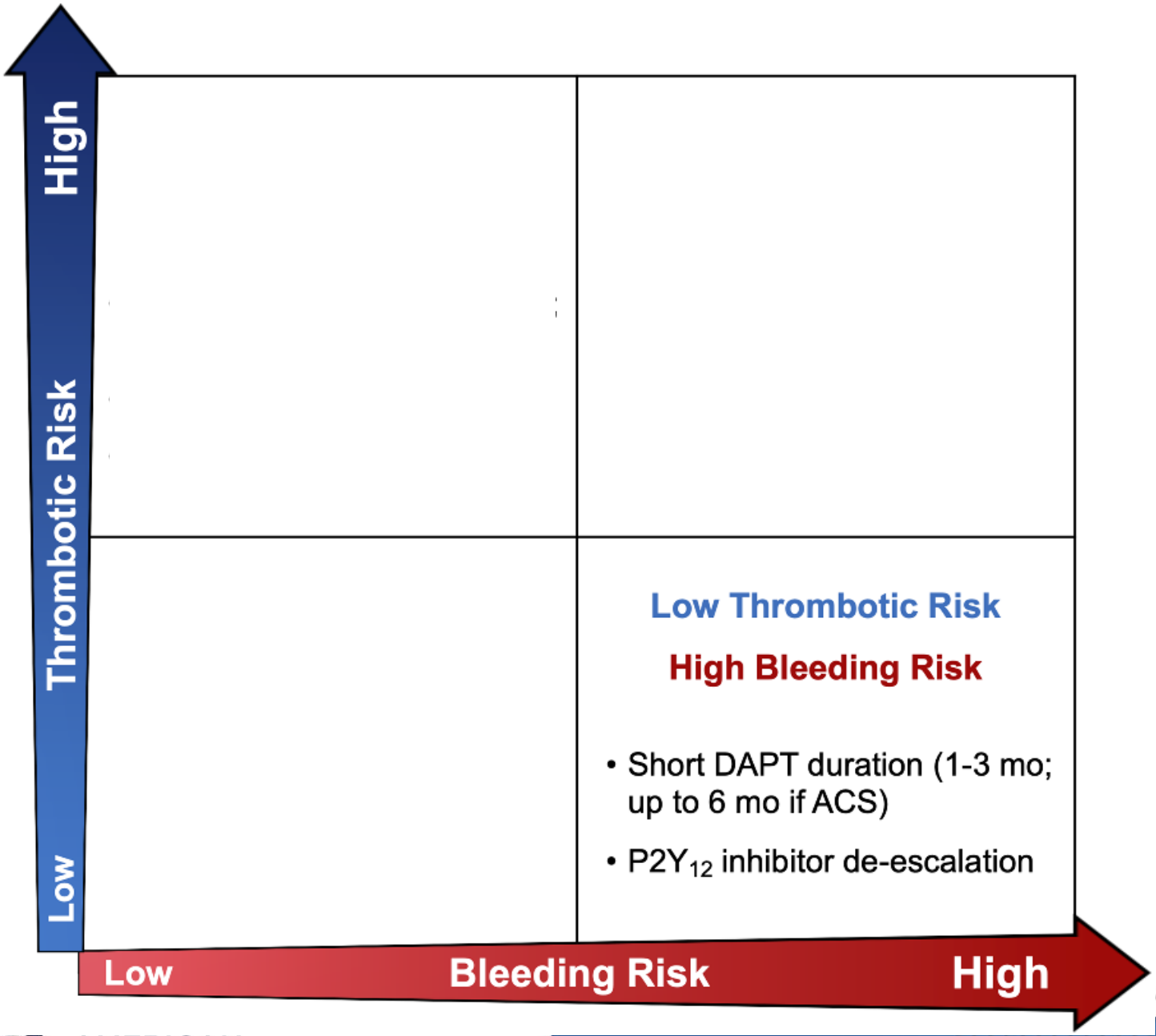
Balance of MACE and Bleeding Risk

Personalized Antithrombotic Therapy



Cao D et al., Eur Heart J. 2020 Dec 26;ehaa824.

Definitions

- **Short DAPT** – DAPT discontinuation to platelet monotherapy at 1 or 3 months with chronic angina, up to 6 months with ACS

- **De-escalation** – DAPT change to lower potency/lower bleeding risk P2Y12 of clopidogrel

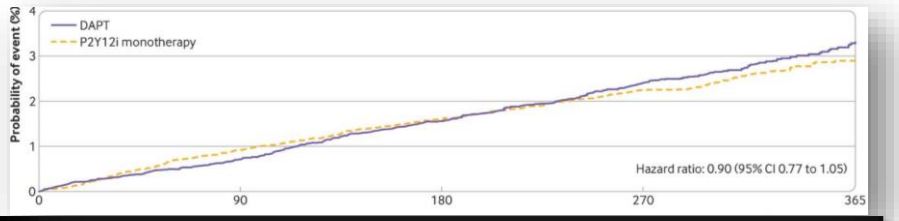
Which do you chose?

State of the Art Antithrombotic Therapies

1. **Aspirin-Free Strategies**
2. De-escalation Strategies
3. Native Disease Dual Therapy
4. Peripheral Arterial Disease

Similar MACE for P2Y12 Monotherapy After Short DAPT

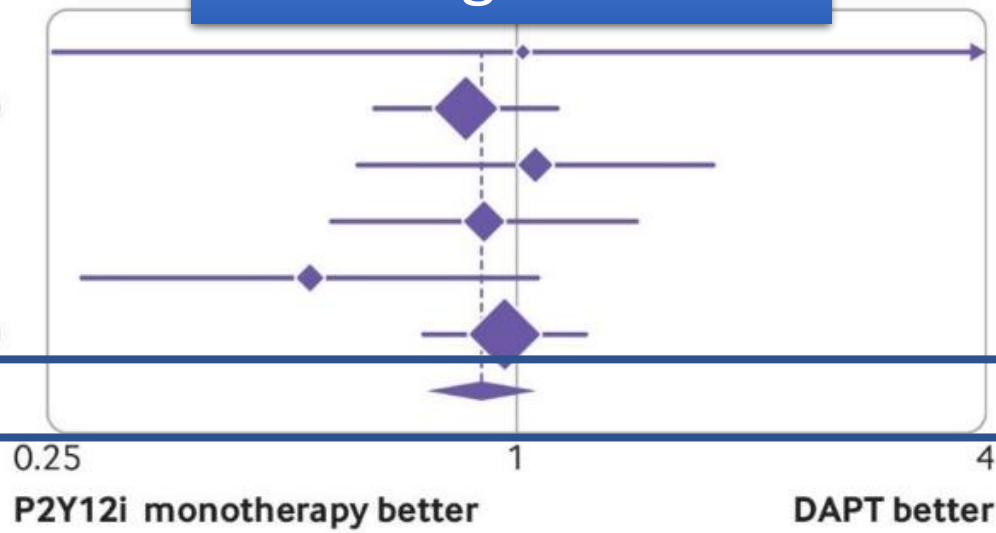
An IPD meta-analysis of 24,096 patients



Primary endpoint of all cause death, MI, or stroke

No change in MACE

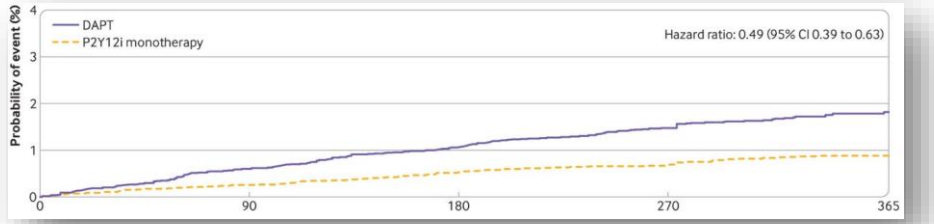
Study ID	P2Y12i monotherapy (%)	DAPT (%)	Weight (%)	Hazard ratio (95% CI)
DACAB (n=334)	4/166 (2.4)	4/168 (2.4)	1.26	1.02 (0.25 to 4.06)
GLASSY (n=7509)	96/3753 (2.6)	112/3756 (3.0)	32.50	0.86 (0.65 to 1.13)
SMART-CHOICE (n=2926)	28/1455 (2.0)	27/1471 (1.9)	8.64	1.05 (0.62 to 1.79)
STOPDAPT-2 (n=3003)	36/1496 (2.4)	40/1507 (2.7)	11.91	0.91 (0.58 to 1.43)
TICO (n=3004)	13/1499 (0.9)	24/1505 (1.6)	5.30	0.54 (0.28 to 1.07)
TWILIGHT (n=6532)	126/3265 (3.9)	131/3267 (4.1)	40.38	0.96 (0.76 to 1.23)
Overall: I^2=0.0%; P=0.71			100.00	0.90 (0.77 to 1.05)



Valgimigli M and Mehran R et.al., BMJ 2021;373:n1332.

Lower Bleeding for P2Y12 Monotherapy After Short DAPT

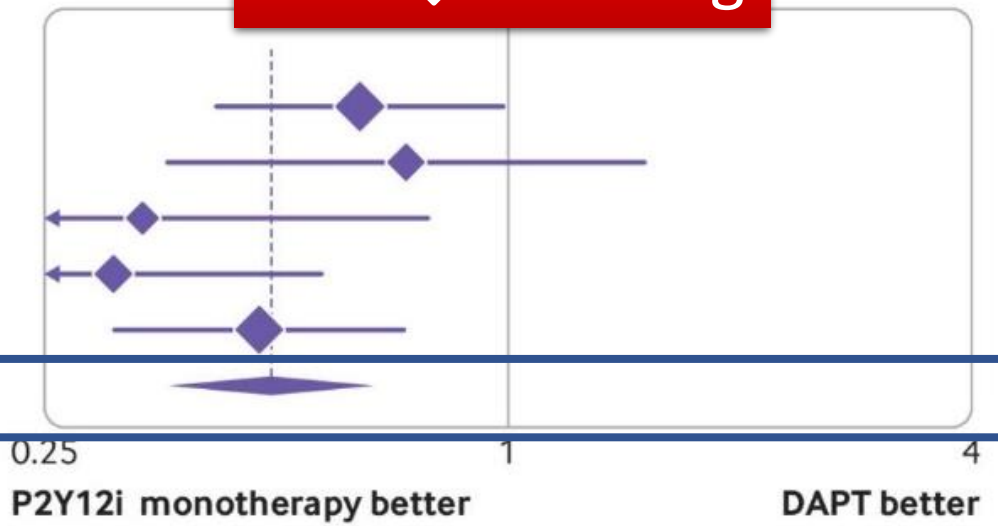
An IPD meta-analysis of 24,096 patients



BARC type 3 or type 5 bleeding

51% ↓ bleeding

Study ID	P2Y12i monotherapy (%)	DAPT (%)	Relative risk	Weight (%)	Hazard ratio (95% CI)
DACAB (n=334)	-	-		-	-
GLASSY (n=7509)	34/3753 (0.9)	53/3756 (1.4)		28.85	0.64 (0.42 to 0.99)
SMART-CHOICE (n=2926)	13/1455 (1.0)	18/1471 (1.4)		14.32	0.74 (0.36 to 1.50)
STOPDAPT-2 (n=3003)	7/1496 (0.5)	21/1507 (1.4)		10.63	0.33 (0.14 to 0.79)
TICO (n=3004)	13/1499 (0.9)	42/1505 (2.8)		17.68	0.31 (0.17 to 0.57)
TWILIGHT (n=6532)	30/3265 (0.9)	63/3267 (2.0)		28.53	0.47 (0.31 to 0.73)
Overall: I^2=29.3%; P=0.23				100.00	0.49 (0.36 to 0.67)



Valgimigli M and Mehran R et.al., BMJ, 2021;373:n1332.

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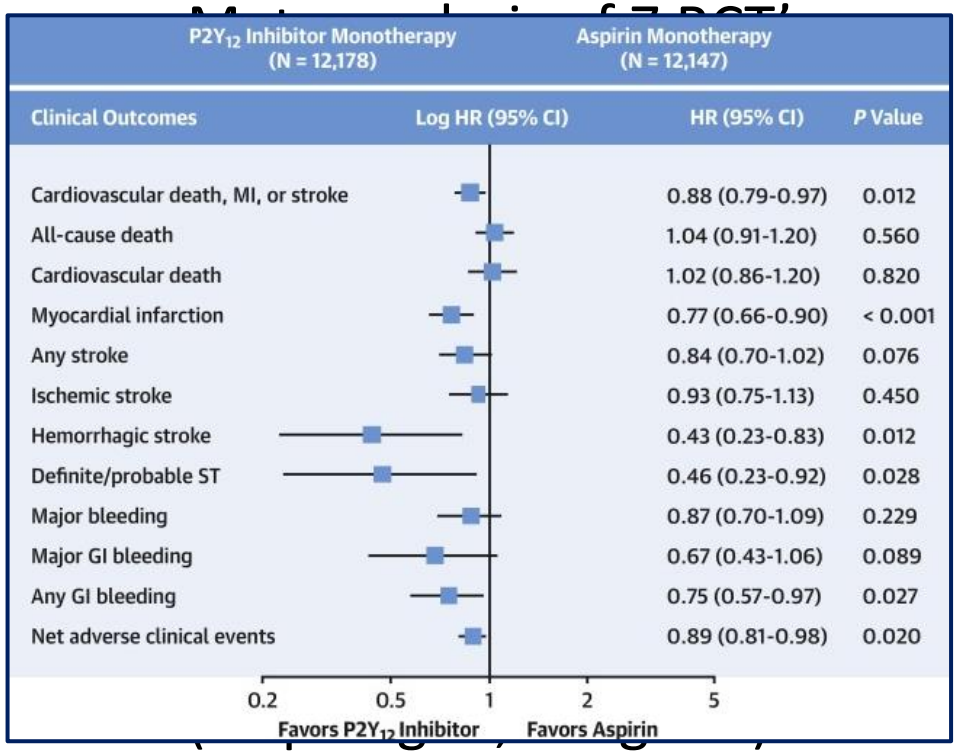
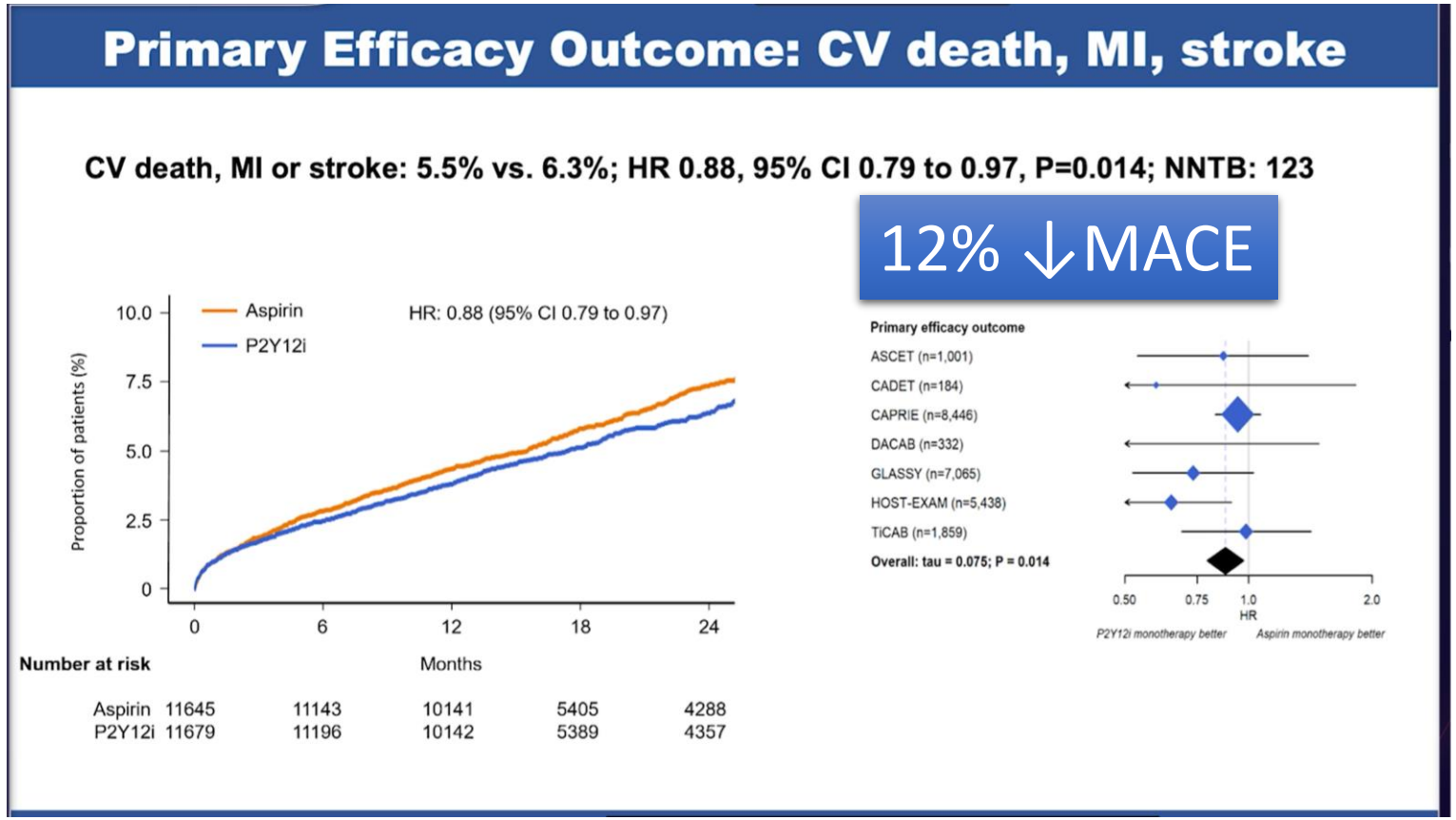
Post-DAPT: PANTHER

P2Y12 inhibitor versus aspirin monotherapy in patients with coronary artery disease





Gragnano F, et al. JACC 2023;82:89-105

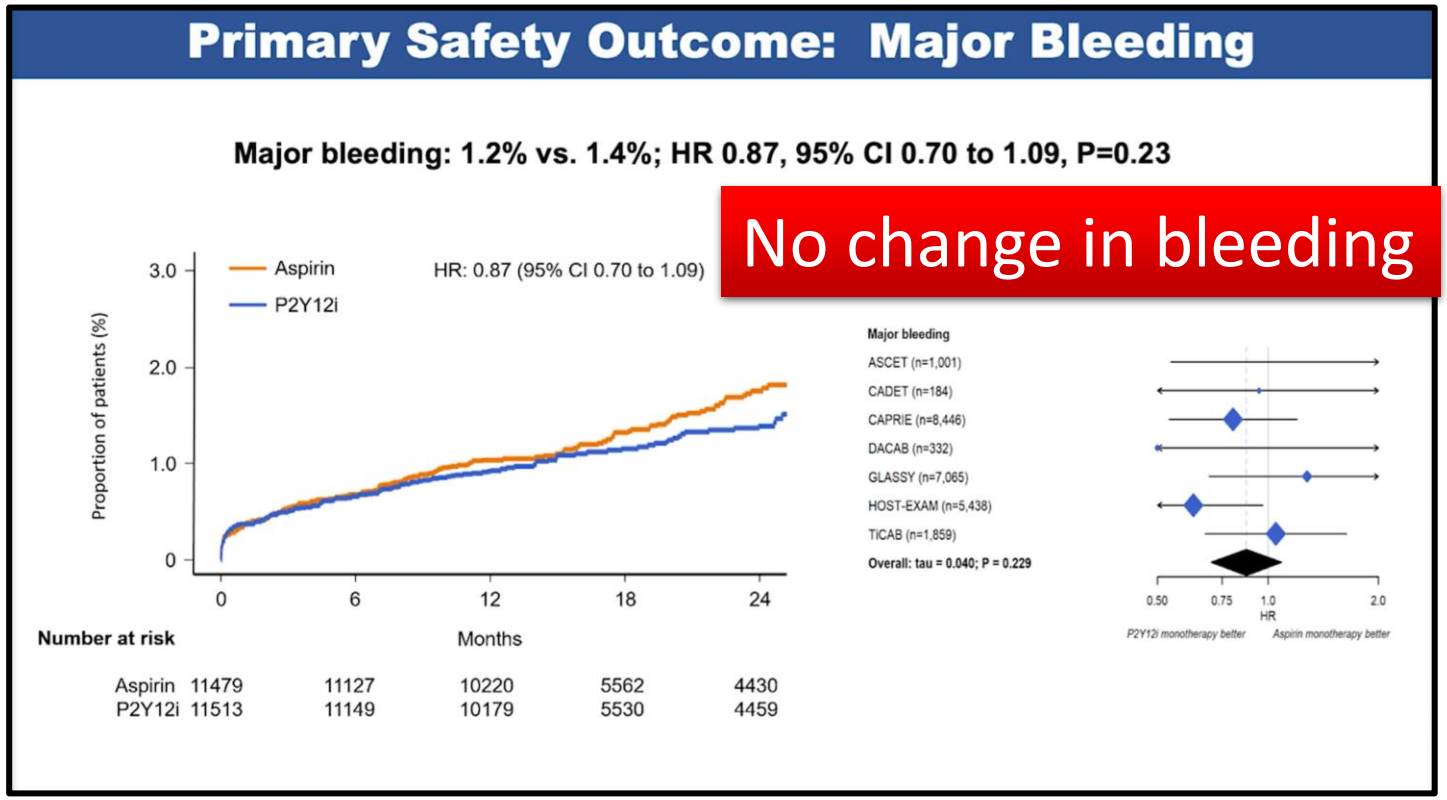
Post-DAPT: PANTHER

P2Y12 inhibitor versus aspirin monotherapy in patients with coronary artery disease

Meta-analysis of 7 RCT's of patients with CAD, Post-DAPT phase

Mixed clinical contexts (ACS, post-PCI)

Any ASA vs. P2Y12 (clopidogrel, ticagelor)



Gragnano F, et al. JACC 2023;82:89-105

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State of the Art Antithrombotic Therapies

1. Aspirin-Free Strategies
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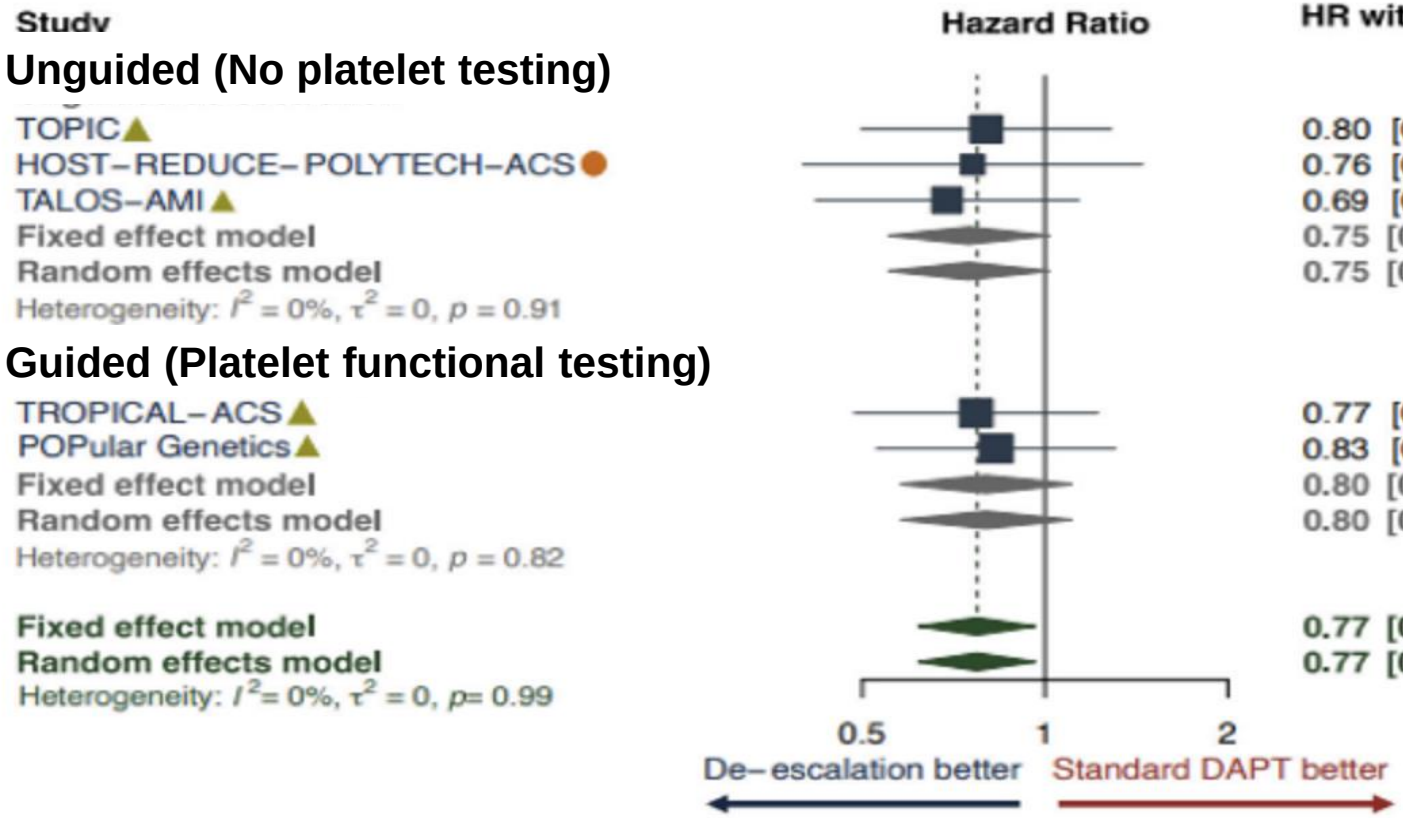
De-Escalation from Potent P2Y12 Inhibitors Post-ACS: Meta-Analysis

MACE



25% ↓MACE

23% ↓MACE

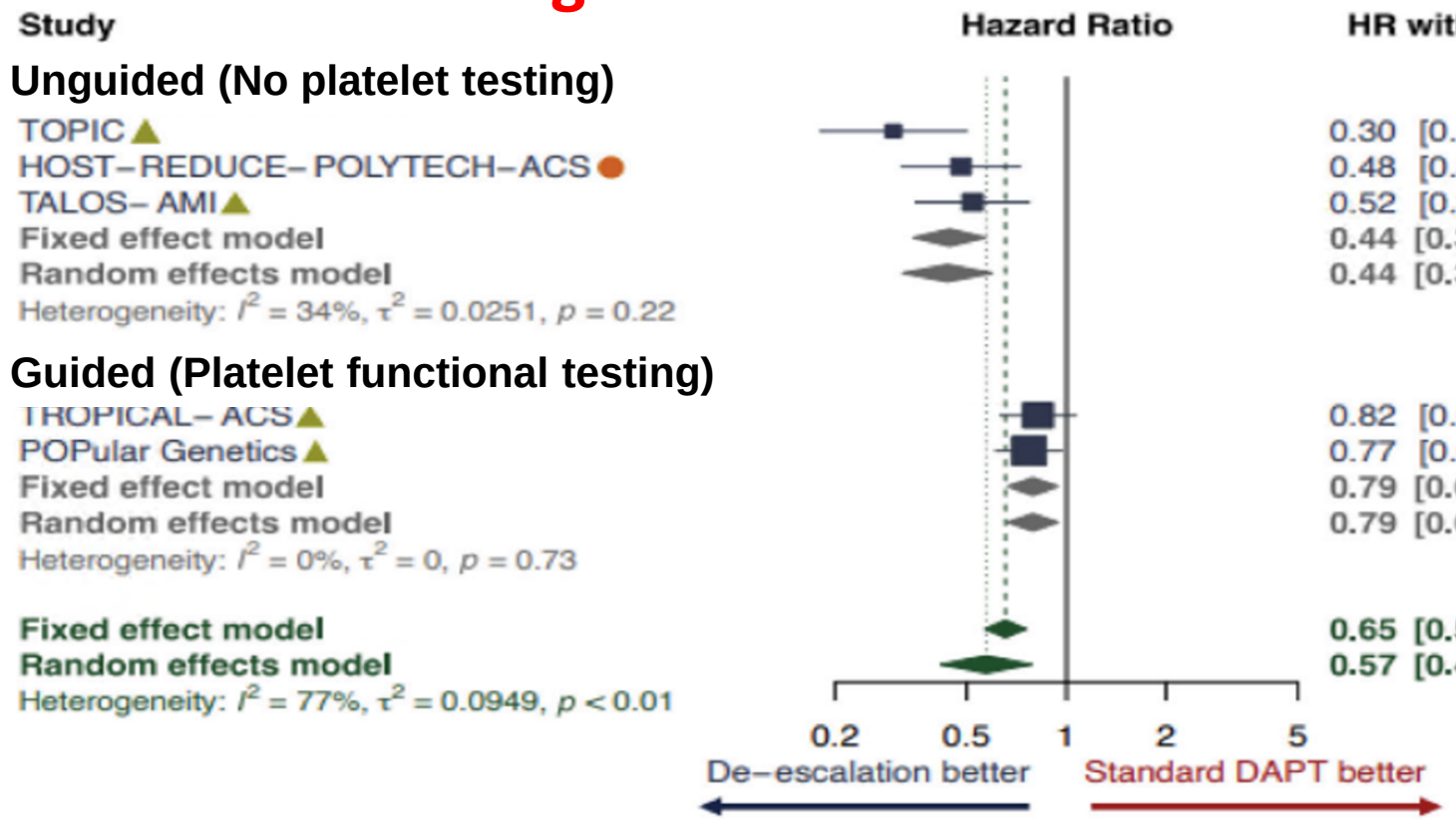
▲ de-escalation to clopidogrel

● de-escalation to reduced dose of potent $P2Y_{12}$ inhibitor

Tavenier AH, Dangas G et al., EHJ CVP, 2021

De-Escalation from Potent P2Y12 Inhibitors Post-ACS: Meta-Analysis

BARC 2-5 Bleeding



56% ↓ bleeding

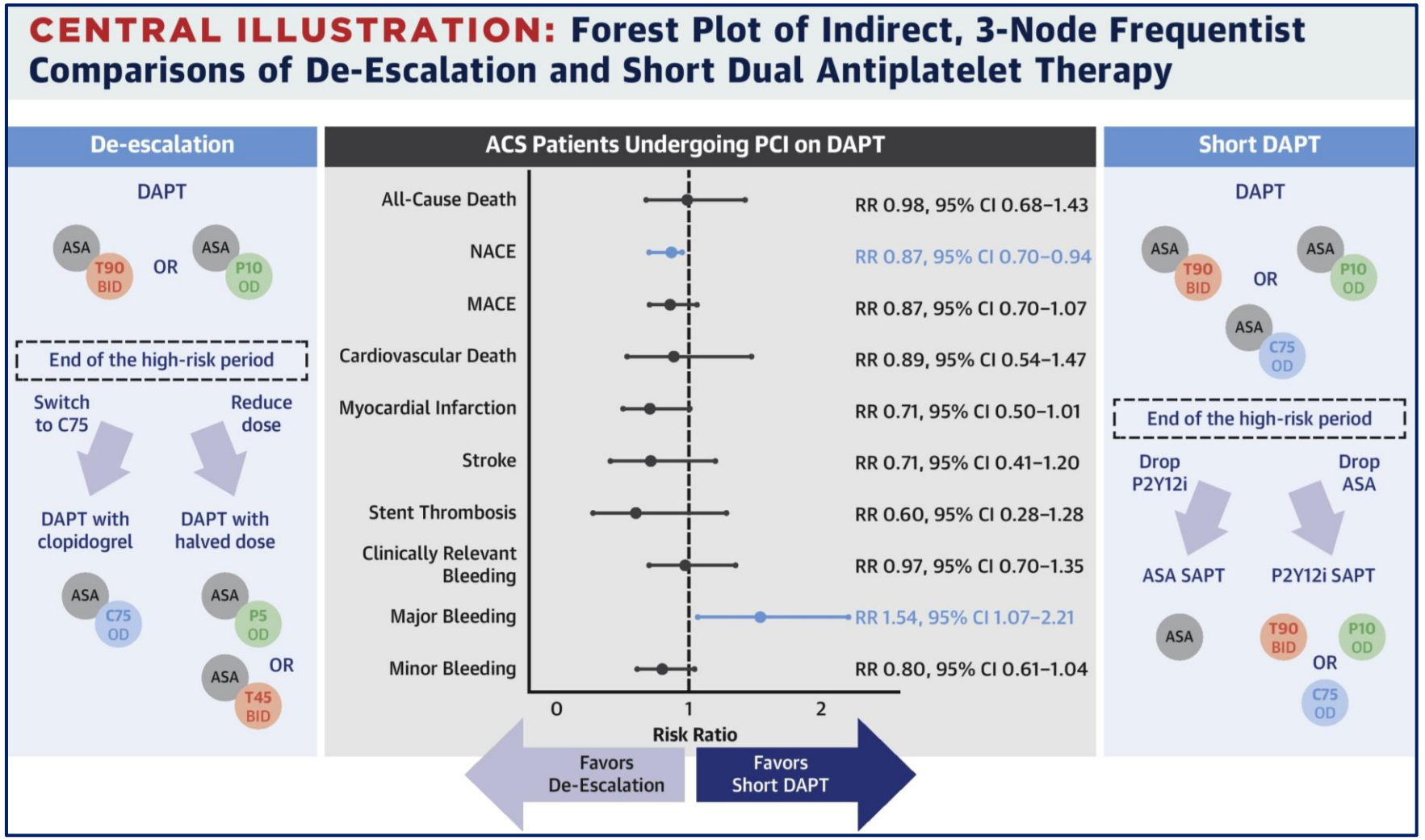
43% ↓ bleeding

▲ de-escalation to clopidogrel

● de-escalation to reduced dose of potent $P2Y_{12}$ inhibitor

Tavenier AH, Dangas G et al., EHJ CVP, 2021

De-Escalation or Short DAPT?

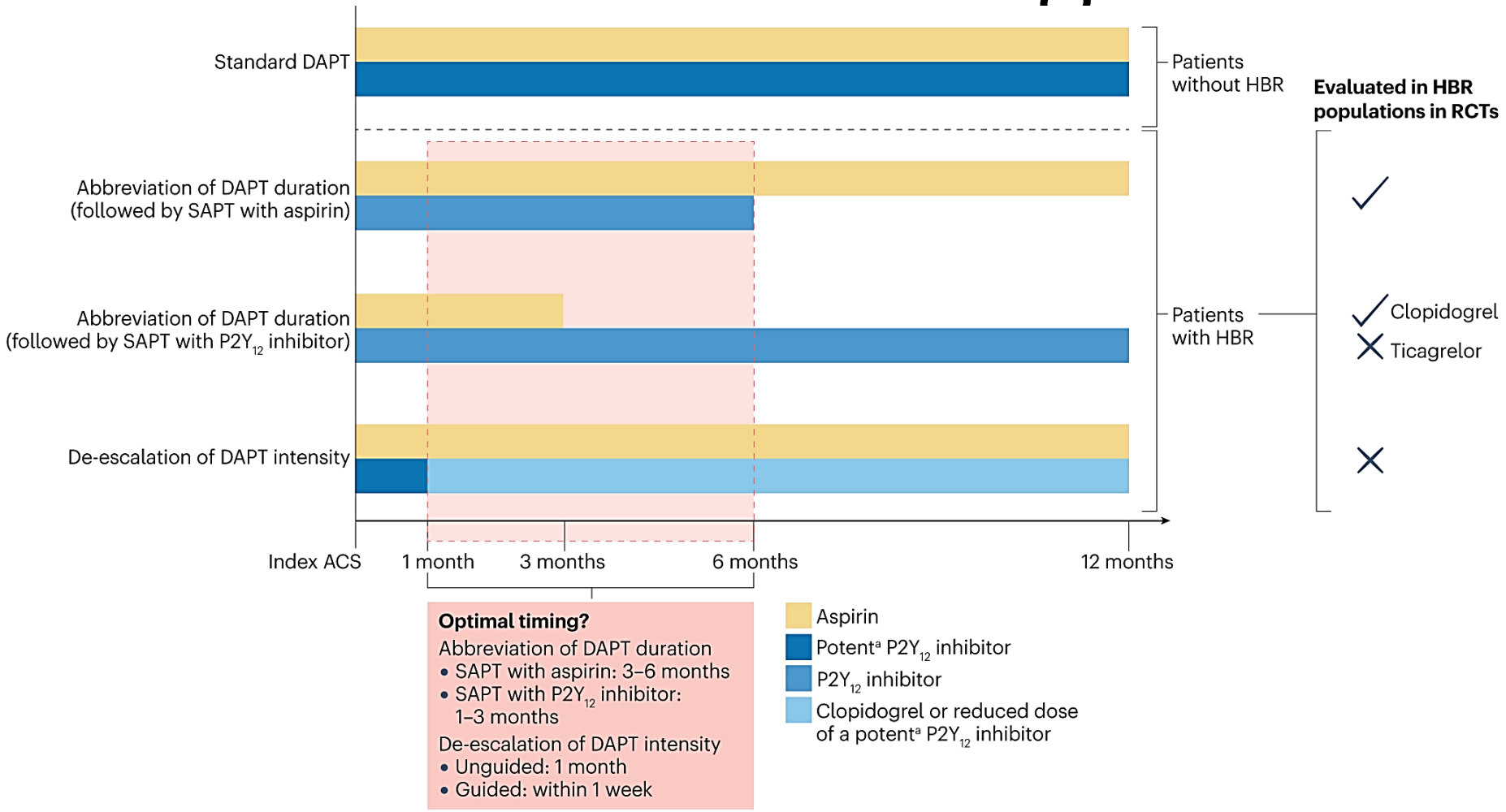


- 29 RCT studies, 50,602 patients
- Both reduce bleeding, negligible effect on MACE
- De-escalation – lower NACE
- Short DAPT - lower major bleeding

Individualize treatment for each patient based on NACE/MACE risk and bleeding

Laudani C, et al. J Am Coll Cardiol Intervent 2022;15:268–277

Potential DAPT Strategies



Gorog, D.A. Nat Rev Cardiol 2023. https://doi.org/10.1038/s41569-023-00901-2

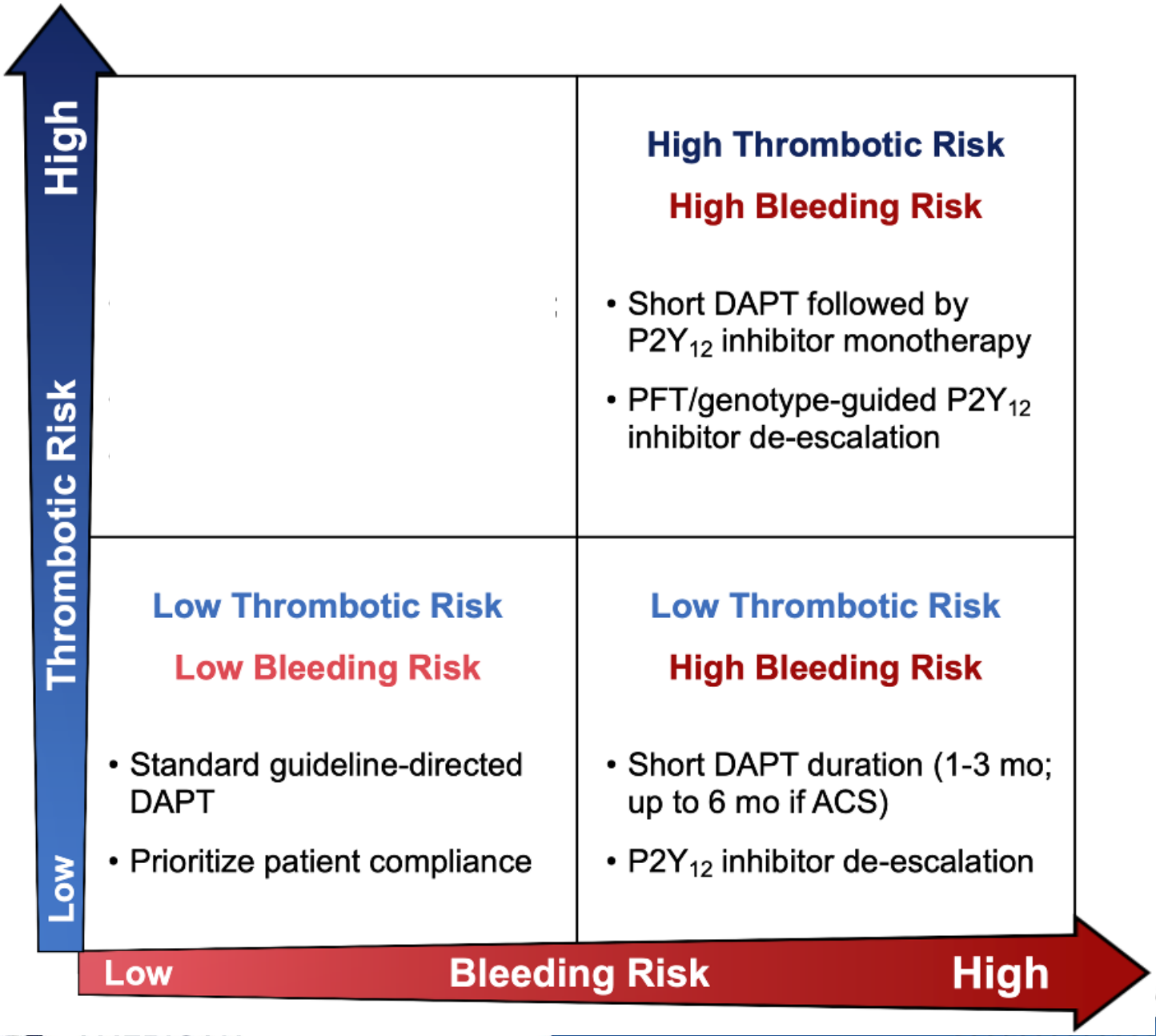
Which do you chose?

You are all correct!

…well, most of you

Balance of MACE and Bleeding Risk

Personalized Antithrombotic Therapy



Cao D et al., Eur Heart J. 2020 Dec 26;ehaa824.

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PATIENT C:

Clinical Presentation

- 58 yo male presents for transfer of care
- No chest pain, exercises 5x/week

PMH:

- CAD – Angina, LCx and RCA stent (2015) – off prasugrel for 3 years
- Hypertension
- Dyslipidemia
- Family history of early CAD

Medications:

- Aspirin 81 mg daily
- Rosuvastatin 20 mg daily
- Losartan 100 mg daily
- Tramadol 250 mg prn pain

Physical Examination:

- BP 138/88 mmHg, HR 75 bpm, RR 12
- Right carotid bruit

Carotid Ultrasound:

- Right internal: 50-70%, Left internal: 1-25%. No other significant disease.

What is the best next step for the patient?

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Escalate to ticagrelor 90 mg BID and stop ASA

Start cliostazol 100 mg BID

Restart clopidogrel 75 mg daily with ASA

Escalate to rivaroxaban 2.5 mg BID with ASA

State of the Art Antithrombotic Therapies

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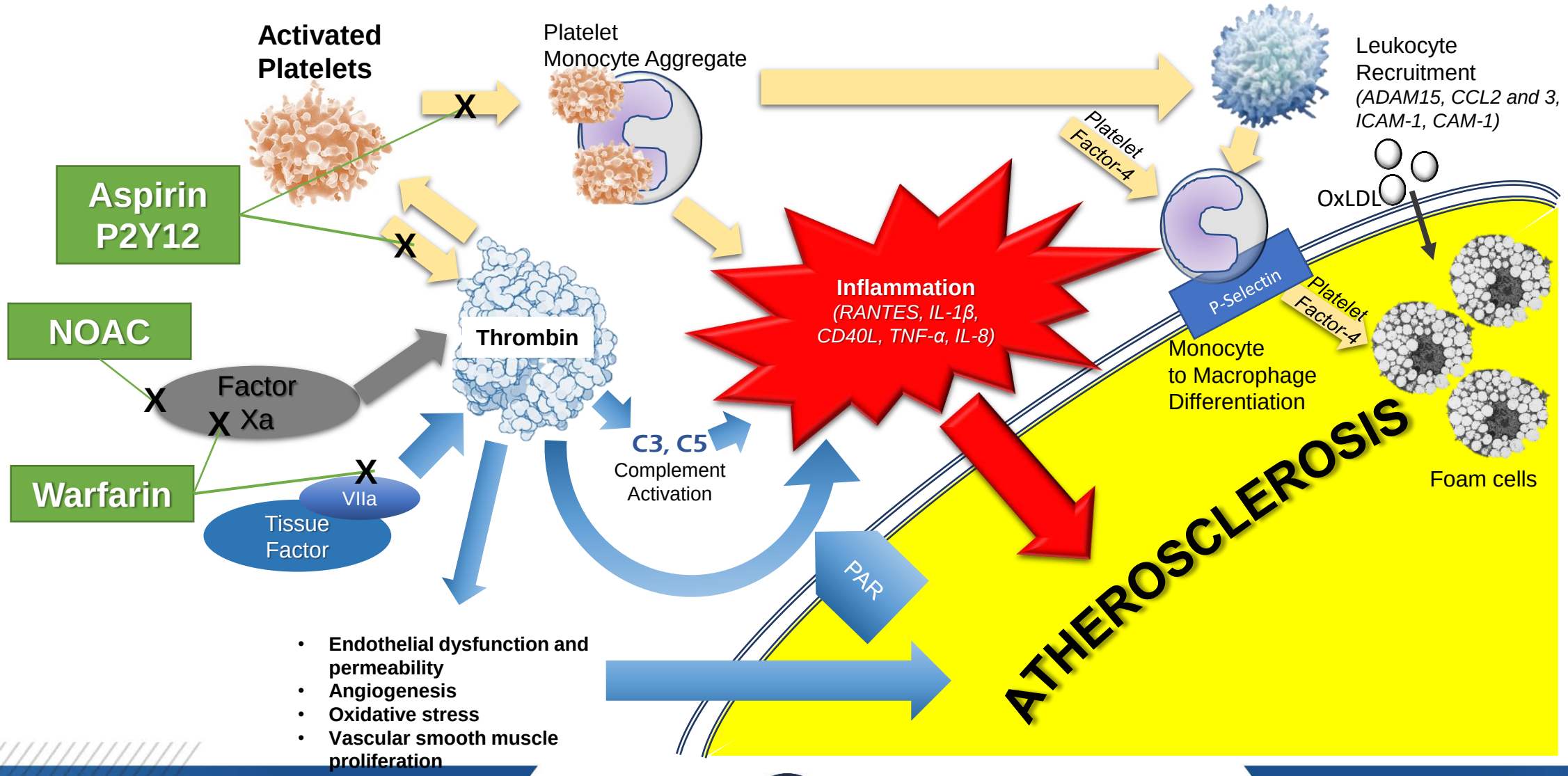
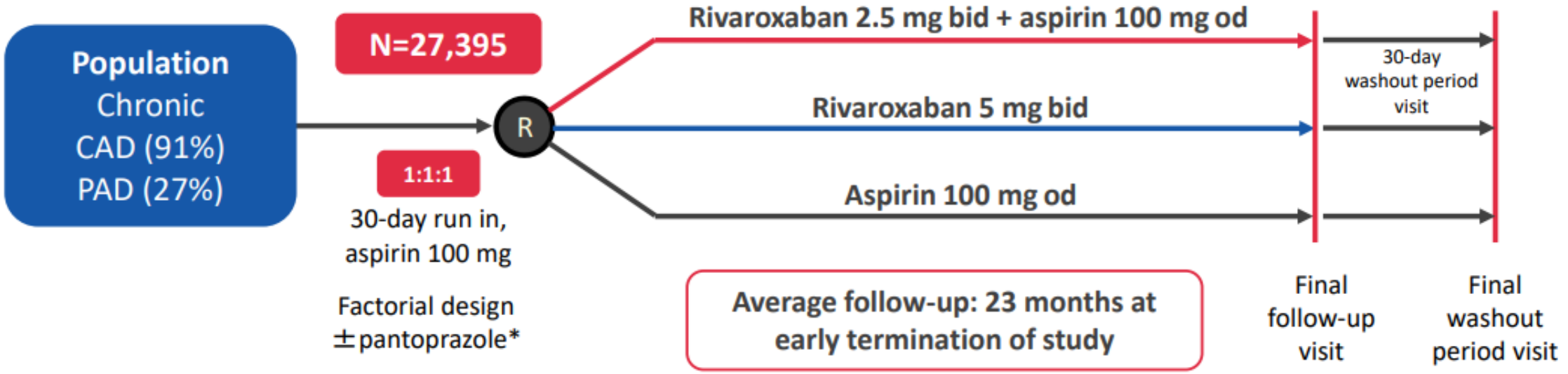
2. De-escalation Strategies
3. **Native Disease Dual Therapy**
4. Peripheral Arterial Disease

Thrombin and Platelets Promote Atherosclerosis



Rivaroxaban with or without Aspirin in Stable Cardiovascular Disease: COMPASS Trial



Antithrombotic investigations* were stopped 1 year ahead of expectations in Feb 2017 due to overwhelming efficacy in the rivaroxaban 2.5 mg bid + aspirin arm

Eikelboom JW, et al. N Engl J Med. 2017;377:1319-1330

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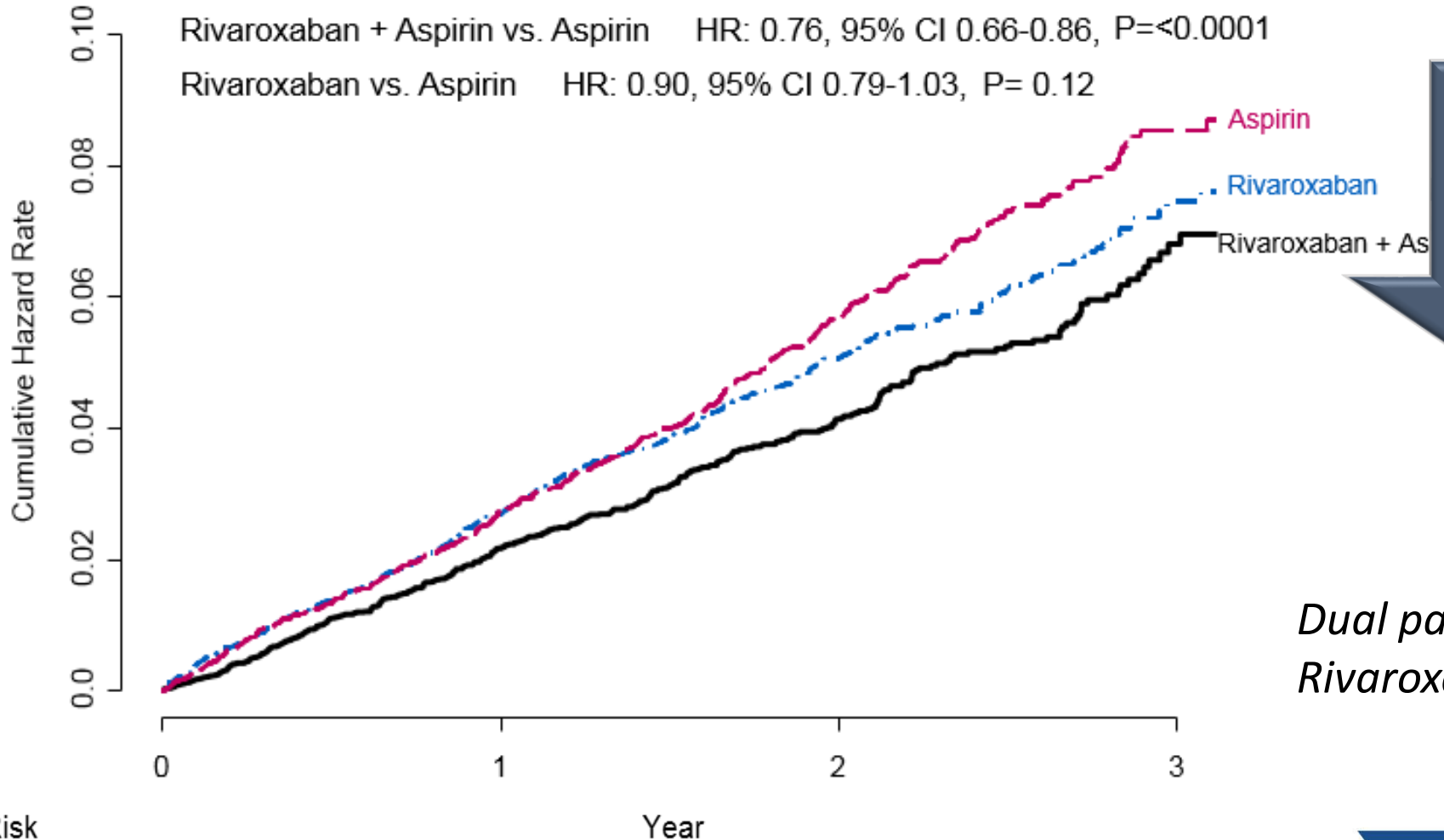
COMPASS Primary Outcome: MACE



R+A vs. A

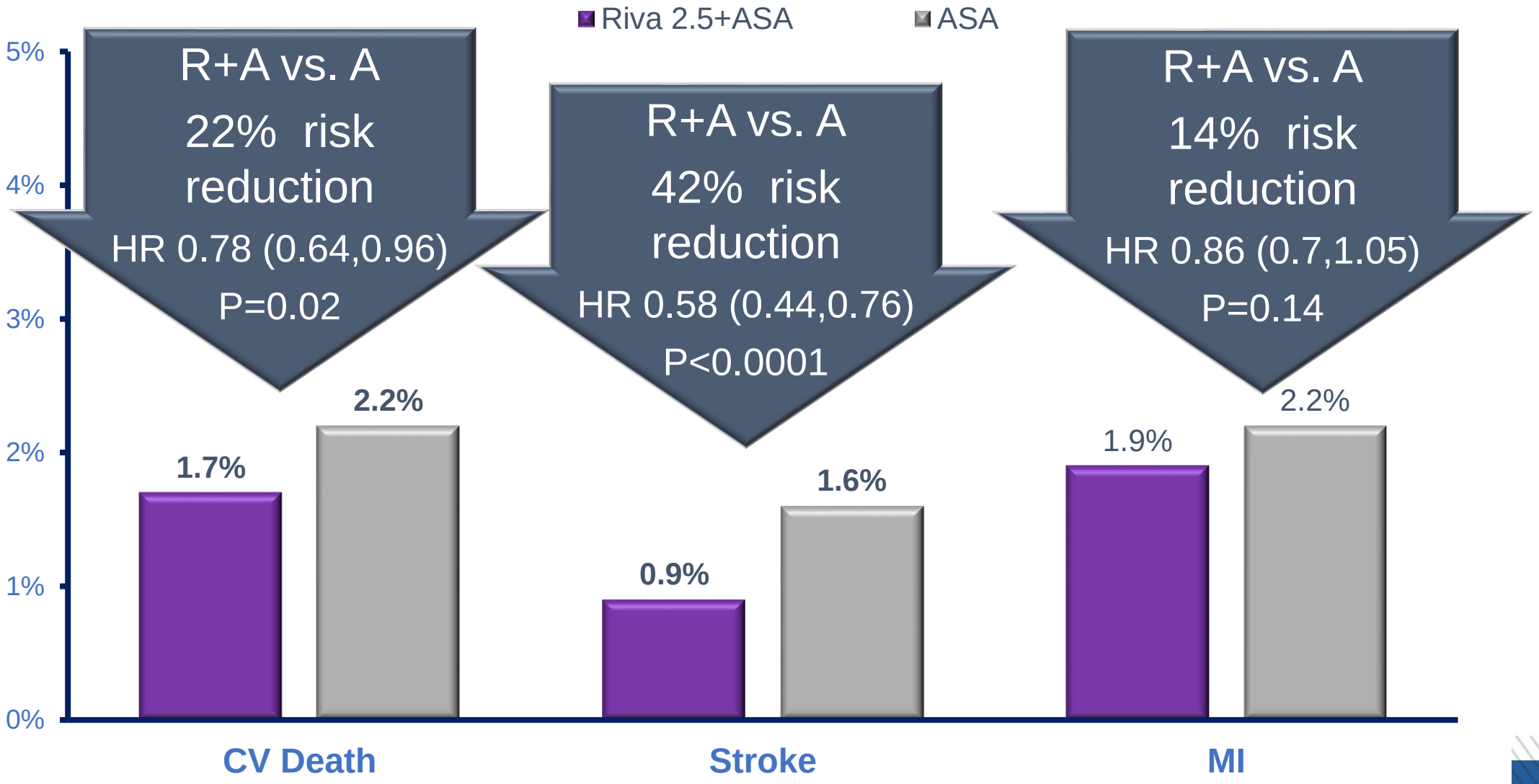
24% risk reduction

HR=0.76 (0.66,0.86)

NNT=77

Dual pathway inhibtion (DPI): Rivaroxaban 2.5 BID + ASA QD

Compass: Primary MACE Components



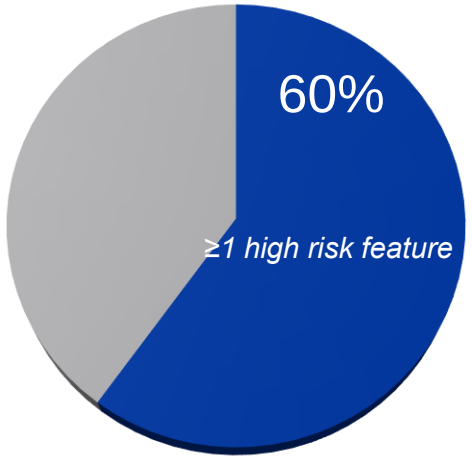
Eikelboom JW, et al. N Engl J Med 2017;377:1319-1330

High Risk Populations in COMPASS:
When to Accelerate

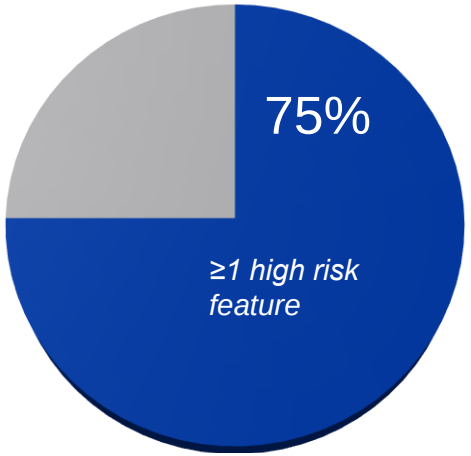
High Risk Features

- ✓ ≥2 vascular beds
- ✓ History of heart failure (HFpEF)
- ✓ Low eGFR < 60 ml/min
- ✓ Diabetes

Patients with high-risk features accounted for:



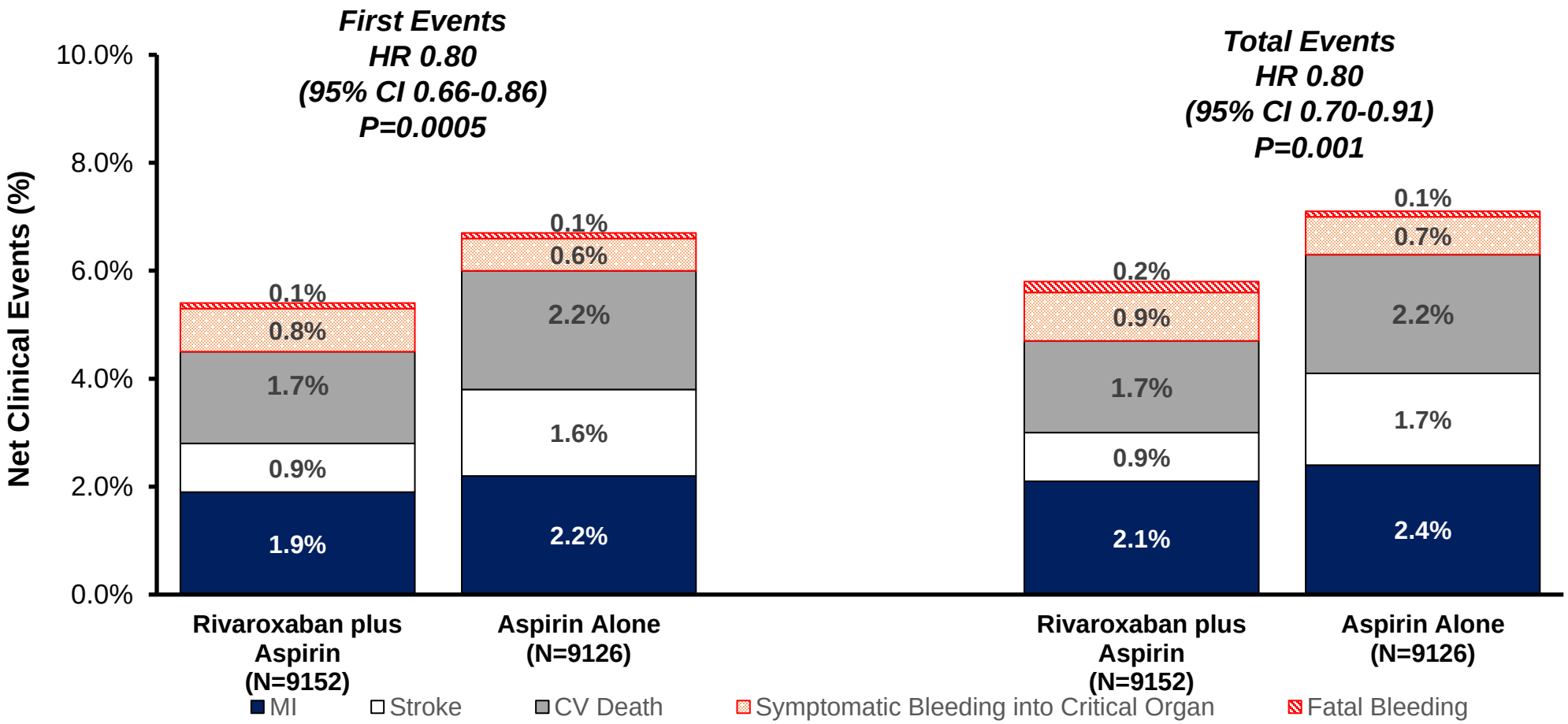
…total patients



…primary events

Anand SS, et al. JACC 2019:73:3271-3280. Fox KAA et al, J Am Coll Cardiol 2019;73:2243-2250. Branch KR, et al, Circulation 2019;13;140(7):529-537.

Net Clinical Benefit: First and Total Events



Branch KR, et al. Am Heart J 2023;258:60-68.

High Residual Risk: *Risk Factors*

High Ischemic Risk (*ESC 2019*)

Diffuse multivessel CAD with ≥1 of the following:

- Peripheral arterial disease (PAD)
- Recurrent myocardial infarction
- Diabetes mellitus, *medicated*
- Renal disease (*eGFR 15-59 ml/min/1.73m^2*)

Very High Ischemic Risk (*AHA/ACC 2018*)

Recurrent MACE or MACE + ≥1 HRF's

Major MACE:

- Recent ACS (<12 mo)
- Prior MI or stroke
- Symptomatic PAD

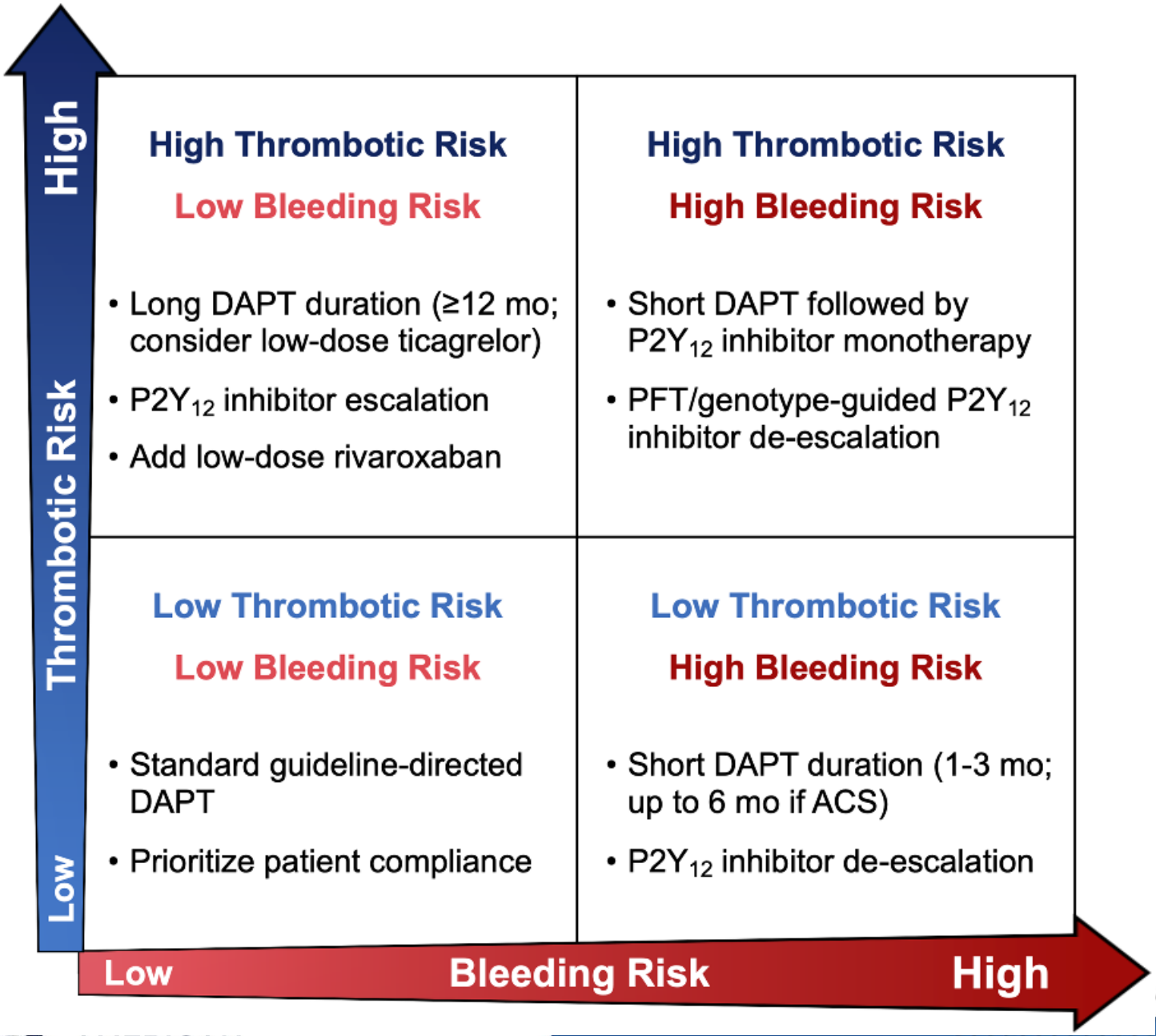
High Risk Factors (HRF):

- Age >65 yrs
- Diabetes mellitus
- Hypertension
- Renal disease (*eGFR 15-59 ml/min/1.73m^2*)
- Heterozygous familial hypercholesterolemia
- Prior coronary revascularization
- Smoking
- LDL >100 mg/dL on maximal meds
- Heart failure

Knuuti, et al. Eur Heart J 2020;41;407-7. Grundy SM, et al. J Am Coll Cardiol 2019;73:3168-209..

Key Points to Remember

Personalized Antithrombotic Therapy



Cao D et al., Eur Heart J. 2020 Dec 26;ehaa824.

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State of the Art Antithrombotic Therapies

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4. **Peripheral Arterial Disease**

PATIENT D:

72 yo male presents for CV follow-up for dyslipidemia, HTN

- Complains of leg discomfort, inability to keep up with grandkids

What patient characteristics would suggest SAPT as most appropriate therapy?

What patient characteristics would suggest dual pathway inhibition as most appropriate therapy?

Factors to consider:

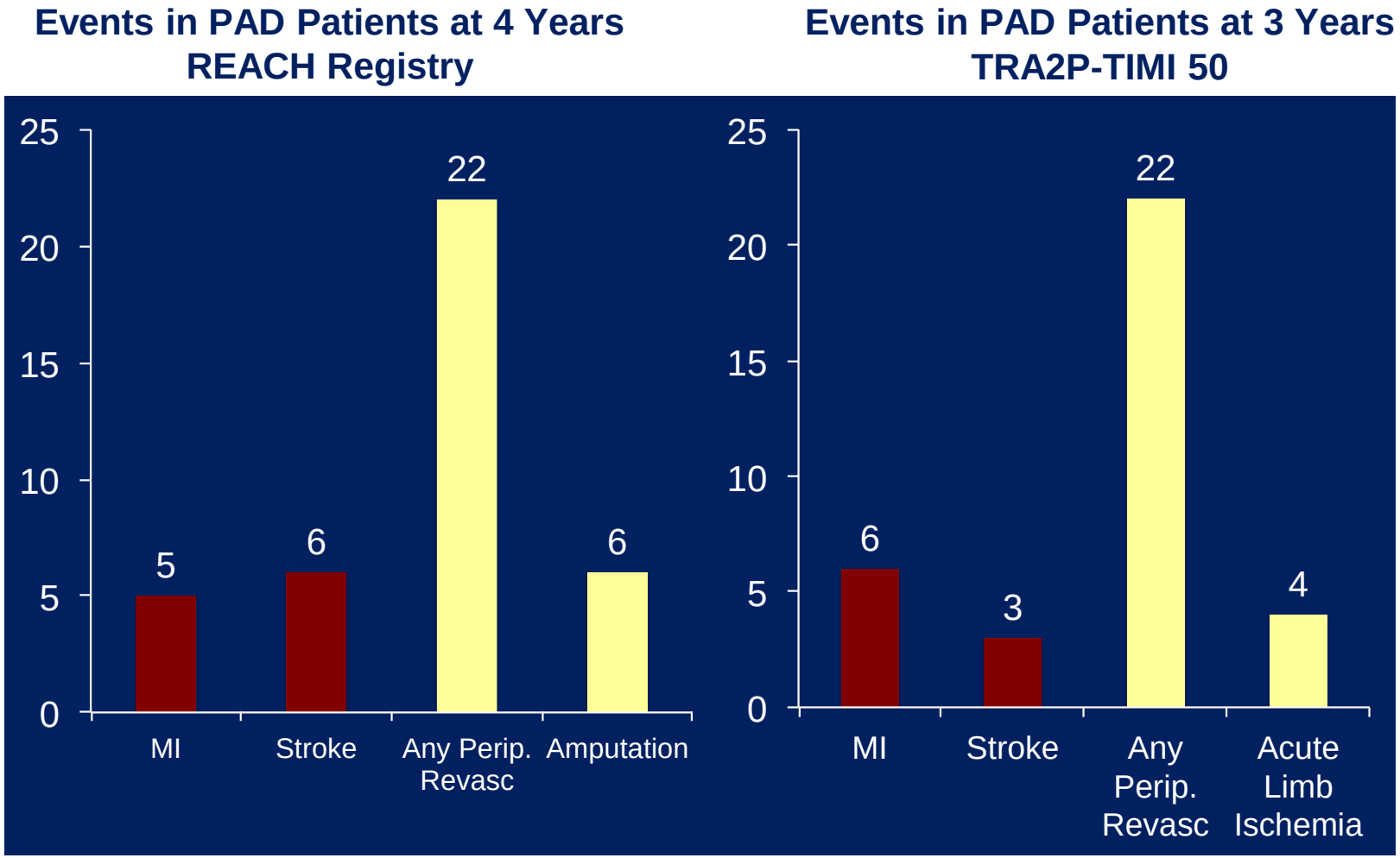
- Physical exam
- Comorbidities
- Testing data
- Bleeding risk
- Other medications
- Clinical setting

Burden of PAD

- >200 million with PAD globally
- Incidence is increasing with key risk factors of age, obesity and diabetes
- Key morbidity is limb symptoms (claudication → critical limb ischemia)

Kumbhani et al. EHJ 2014. Bonaca et al. Circulation 2013. Fowkes *et al. Lancet* 2017;14:156-170

Burden of Risk in PAD is Driven by Limb Events



- **Limb revascularization procedure → most common outcome**
- **Limb tissue loss events (e.g. amputation and ALI) are as common as MI and stroke**

Kumbhani et al. EHJ 2014. Bonaca et al. Circulation 2013. Fowkes *et al. Lancet* 2017;14:156-170

ACC / AHA PAD Guidelines 2016 – No Class 1 Recommendations for MALE

- Similar to 2005 Guideline
- **Recommendations for therapy to reduce MACE** based on presence of claudication (not MACE risk factors)

For "Symptomatic PAD"

COR LOE	Therapy	Comment
I A	**Monotherapy** ASA 75-325 mg or **Clopidogrel**	CAPRIE showed clopidogrel superior to ASA
IIb B-R	**DAPT** ASA+ Clopidogrel	Refer to the DAPT guideline for CAD
IIb B-R	**DAPT or TAPT** **Vorapaxar** (plus ASA and/or clopidogrel)	Benefit for MACE and ALI but increase in bleeding so overall benefit uncertain

US FDA approved for PAD in BLUE

MALE = major adverse limb events

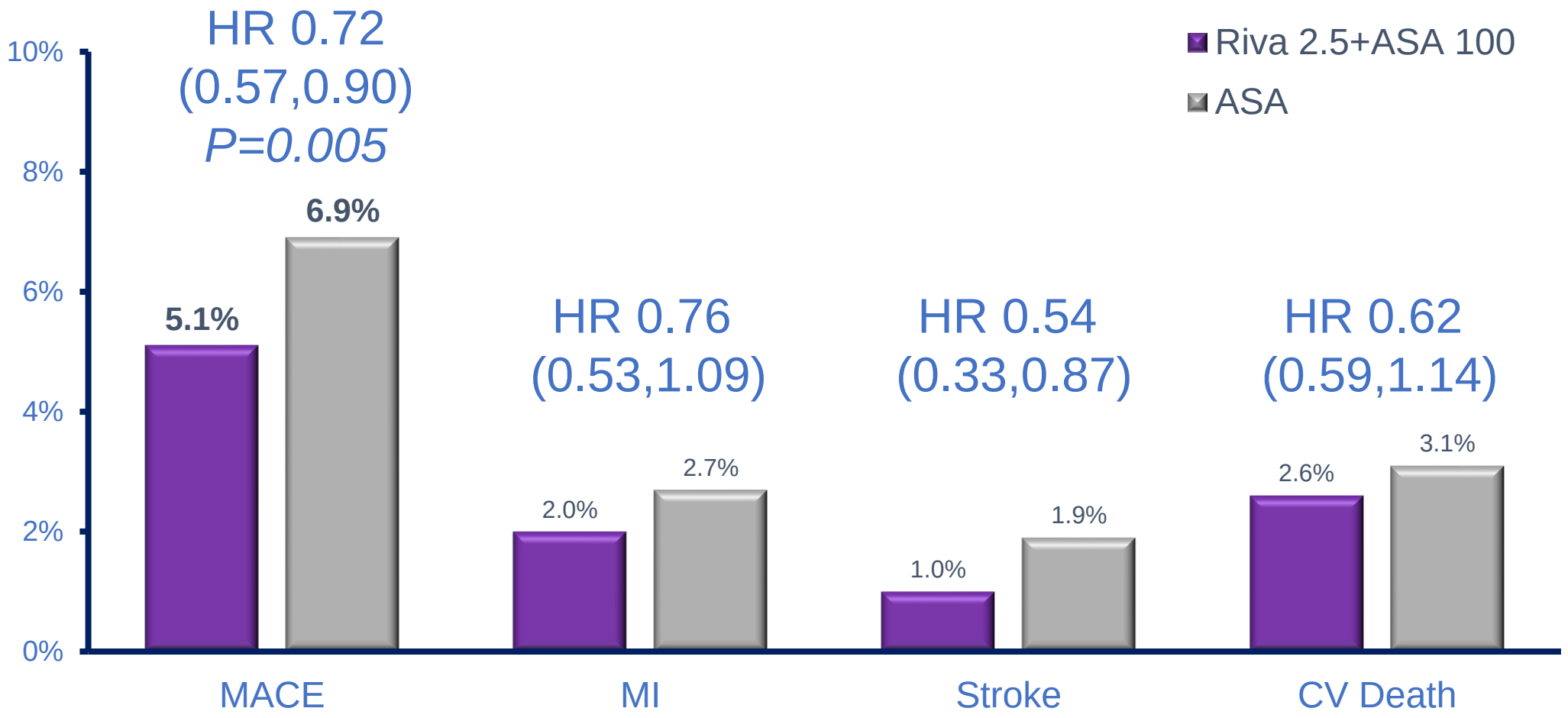
Gerhard-Herman et al. Circulation 2016

Are current guidelines good enough?

COMPASS PAD: Primary Outcome and Components

PAD N=7470 (27%)

-Symptomatic lower extremity disease, revascularization, amputation
-Carotid stenosis ≥50%



Riva 5mg BID alone (p=0.19)

Anand et al, Lancet 2018;391(10117):219-229

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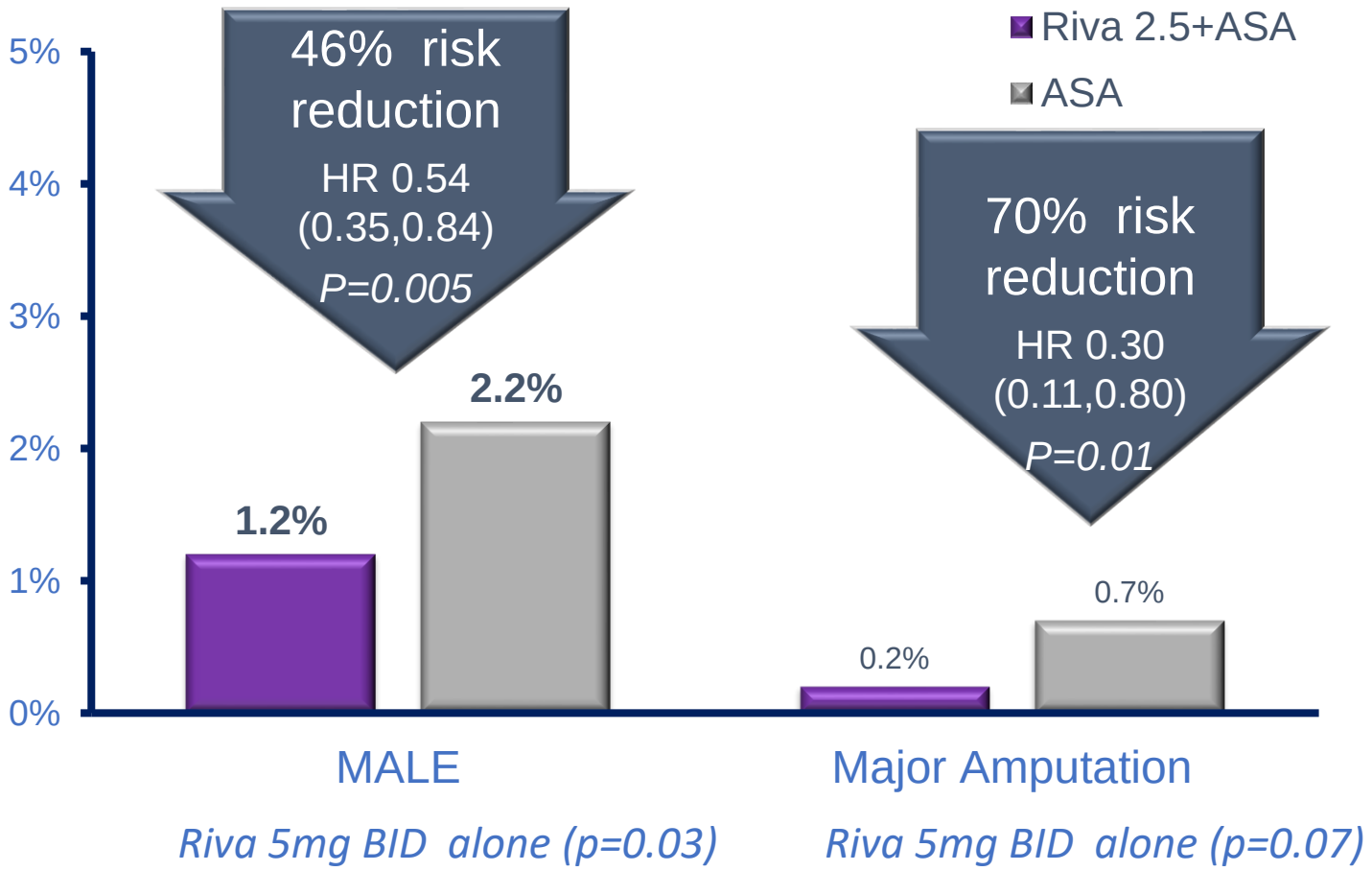
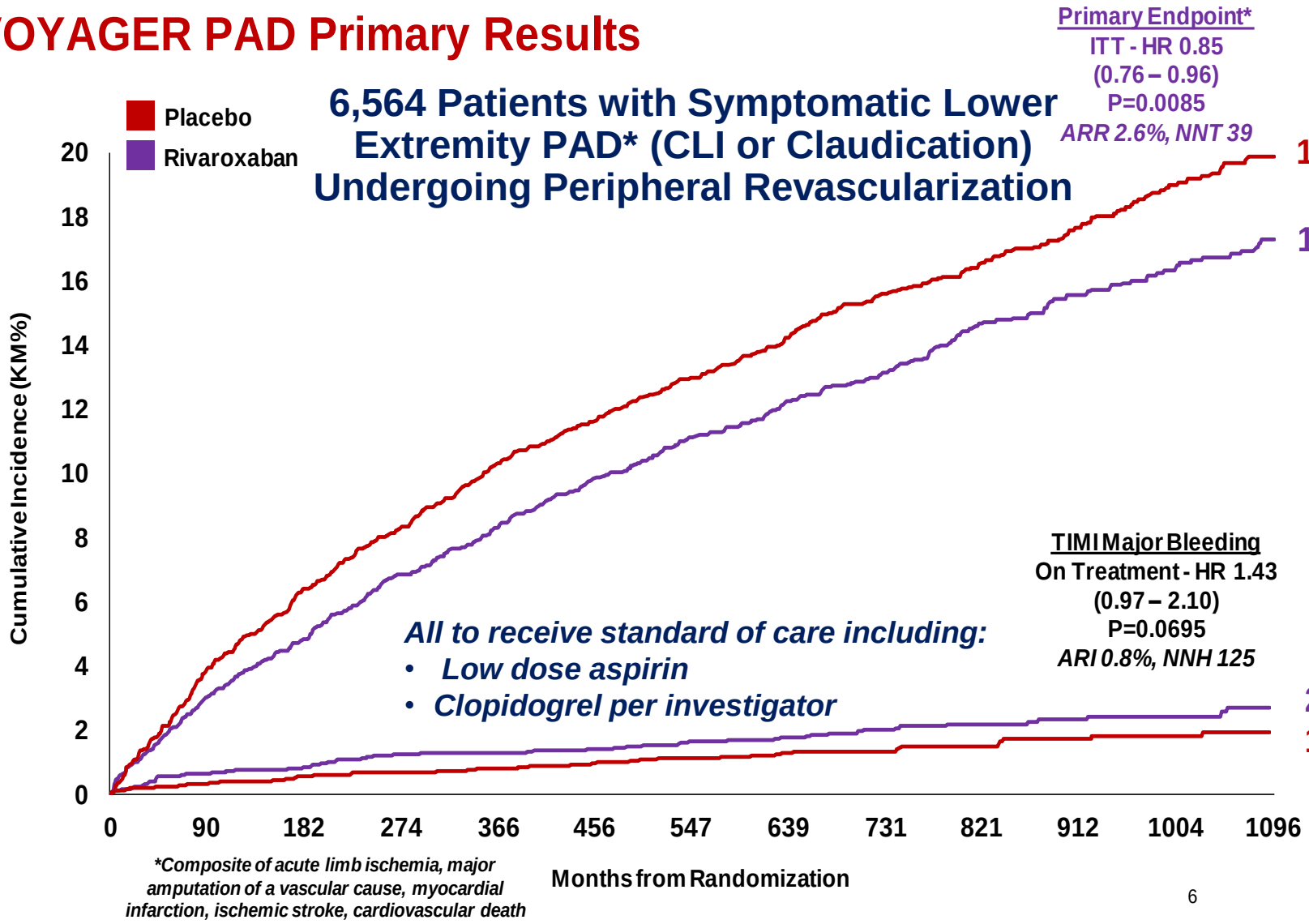
COMPASS PAD: MALE, or Major Amputation

MALE = Major Adverse Limb Events

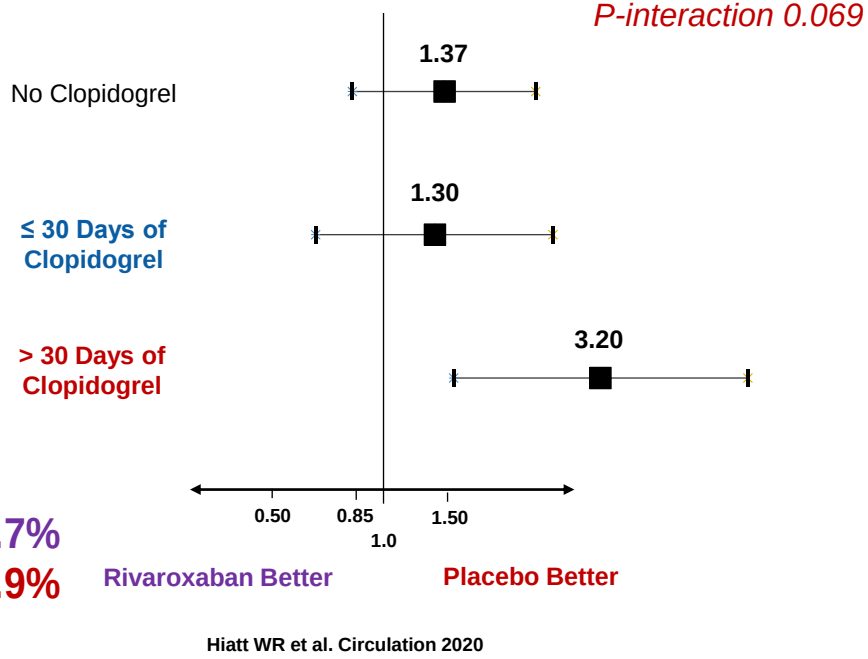


Anand et Lancet 2019

VOYAGER PAD Primary Results



*Composite of acute limb ischemia, major amputation of a vascular cause, myocardial infarction, ischemic stroke, cardiovascular death

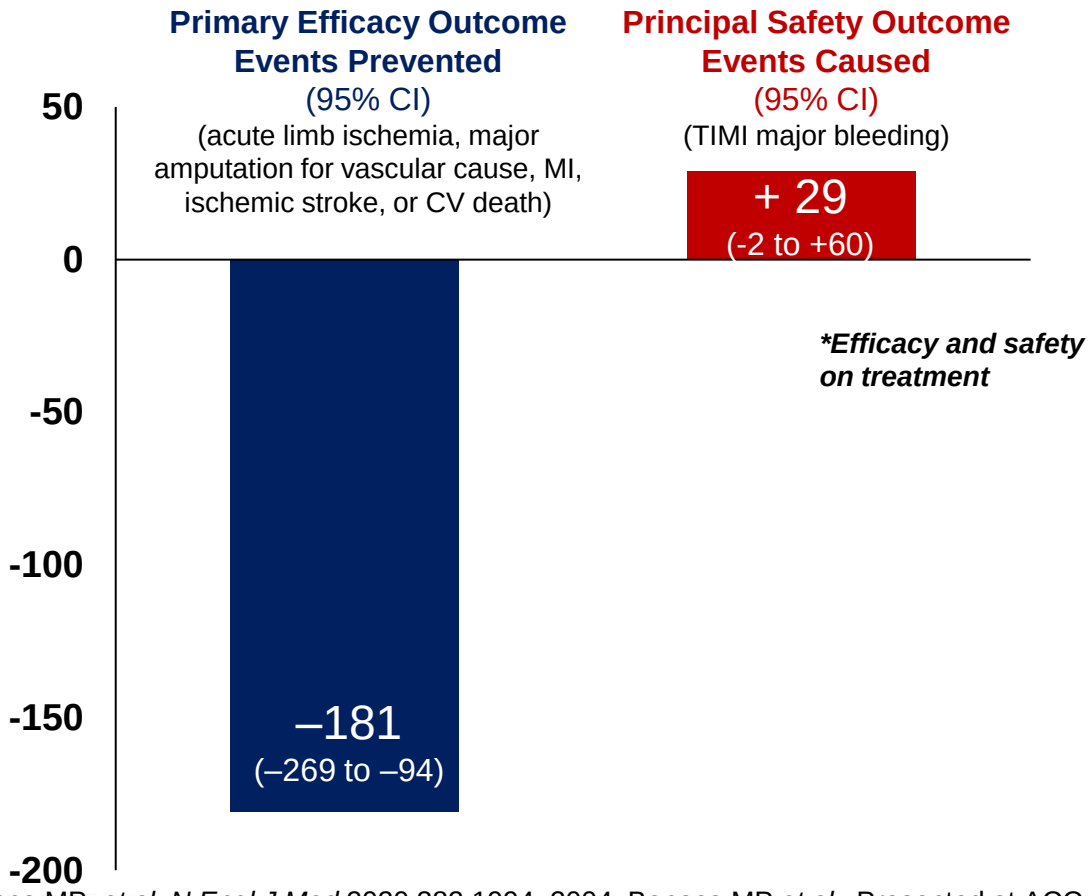


Hiatt WR et al. Circulation 2020

Bonaca MP, *et al*. *N Engl J Med* 2020;382:1994–2004

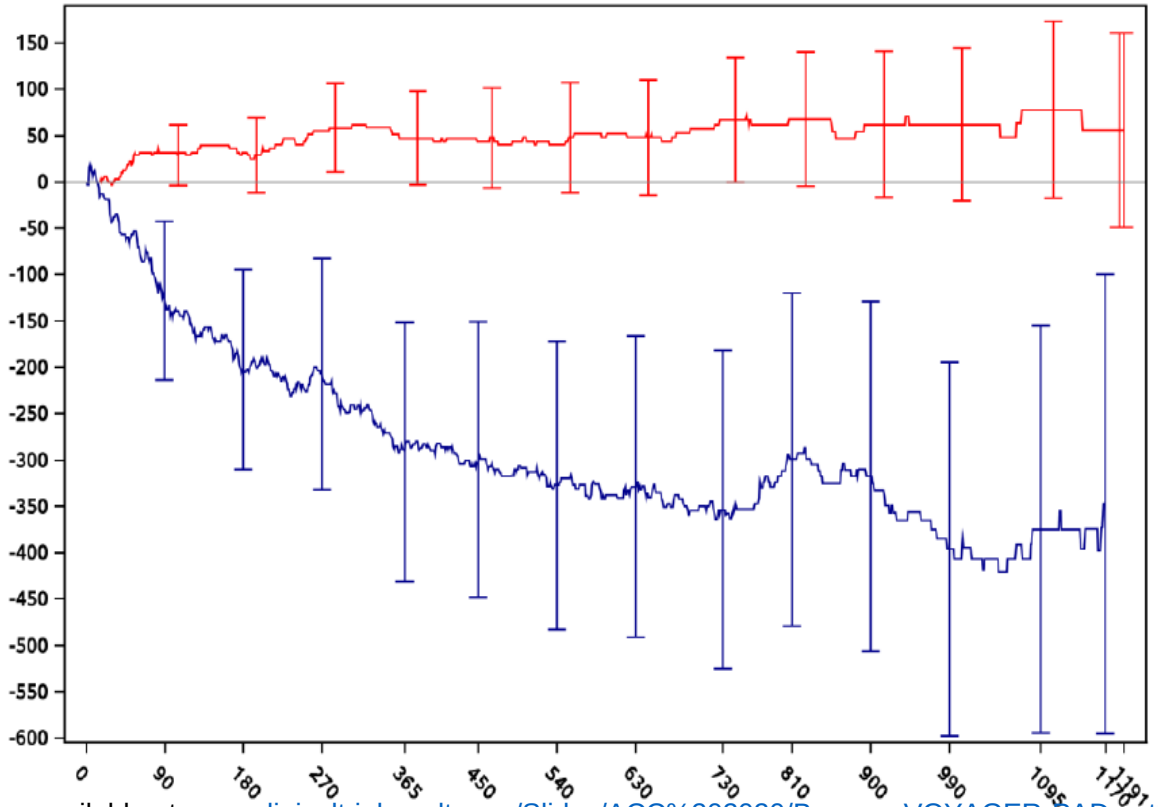
Riva+ ASA: Risk–Benefit

First Events Prevented / Caused for 10,000 Patients Treated* for 1 Year



Efficacy and safety on treatment

First Events Prevented / Caused from Time from Randomization



Bonaca MP, *et al*. *N Engl J Med* 2020;382:1994–2004. Bonaca MP *et al*.. Presented at ACC 2020. Slides available at www.clinicaltrialresults.org/Slides/ACC%202020/Bonaca_VOYAGER-PAD.pptx

PATIENT D:

72 yo male presents for CV follow-up for dyslipidemia, HTN

- Complains of leg discomfort, inability to keep up with grandkids

SAPT as most appropriate therapy?

- **No CLI findings**
- **Few comorbidities**
- **Mild ABI abnormalities**
- **Higher bleeding risk (NSAID use, prior bleed)**

Dual pathway inhibition as most appropriate therapy?

- **CLI or ALI**
- **Polyvascular, CKD, DM2**
- **Moderate-severe ABI abnormalities**
- **Low bleeding risk**
- **Post-procedure**

State of the Art Antithrombotic Therapies

Personalize Approach to Antithrombotics

- ASA: ↓ MACE for CAD and PAD; ↑ bleeding risk
- DAPT post-ACS, duration dependent on bleeding and thrombotic risk
- Shorter DAPT (3-12 mo) in high bleeding risk ↓ major bleeding, neutral MACE
- De-escalation to lower potency P2Y12 (clopidogrel) may lower net adverse clinical events (NACE) in high bleeding risk

Reduce antithrombotic potency with higher bleeding risk and low (or intermediate) thrombotic risk

State of the Art Antithrombotic Therapies
Personalized Approach to Antithrombotics

- Patients with PAD: ↑ risk of MACE and MALE
  - Thrombin plays significant role in limb ischemia, stroke
- Rivaroxaban 2.5 mg + aspirin 81: ↓ MACE and MALE with favorable net benefit
  - Post-procedure AND chronic disease
  - Not applicable to other oral anticoagulants

High risk patients (polyvascular disease, eGFR 15-59, DM, HFpEF) benefit from addition of higher potency agents (e.g. DAPT or rivaroxaban) if not at heightened bleeding risk

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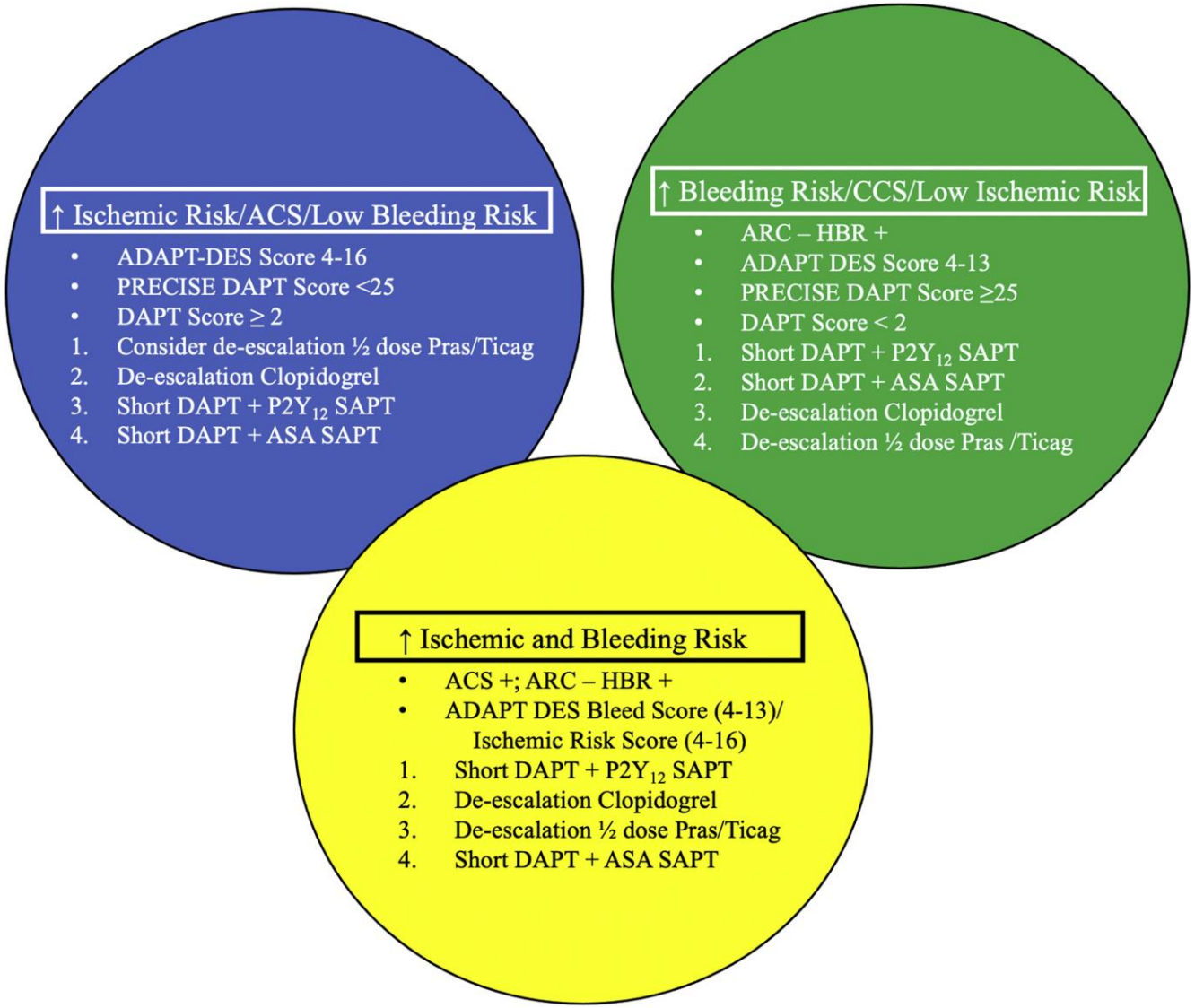
Advancing Heart Care Worldwide



Kereiakes DJ and Yeh RW. J Am Coll Cardiol Intv. 2022;15:278–281