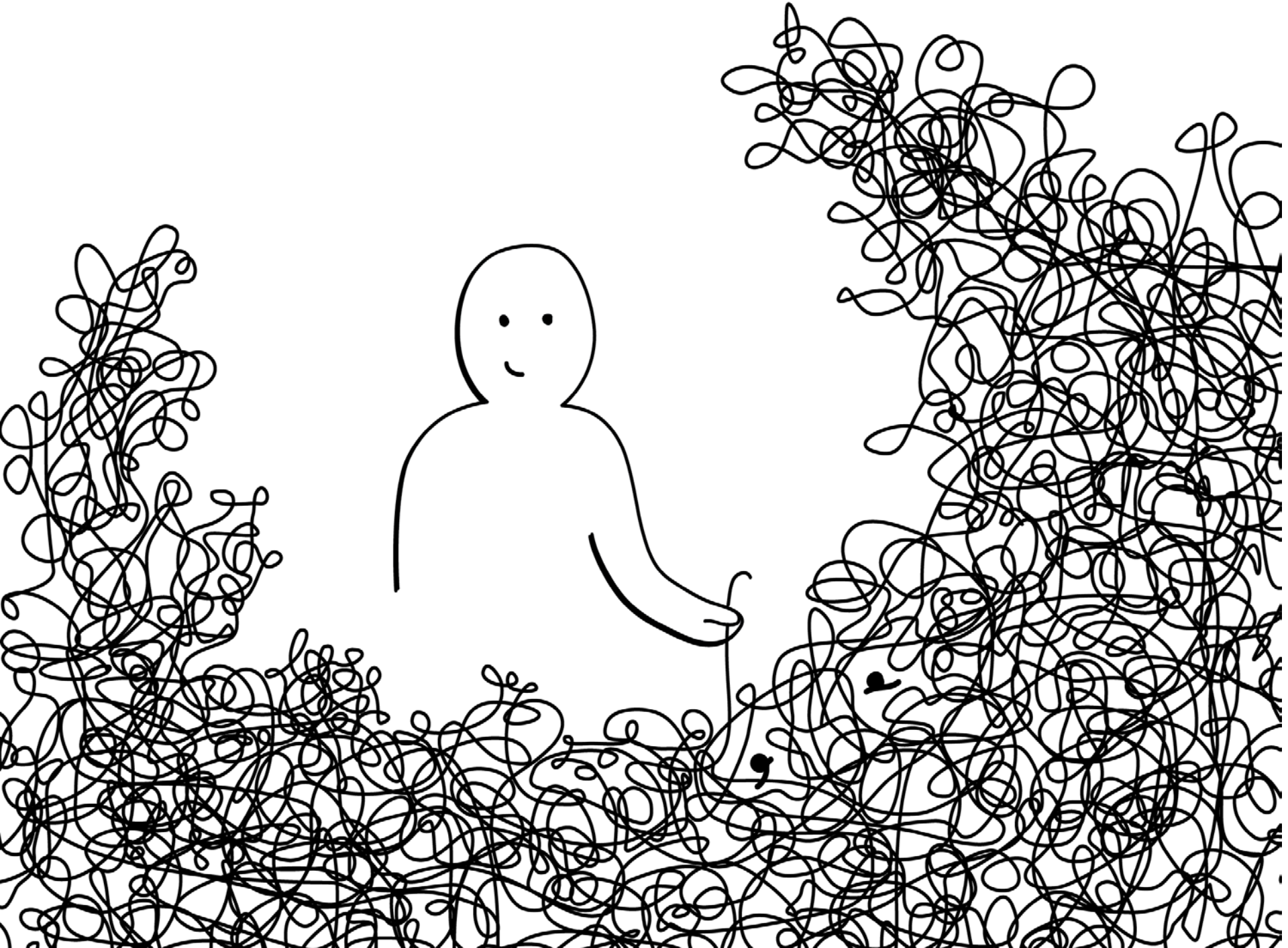
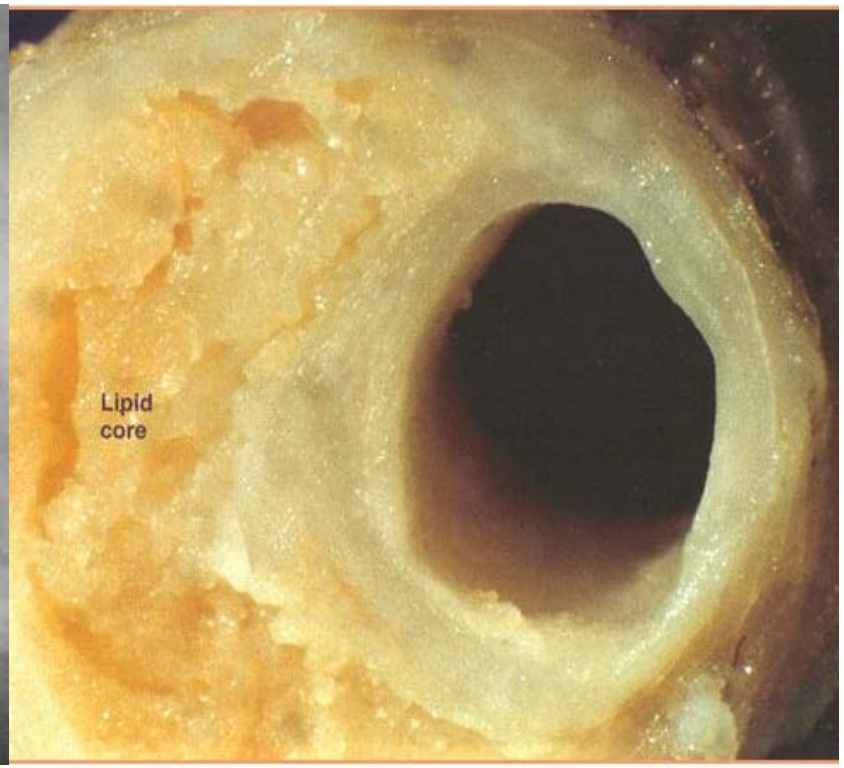
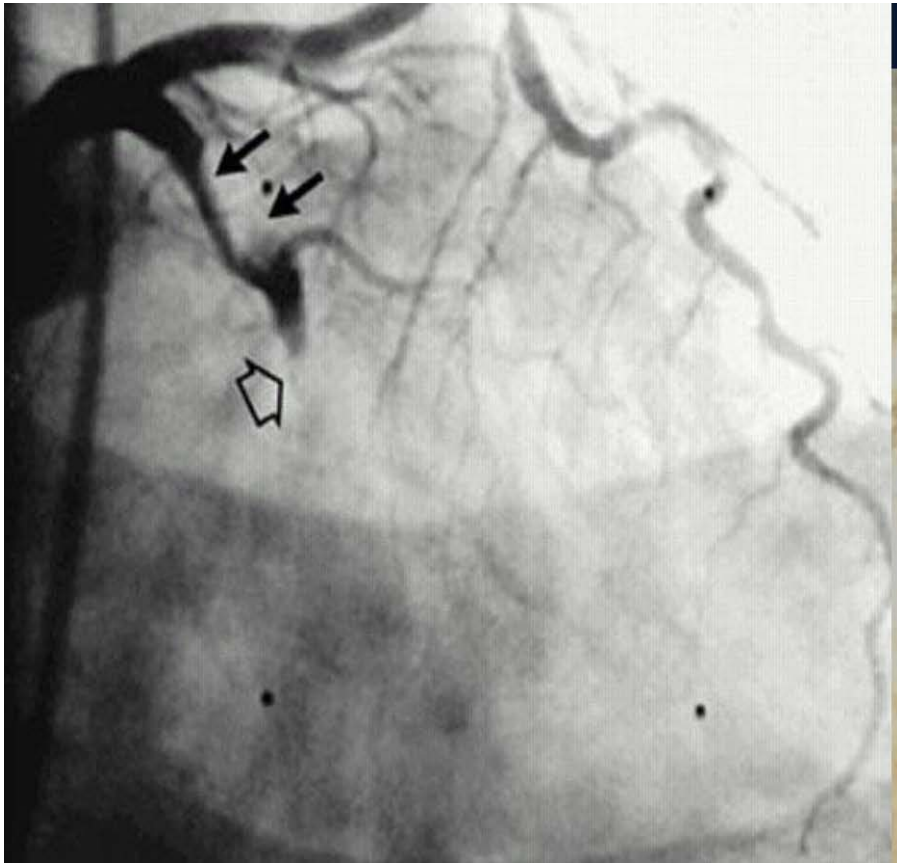
Kronik Total Oklüzyon Kulübü

KTO'da antiplatelet seçimi nasıl olmalı? DAPT süresi daha mı uzun olmalı?

Prof.Dr.Oğuz Yavuzgil
Ege Üniversitesi Tıp Fakültesi
Kardiyoloji Abd, İzmir




Lipid
core



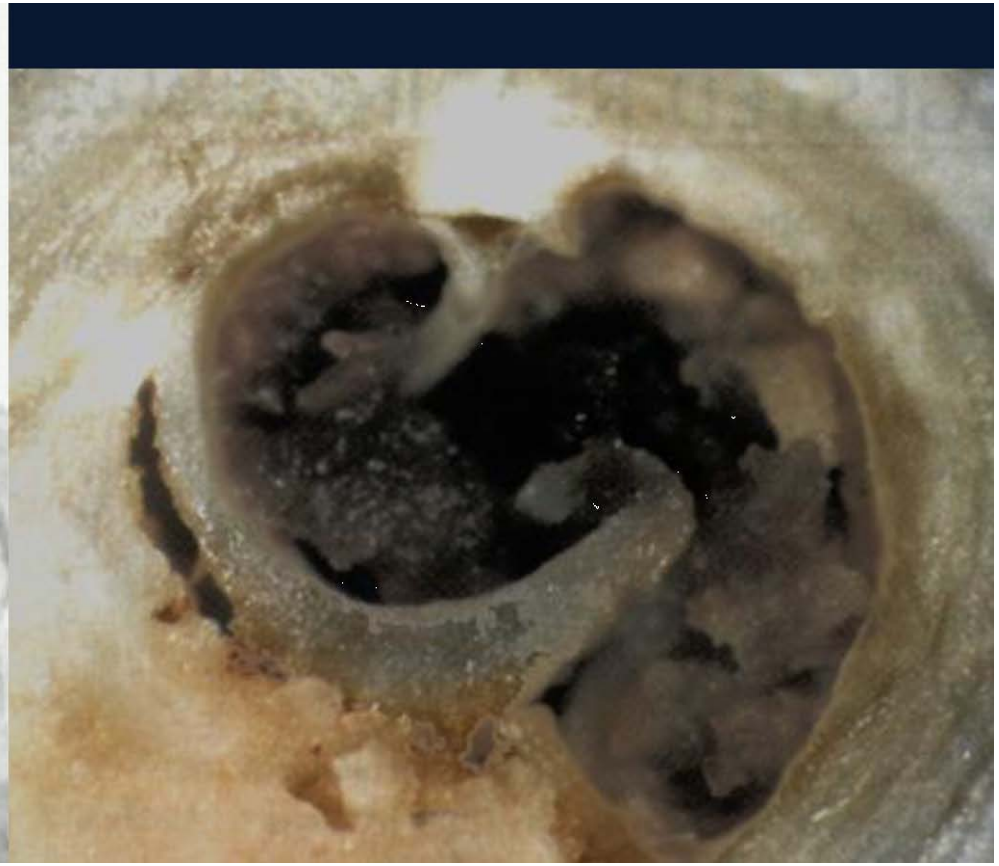
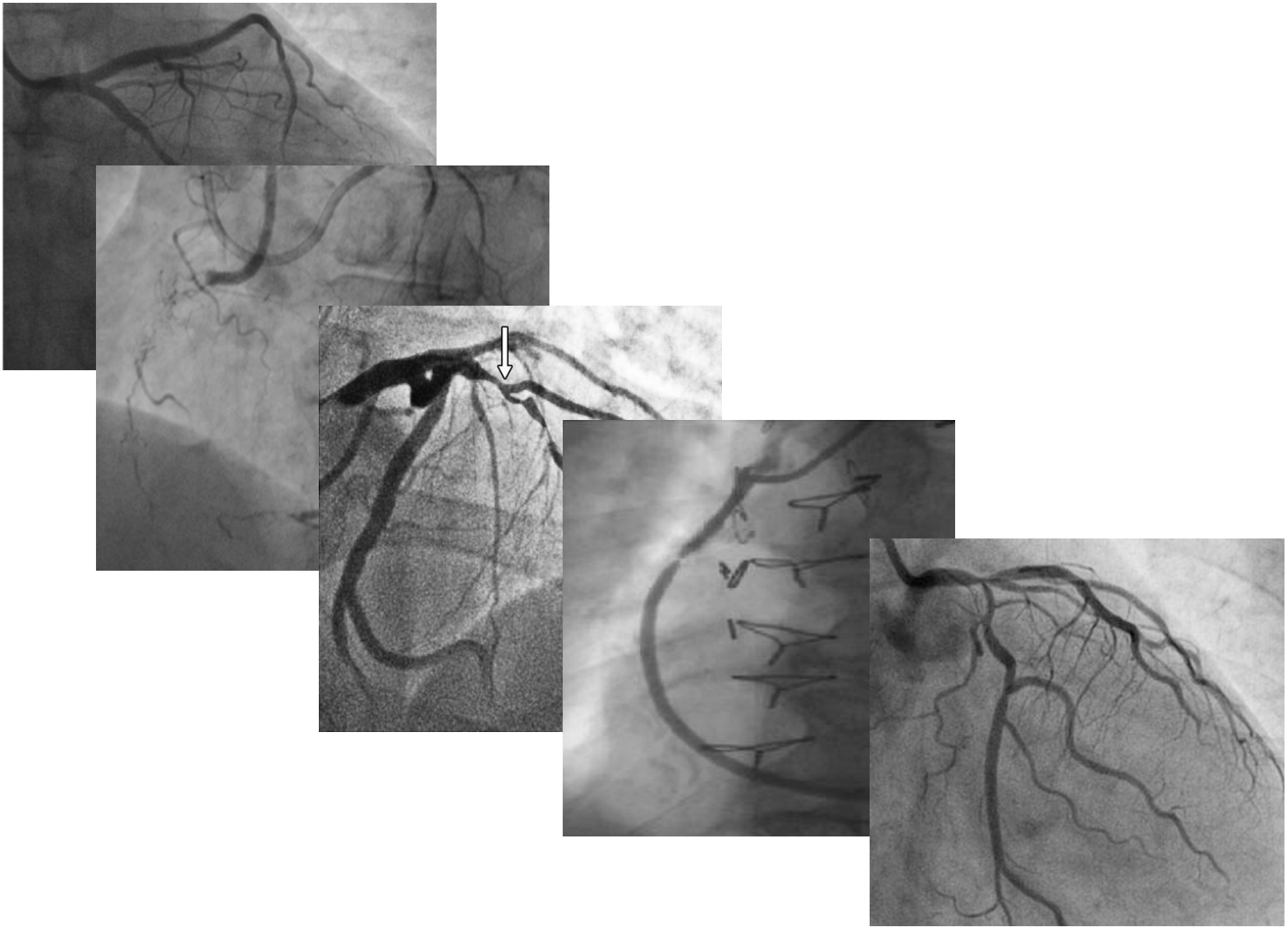
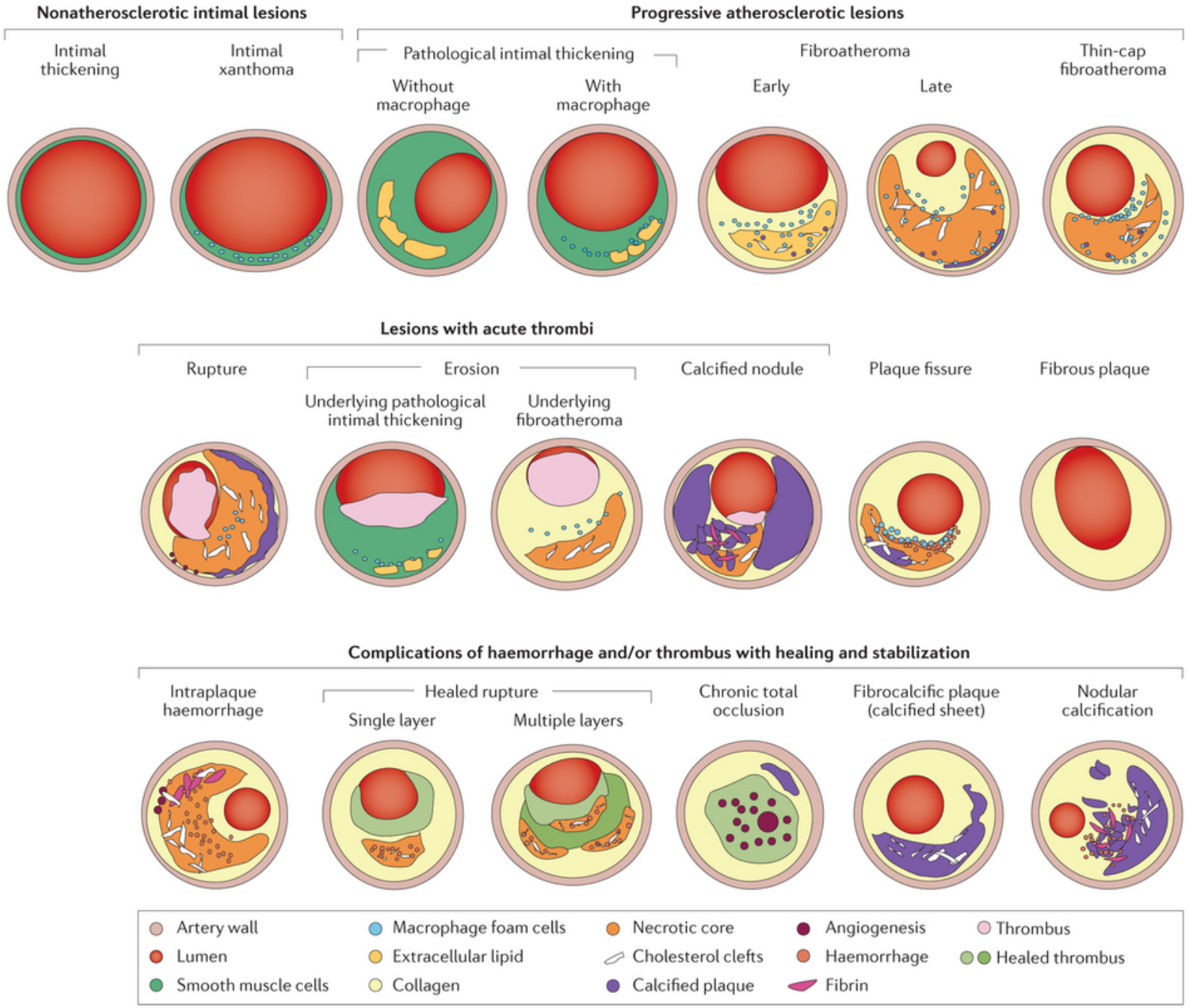


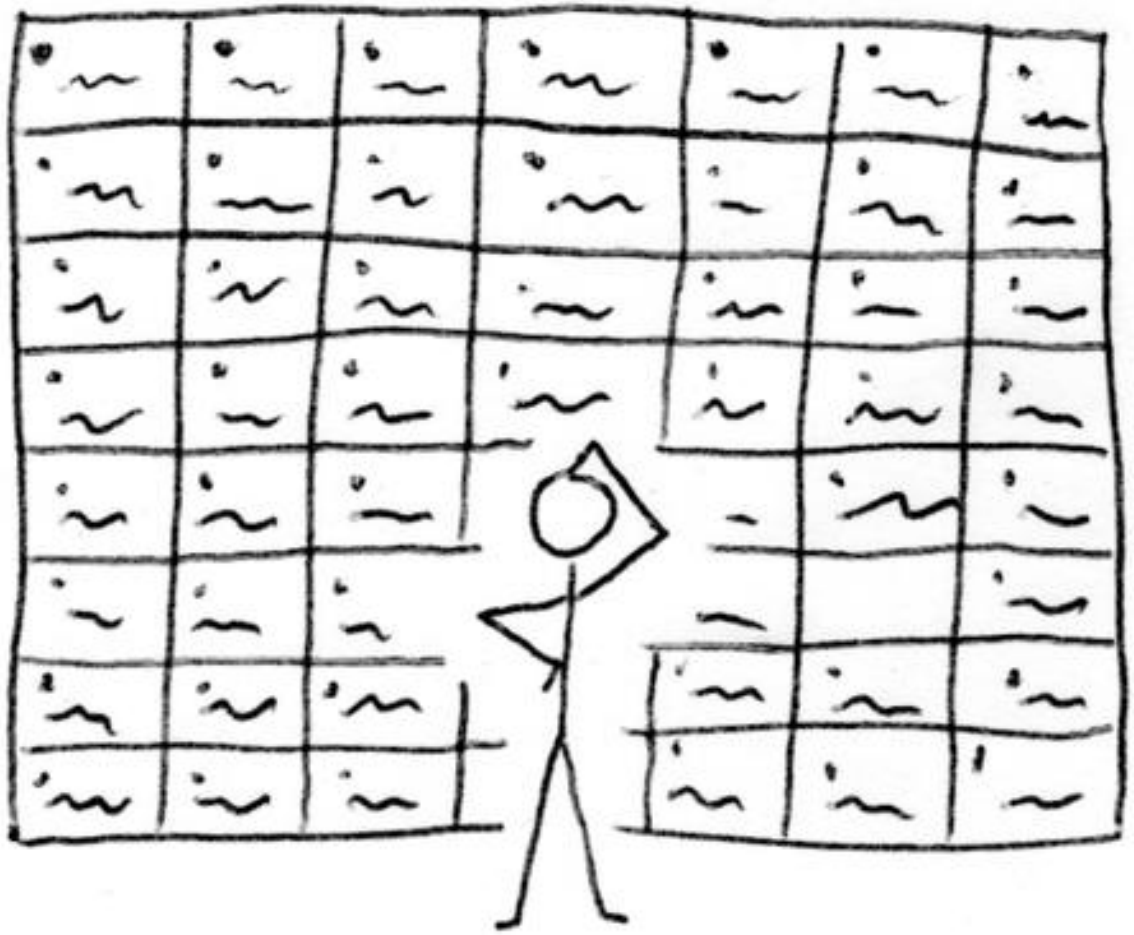
TABLE 2. **Angiographic Characteristics of Lesions**

Type A lesion (high primary success rate, 85%; low risk)		
Short (<10 mm)	Concentric	Easy access
Nonangulated segment (<45°)	Smooth contour	Calcification absent or mild
No complete occlusion	Absence of thrombus	No compromise of adjacent branches
Type B lesion (lower primary success rate, 60%-85%; moderate risk)		
Tubular (length, 10-20 mm)	Eccentric	Moderate tortuosity of the proximal segment
Moderate or severe calcification	Ostial	Moderately angulated segment (>45°-<90°)
Complete occlusion <3 months	Presence of thrombus	Bifurcation lesions that require a double guidewire
Irregular contour		
Type C lesion (low primary success rate, <60%; high risk)		
Diffuse (length, >20 mm)	Complete occlusion >3 months	Excessive tortuosity of the proximal segment
Highly angulated segments (>90°)	Impossibility of protecting adjacent major branches	Degenerated bypass grafts with unstable lesions




Nonatherosclerotic intimal lesions
Intimal thickening
Intimal xanthoma
Progressive atherosclerotic lesions
Pathological intimal thickening
Without macrophage
With macrophage
Fibroatheroma
Early
Late
Thin-cap fibroatheroma
Lesions with acute thrombi
Rupture
Erosion
Underlying pathological intimal thickening
Underlying fibroatheroma
Calcified nodule
Plaque fissure
Fibrous plaque
Complications of haemorrhage and/or thrombus with healing and stabilization
Intraplaque haemorrhage
Healed rupture
Single layer
Multiple layers
Chronic total occlusion
Fibrocalcific plaque (calcified sheet)
Nodular calcification
Artery wall
Lumen
Smooth muscle cells
Macrophage foam cells
Extracellular lipid
Collagen
Necrotic core
Cholesterol clefts
Calcified plaque
Angiogenesis
Haemorrhage
Fibrin
Thrombus
Healed thrombus

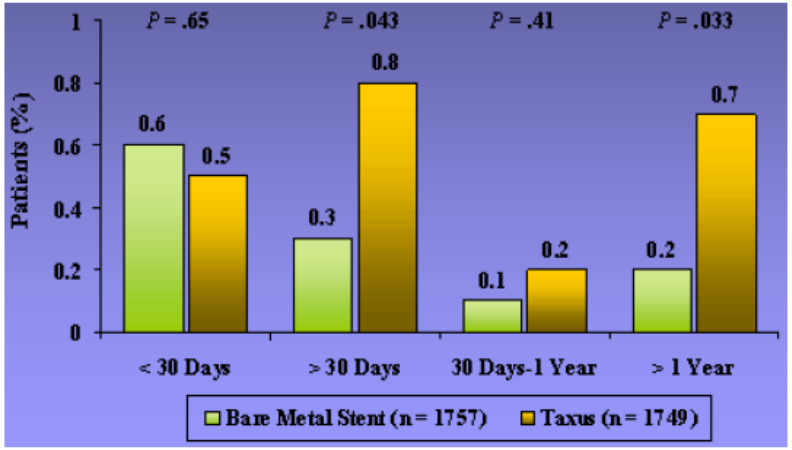
US FDA approval	Stent	Manufacturer	Generation	Type of stent: Platform	Drug eluted
2000	Bx Velocity	Cordis, Bridgewater, NJ	First	BMS: 316L Stainless steel	N/A
2002	Liberté →VeriFLEX*	Boston Scientific, Natick, MA	First	BMS: 316L Stainless steel	N/A
2003	Vision	Guidant/Abbott, Indianapolis, IN	Second	BMS: Cobalt chromium	N/A
2003	Driver/Integrity	Medtronic, Minneapolis, MN	Second	BMS: Cobalt chromium	N/A
Trials underway	Omega	Boston Scientific, Natick, MA	Third	BMS: Platinum chromium	N/A
2003†	Cypher	Cordis, Bridgewater, NJ	First	DES: 316L Stainless steel	Sirolimus
2004	Taxus Express	Boston Scientific, Natick, MA	First	DES: 316L Stainless steel	Paclitaxel
2008	Taxus Liberté	Boston Scientific, Natick, MA	First	DES: 316L Stainless steel	Paclitaxel
2008	Endeavor	Medtronic, Minneapolis, MN	Second	DES: Cobalt chromium	Zotarolimus
2008	Xience V/Prime	Guidant/Abbott, Indianapolis, IN	Second	DES: Cobalt chromium	Everolimus
2008	Promus	Boston Scientific, Natick, MA	Second	DES: Cobalt chromium	Everolimus
2011	Promus Element	Boston Scientific, Natick, MA	Third	DES: Platinum chromium	Everolimus
2012	Taxus Element	Boston Scientific, Natick, MA	Third	DES: Platinum chromium	Paclitaxel
2013	Resolute Integrity	Medtronic, Minneapolis, MN	Third	DES: Cobalt chromium	Zotarolimus



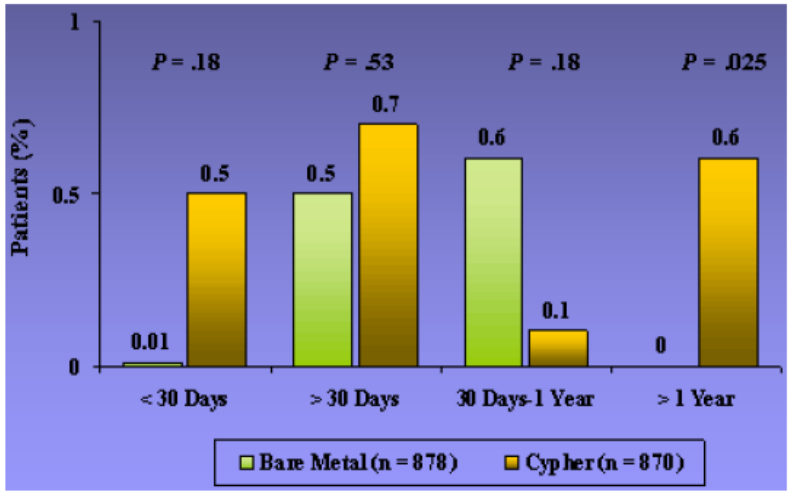
The Firestorm on DES (ESC conference 2006)

Edoardo Camenzind

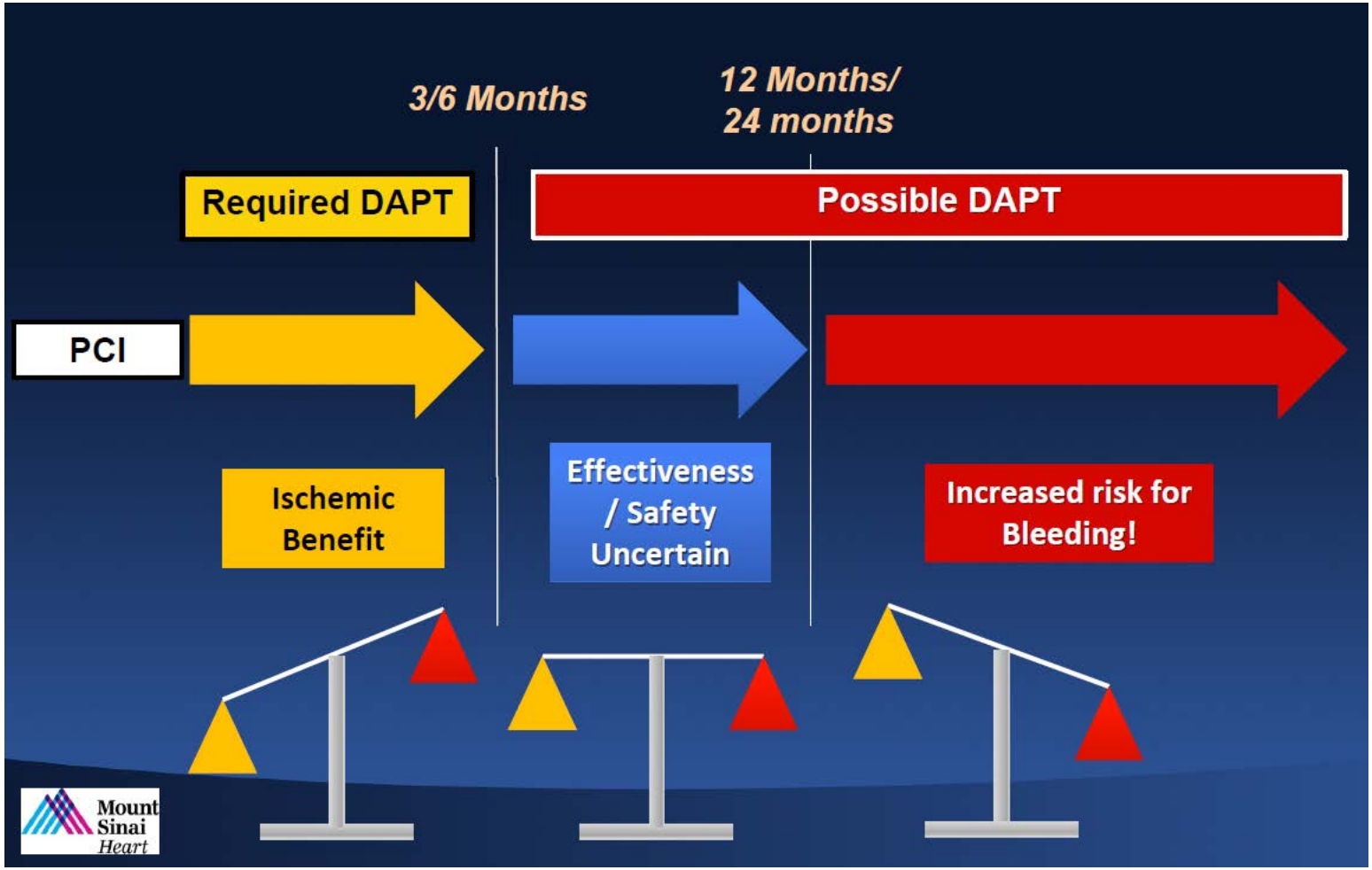
TAXUS Vs. BMS



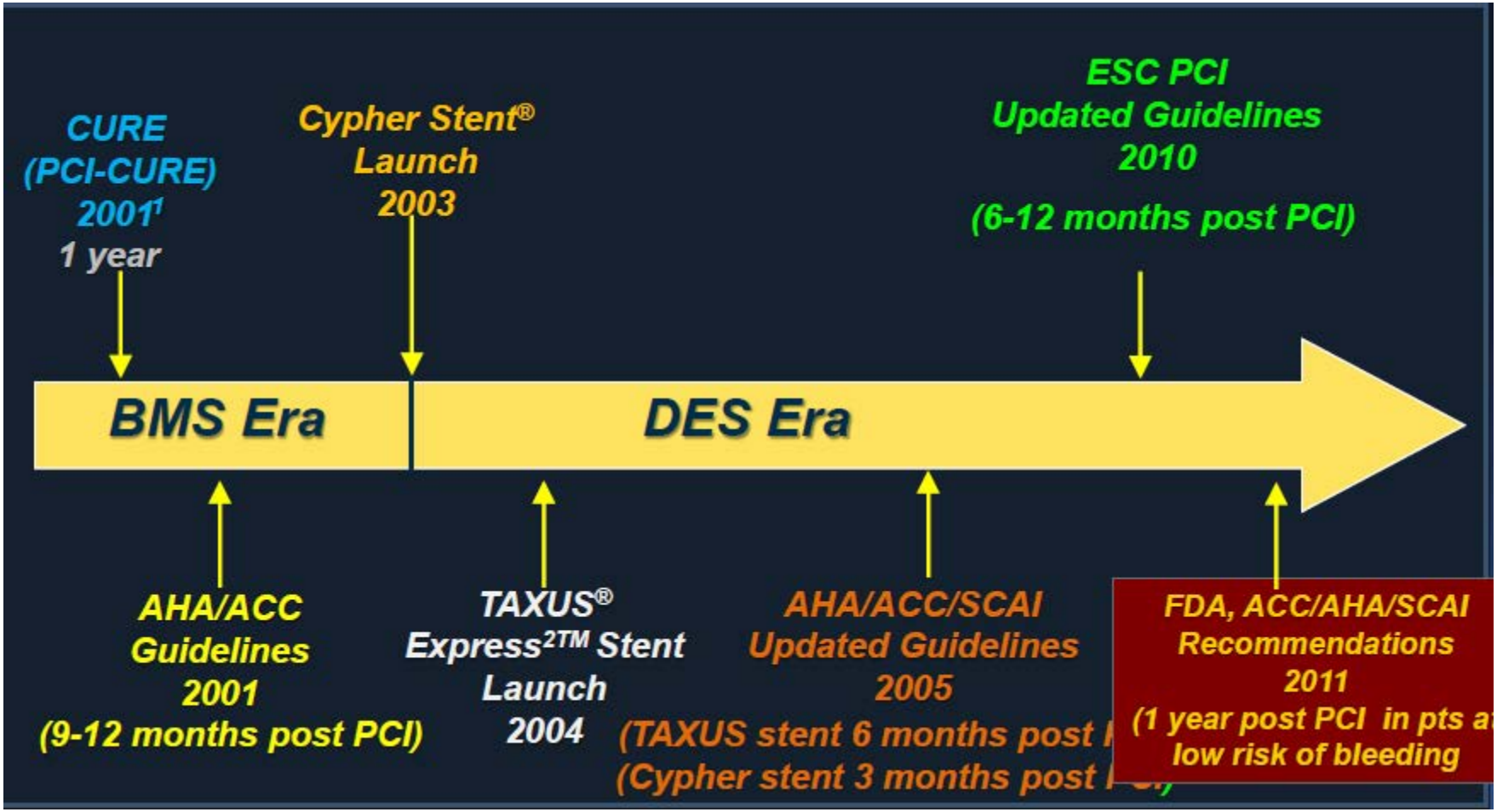
CYPHER Vs.



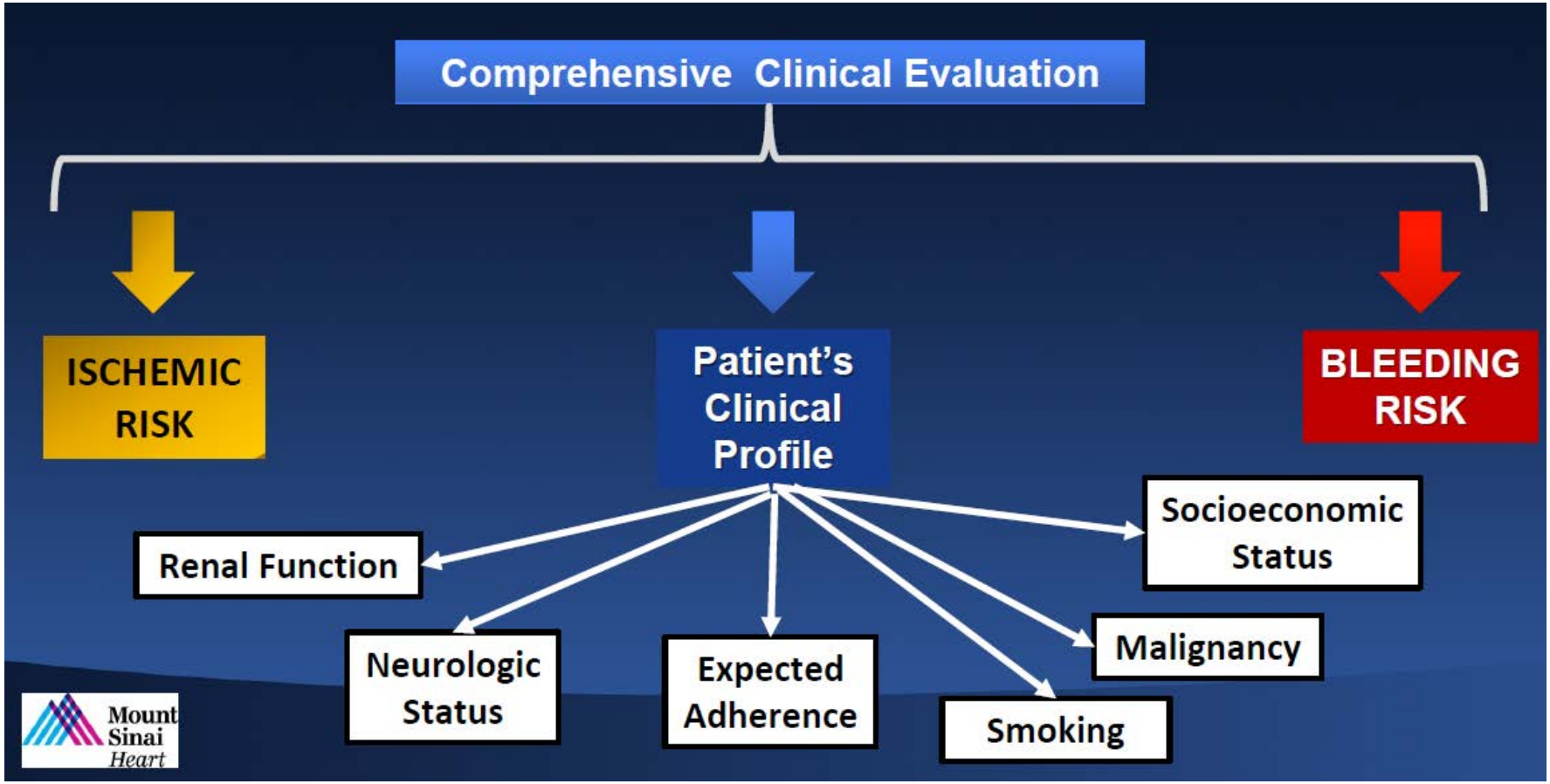
DES implantasyonu sonrası DAPT süresi



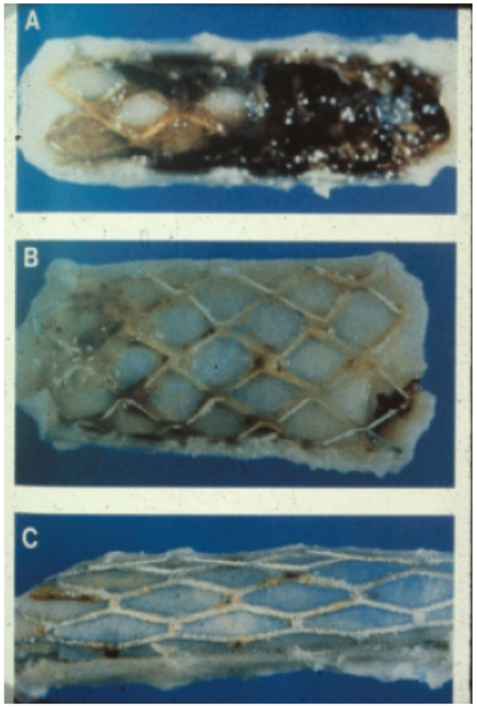
DES sonrası optimal DAPT süresi

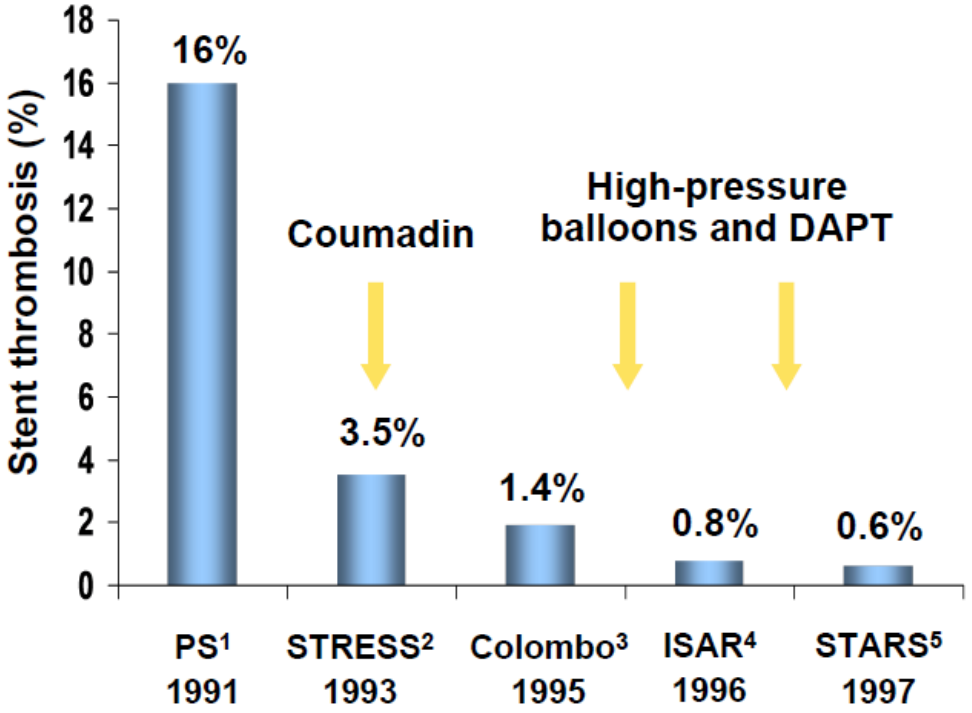


Herkes için aynı olabilir mi?



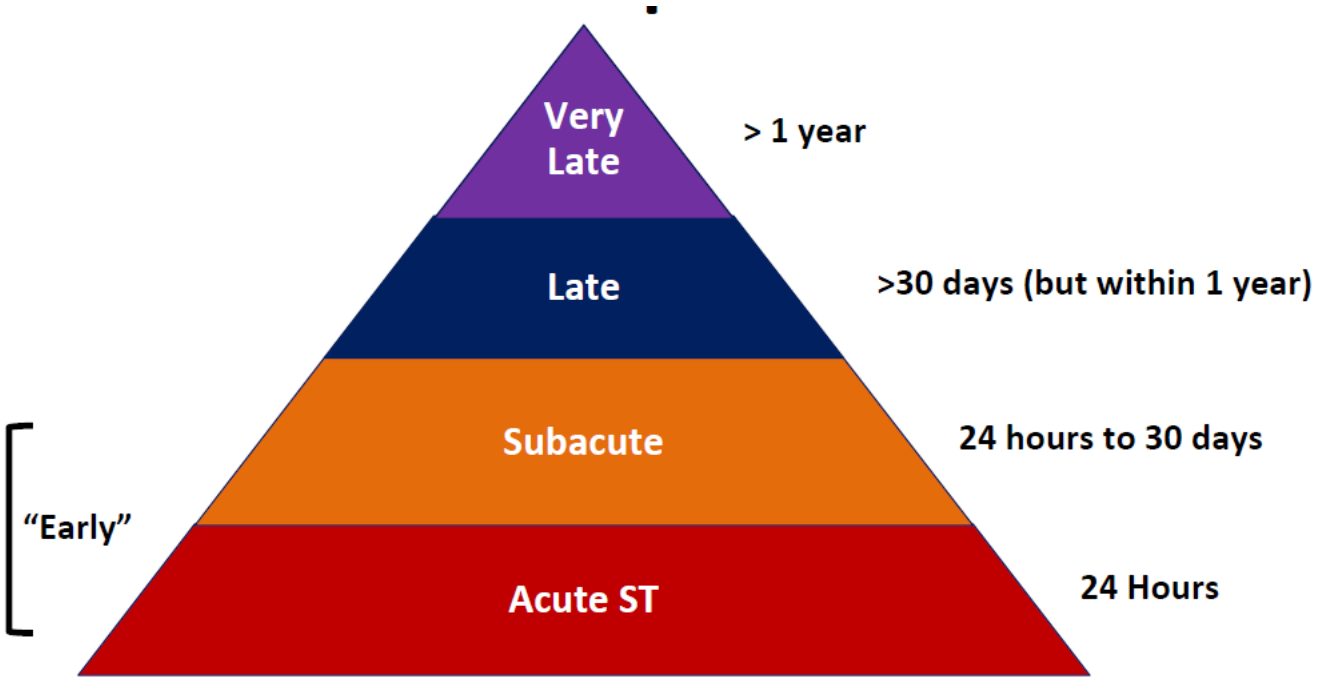
Stent trombozu ve hikayesi





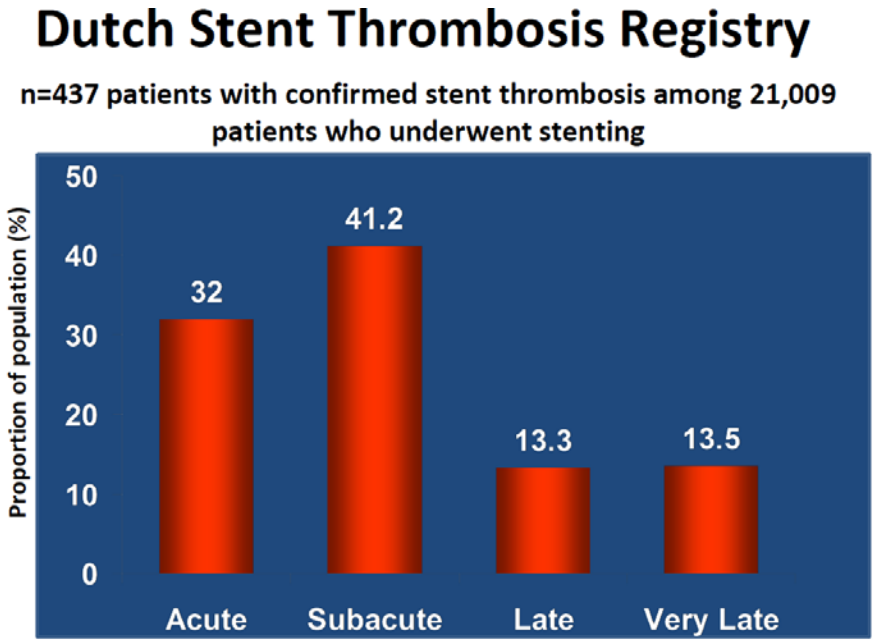
1. Schatz et al. Circulation.1991;83:148; 2. Fischman et al. N Engl J Med. 1994;331496; 3. Colombo et al. Circulation.1995;91:1676;
4. Schömig et al.Circulation.1994,90:2716; 5. Leon et al. N Engl J Med. 1998;339:1665; 6. Joner et al. J Am Coll Cardiol. 2006;48:193.

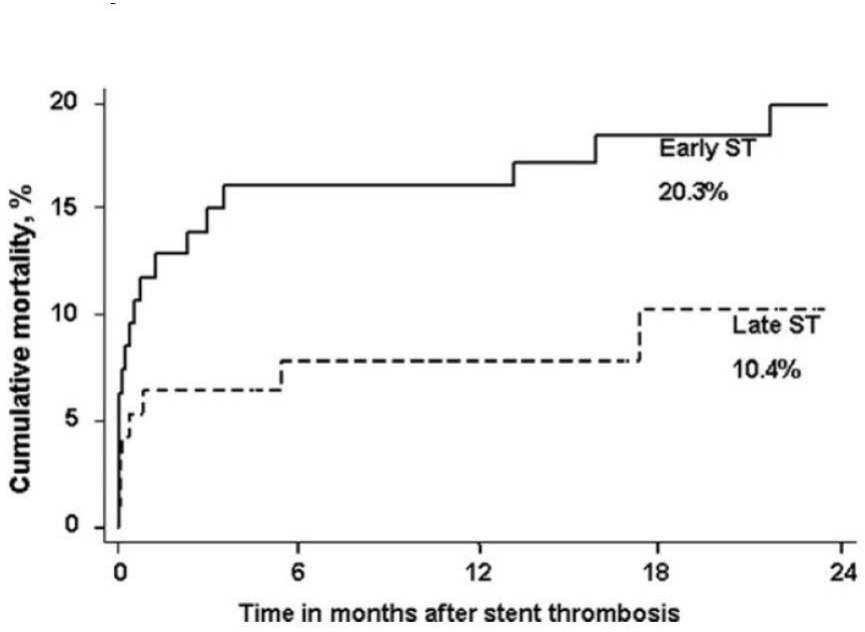
Stent implantasyonu sonrasında stent trombozu zamanlaması



Cutlip et al. Circulation. 2007;115:2344-51

Stent trombozu zamanlaması



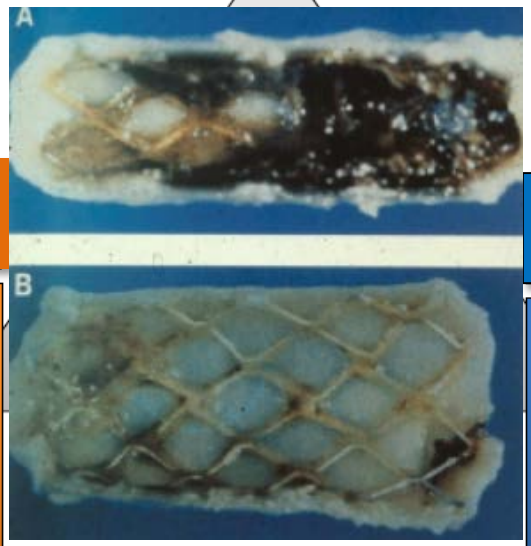


Stent trombozu ile ilişkili faktörler

- ACS / STEMI
- Diabetes Mellitus
- Chronic Kidney Disease
- LV Dysfunction
- Saphenous Vein Graft

Hasta

- Platelet Reactivity
- Non compliance to DAPT
- APT Non-Responsiveness
- Malignancy



Cihaz

- Type of stent
- Polymer integrity and reactions
- Drug effects
- Covered Stents
- Incomplete Vascular Healing and / or Inadequate Neointimal Coverage
- Hypersensitivity to drug coating or polymer
- Neoatherosclerosis

İşlem

- Residual Edge Dissection Dissection
- Lesion / Stent Length
- Vessel / Stent Diameter
- Complex Lesions
- Incomplete Stent Apposition

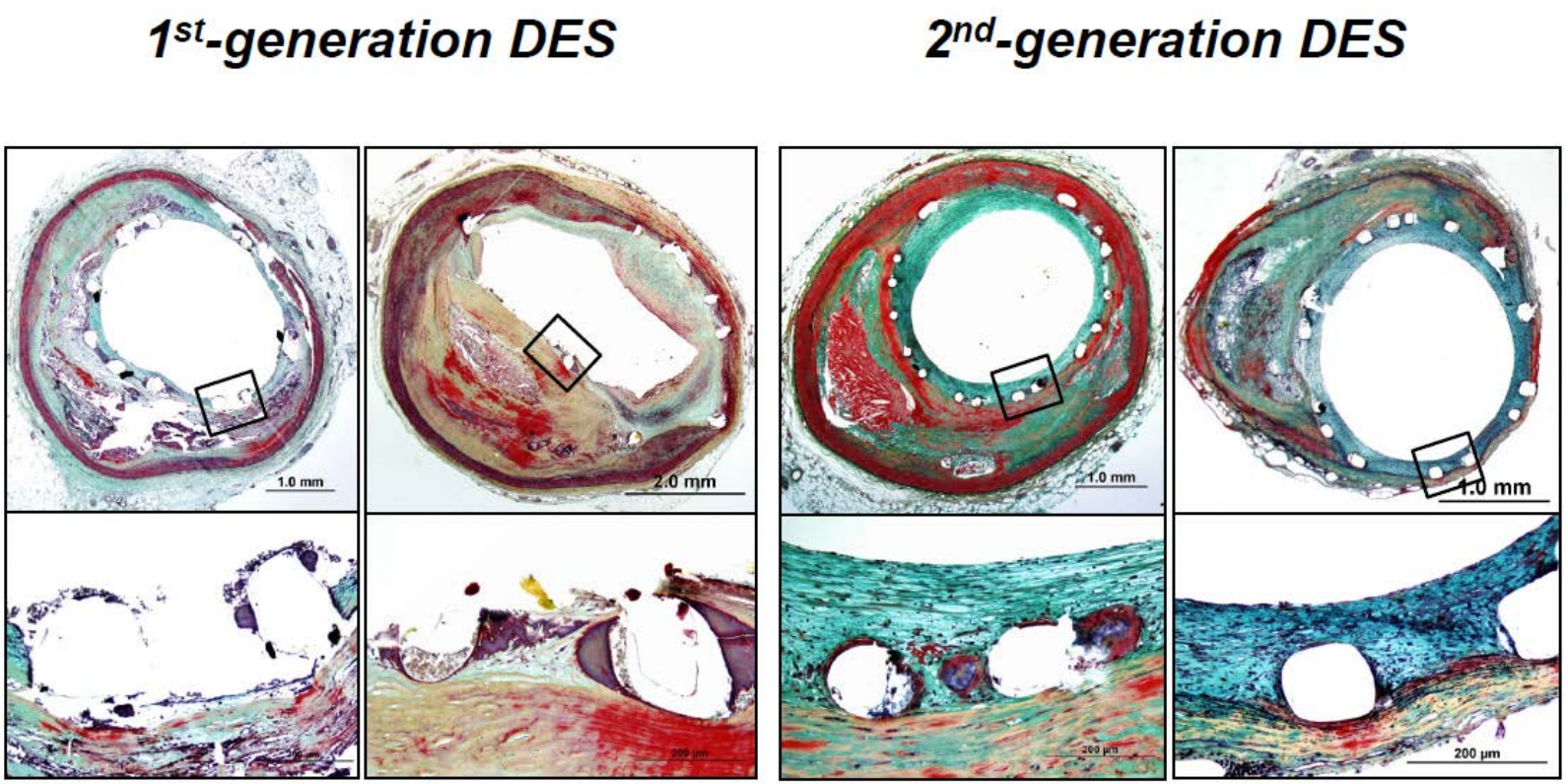
Antitrombositer tedavi

İlk nesil DES'lerde stent trombozu prediktörleri

Variables	Hazard Ratio (95% Confidence Interval)	*P* Value
Subacute stent thrombosis		
Premature antiplatelet therapy discontinuation	161.17 (26.03-997.94)	<.001
Renal failure	10.06 (3.13-32.35)	<.001
Bifurcation lesion	5.96 (1.90-18.68)	.002
Diabetes	5.84 (1.74-19.55)	.004
Left ventricular ejection fraction per 10% decrease	1.12 (1.06-1.19)	<.001
Stent length, per 1-mm increase	1.03 (1.00-1.05)	.01
Late stent thrombosis		
Premature antiplatelet therapy discontinuation	57.13 (14.84-219.96)	<.001
Bifurcation lesion	8.11 (2.50-26.26)	.001
Left ventricular ejection fraction per 10% decrease	1.06 (1.01-1.12)	.03
Cumulative stent thrombosis		
Premature antiplatelet therapy discontinuation	89.78 (29.90-269.60)	<.001
Renal failure	6.49 (2.60-16.15)	<.001
Bifurcation lesion	6.42 (2.93-14.07)	<.001
Diabetes	3.71 (1.74-7.89)	.001
Left ventricular ejection fraction per 10% decrease	1.09 (1.05-1.13)	<.001

Iakovou et al - JAMA, May 4, 2005—Vol 293, No. 17

1. ve 2. nesil ilaç salınımlı stentlerde stent trombozu riski bakımından fark nerede?



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CLINICAL RESEARCH

Examination of the In Vivo Mechanisms of Late Drug-Eluting Stent Thrombosis

CME

Findings From Optical Coherence Tomography and Intravascular Ultrasound Imaging

Giulio Guagliumi, MD,* Vasile Sirbu, MD,* Giuseppe Musumeci, MD,* Robert Gerber, MD,† Giuseppe Biondi-Zoccai, MD,* Hideyuki Ikejima, MD,* Elena Ladich, MD,‡ Nikoloz Lortkipanidze, MD,* Aleksandre Matiashvili, MD,* Orazio Valsecchi, MD,* Renu Virmani, MD,‡ Gregg W. Stone, MD§

Bergamo, Italy; London, United Kingdom; Gaithersburg, Maryland; and New York, New York

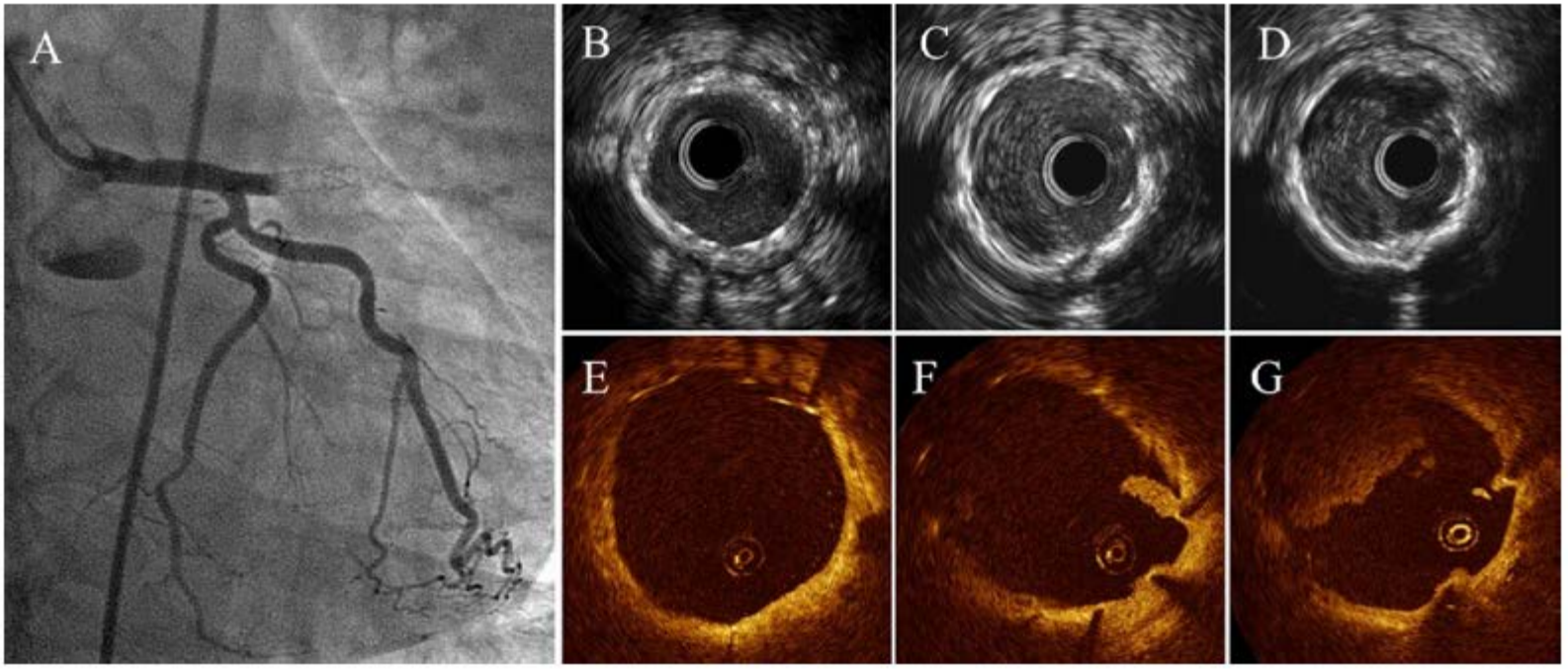

Figure 1. OCT Evidence of Uncovered Struts in DES Late Stent Thrombosis

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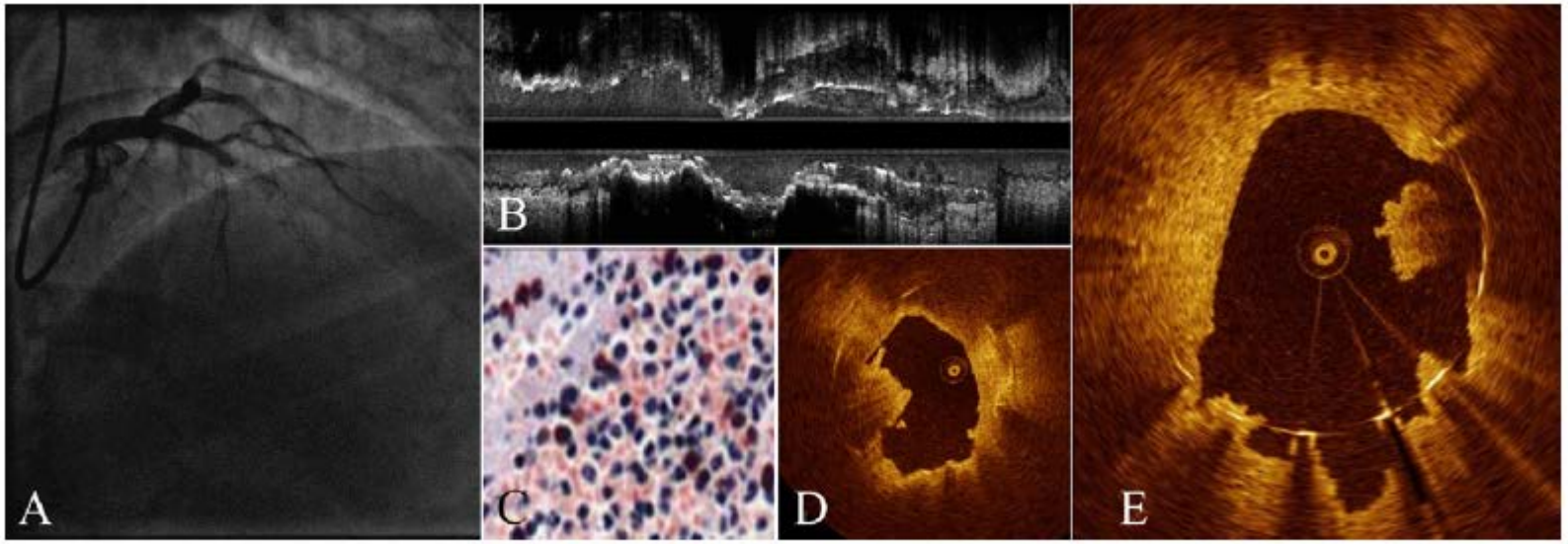
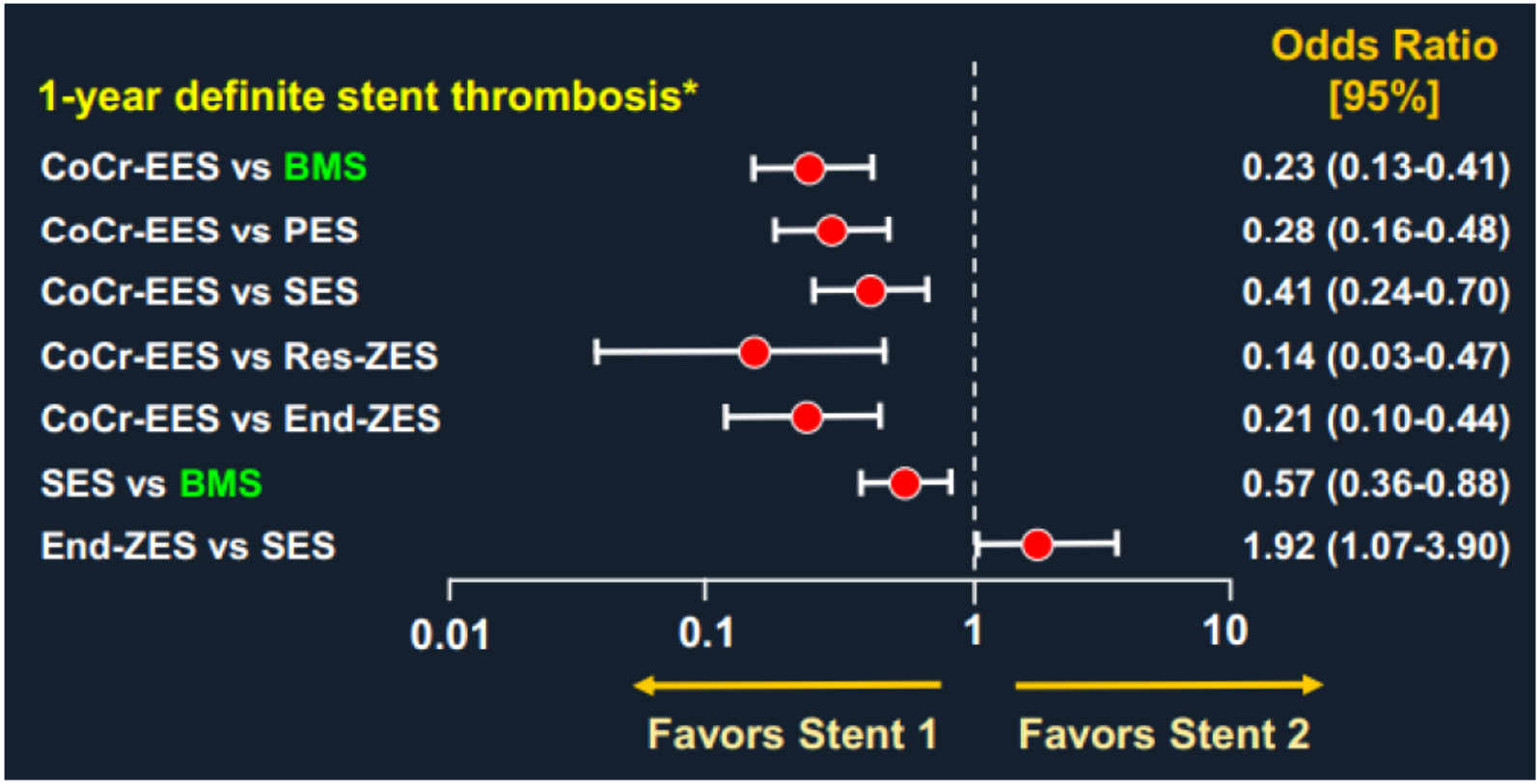


Figure 2. Vascular Toxicity as a Hallmark of DES Late Stent Thrombosis

Stent thrombosis: has the firestorm been extinguished?

THE LANCET
Volume 379, Issue 9824, 14–20 April 2012, Pages 1368–1369

Second-Generation DES are safer!



Palmerini et al; Lancet 2012

PROTECT Trial

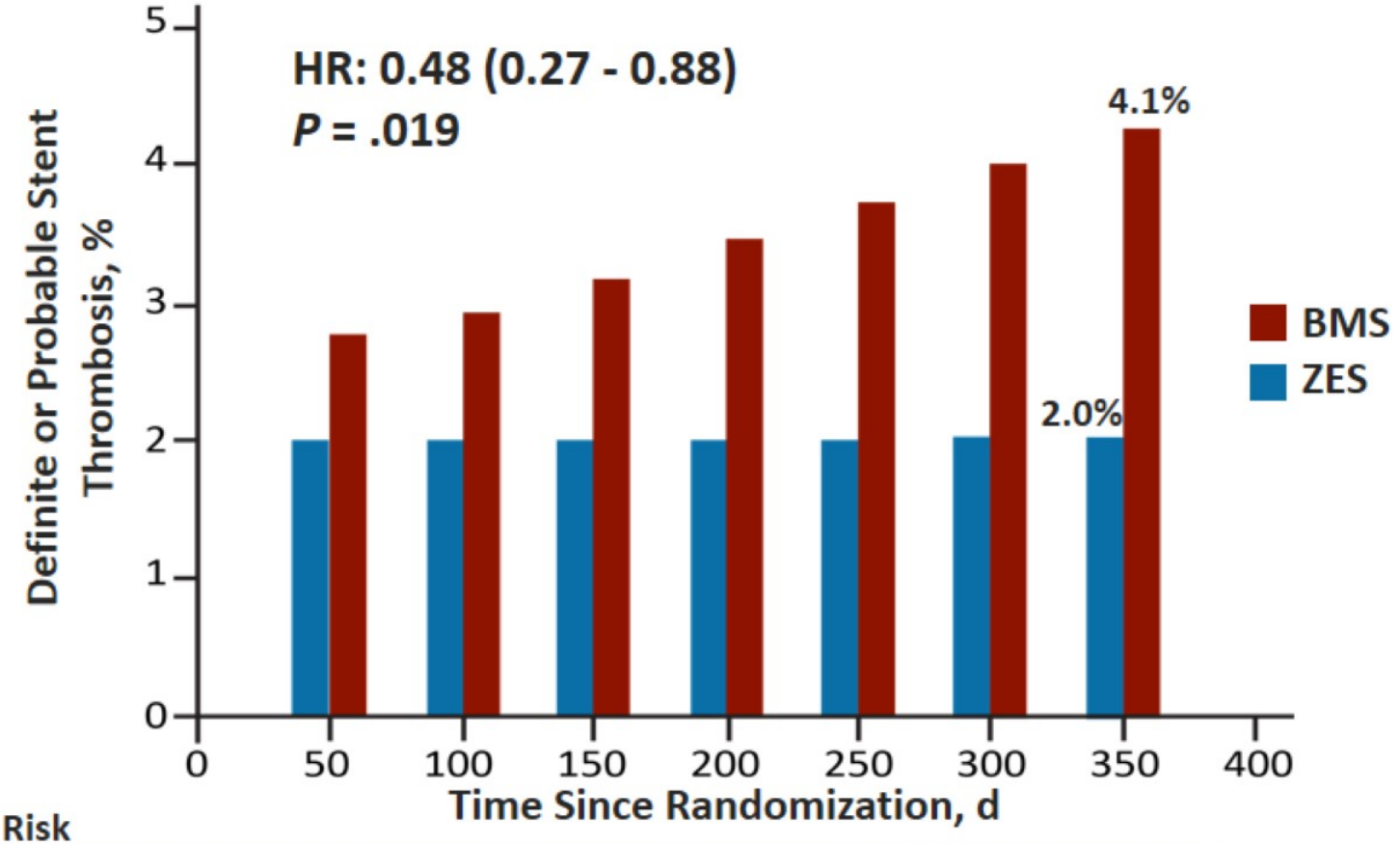
Primary Endpoint at 4 Years: Definite/Probable Stent Thrombosis

- At 4-year follow-up, the primary outcome occurred in 1.6% of ZES vs 2.6% of SES:
  - HR 0.63 (95% CI: 0.46, 0.85; *P* = .003)

Wijns W, et al. *Eur Heart J*. 2014;35:2812-2820.

ZEUS Trial

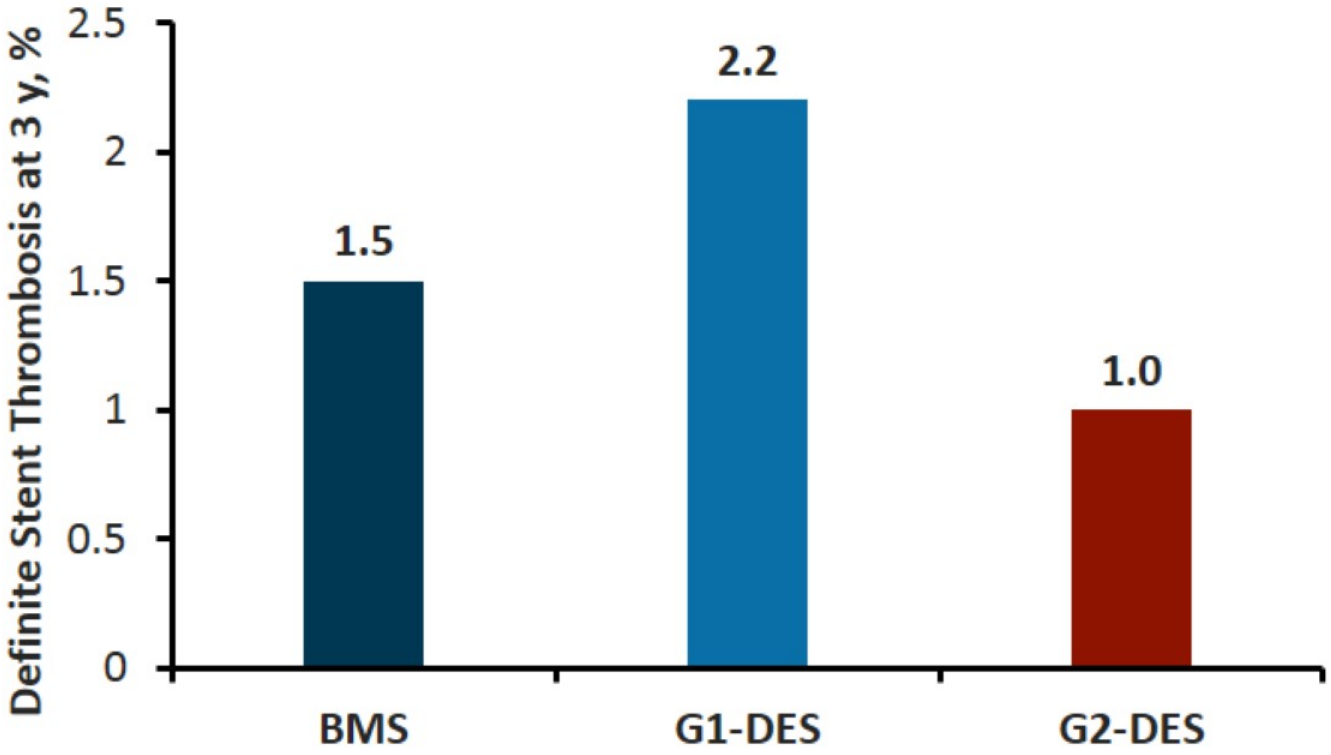
Definite or Probable Stent Thrombosis



No. at Risk								
BMS	804	763	739	723	712	701	692	685
ZES	802	767	758	741	733	721	713	708

Valgimigli M, et al. *J Am Coll Cardiol*. 2015;65:805-815.

Less Stent Thrombosis With New-Generation DES



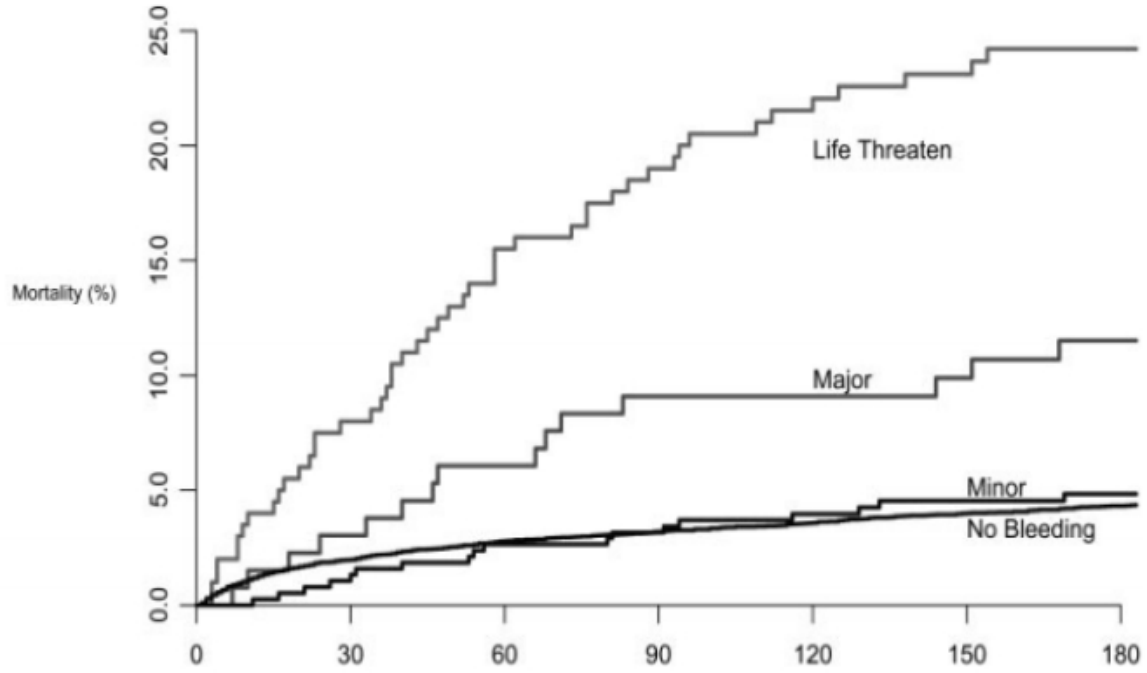
G1-DES vs BMS: OR 2.05 (95% CI: 1.47, 2.86); *P* < .001

G2-DES vs BMS: OR 0.82 (95% CI: 0.56, 1.19); *P* = .30

Tada T, et al. *JACC Cardiovasc Interv.* 2013;6:1267-1274.

Adverse Impact of Bleeding on Prognosis in Patients With Acute Coronary Syndromes

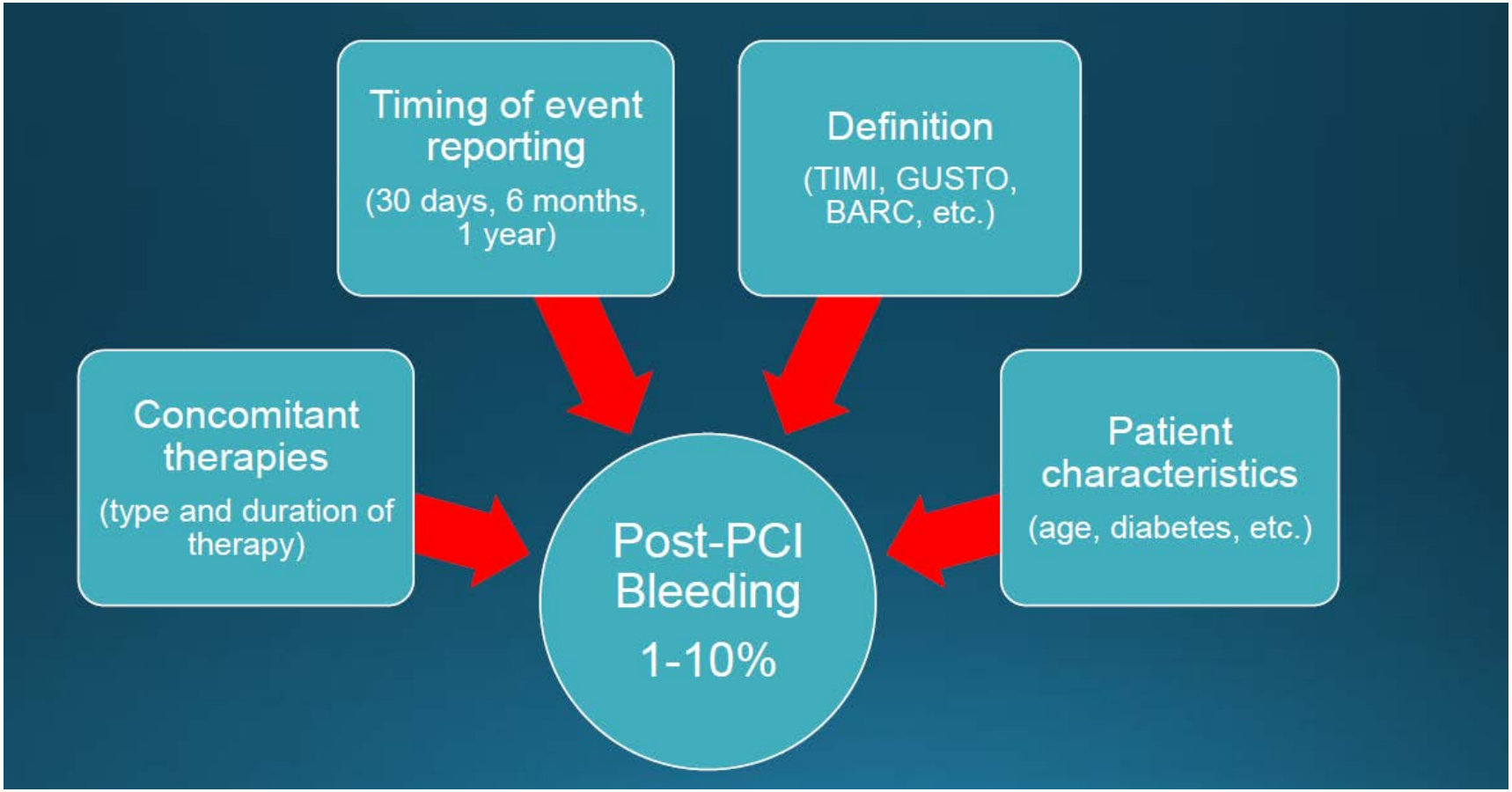
John W. Eikelboom, MBBS, MSc; Shamir R. Mehta, MD, MSc; Sonia S. Anand, MD, PhD; Changchun Xie, PhD; Keith A.A. Fox, MBChB; Salim Yusuf, MBBS, DPhil



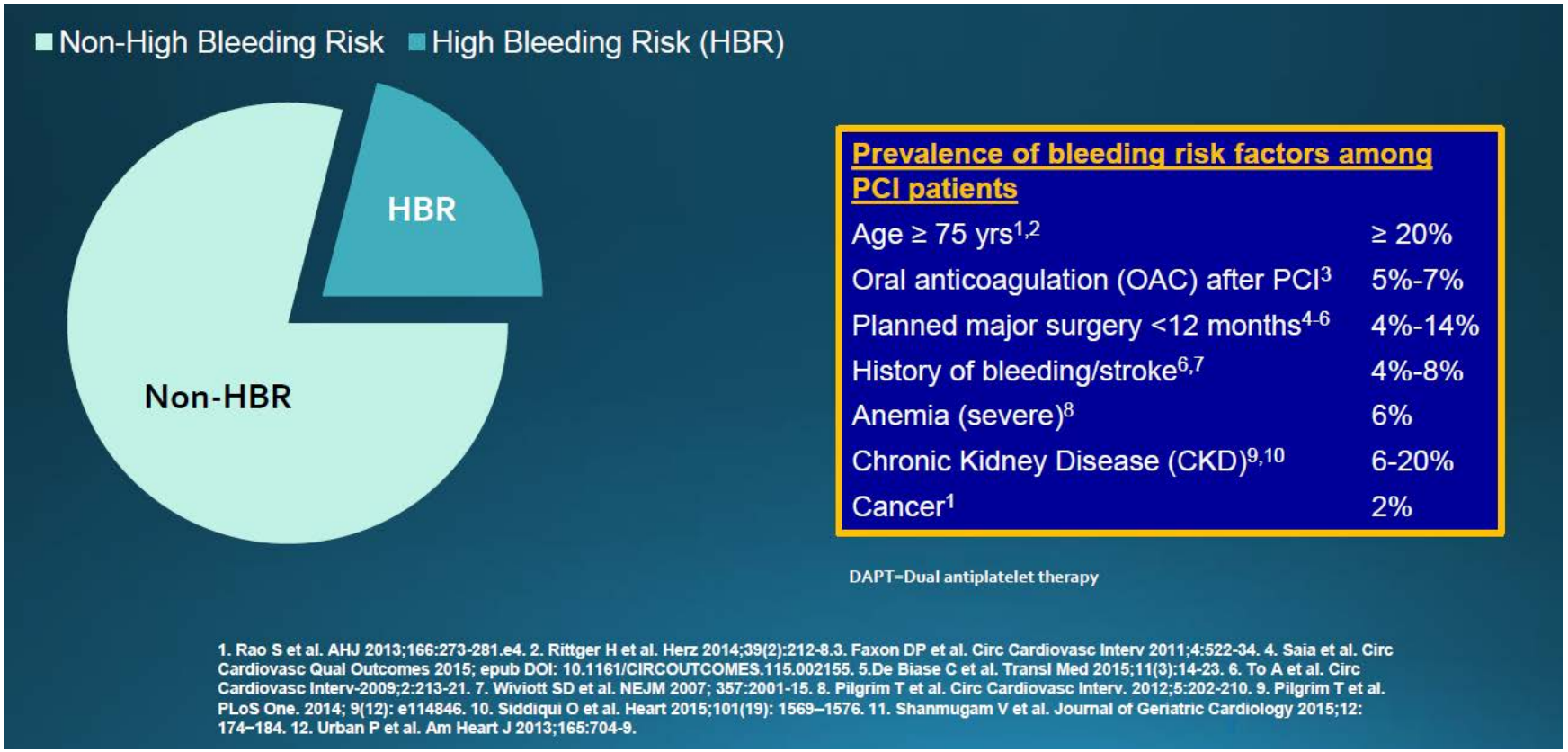
No. at Risk							
Life Threaten	200	185	172	163	152	141	130
Major	132	129	125	121	117	112	107
Minor	379	375	370	368	349	326	308
No Bleeding	11851	11612	11514	11465	10790	10105	9368

Circulation. 2006;114:774-782

Post PKG kanama



Günlük pratiğimizde her beş PKG olgusundan birinde yüksek kanama riski sözkonusudur

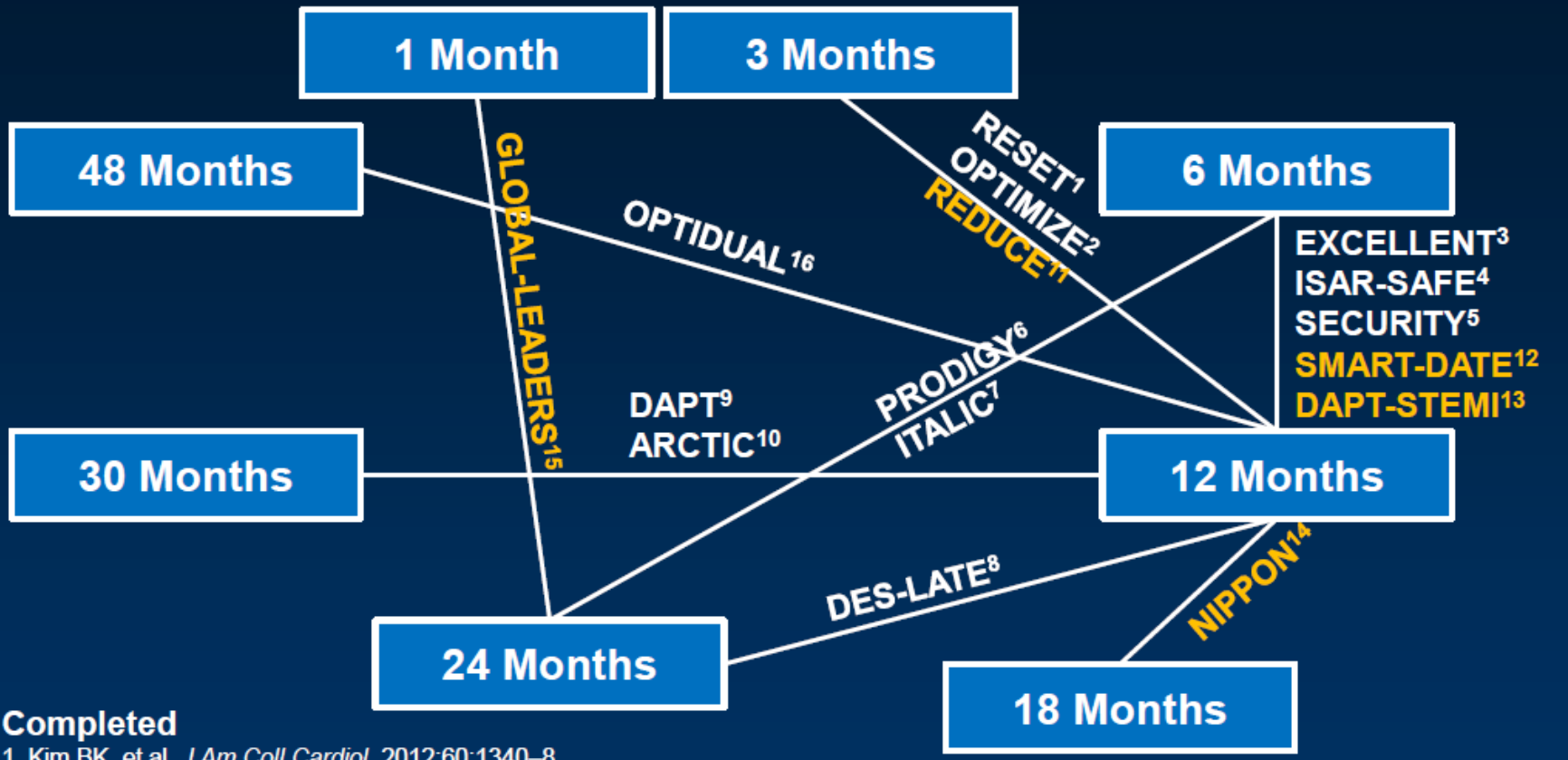


Prevalence of bleeding risk factors among PCI patients	
Age ≥ 75 yrs[1,2]	≥ 20%
Oral anticoagulation (OAC) after PCI[3]	5%-7%
Planned major surgery <12 months[4-6]	4%-14%
History of bleeding/stroke[6,7]	4%-8%
Anemia (severe)[8]	6%
Chronic Kidney Disease (CKD)[9,10]	6-20%
Cancer[1]	2%

DAPT=Dual antiplatelet therapy

1. Rao S et al. AHJ 2013;166:273-281.e4. 2. Rittger H et al. Herz 2014;39(2):212-8.3. Faxon DP et al. Circ Cardiovasc Interv 2011;4:522-34. 4. Saia et al. Circ Cardiovasc Qual Outcomes 2015; epub DOI: 10.1161/CIRCOUTCOMES.115.002155. 5.De Biase C et al. Transl Med 2015;11(3):14-23. 6. To A et al. Circ Cardiovasc Interv-2009;2:213-21. 7. Wiviott SD et al. NEJM 2007; 357:2001-15. 8. Pilgrim T et al. Circ Cardiovasc Interv. 2012;5:202-210. 9. Pilgrim T et al. PLoS One. 2014; 9(12): e114846. 10. Siddiqui O et al. Heart 2015;101(19): 1569–1576. 11. Shanmugam V et al. Journal of Geriatric Cardiology 2015;12: 174–184. 12. Urban P et al. Am Heart J 2013;165:704-9.

Randomized Trials of DAPT Duration



Completed

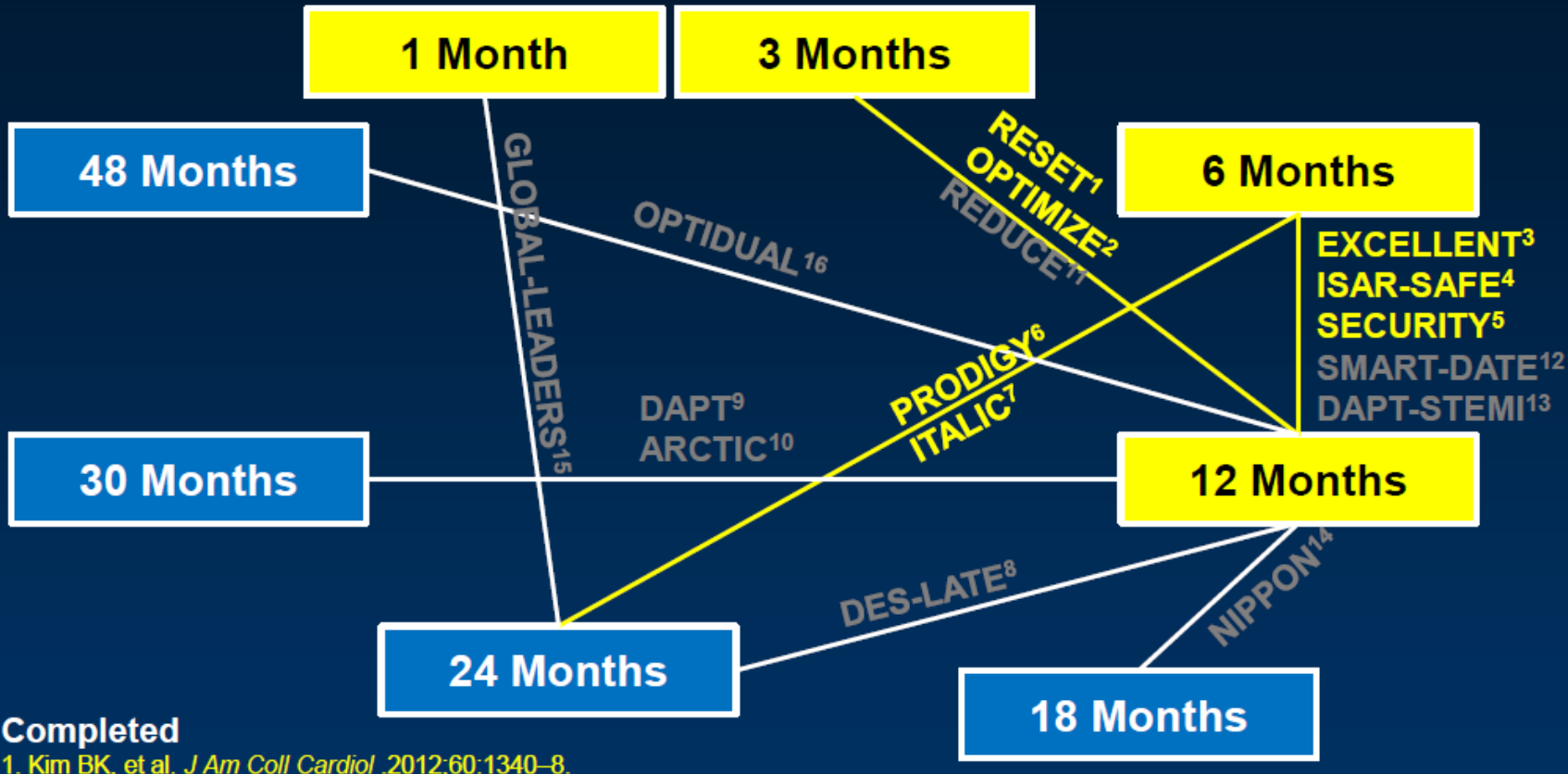
1. Kim BK, et al. *J Am Coll Cardiol* .2012;60:1340–8.
2. Feres F, et al. *JAMA*. 2013;310:2510–22.
3. Gwon HC, et al. *Circulation*. 2012;125:505–13.
4. Schulz-Schupke S, et al. *Eur Heart J* .2015;36(20):1252-63.
5. Colombo A, et al. *J Am Coll Cardiol* .2014;64:2086–97.
6. Valgimigli M,, et al. *Circulation*. 2012;125: 2015–26.
7. Gilard M, et al. *J Am Coll Cardiol*. 2015;65:777–86.
8. Park SJ, et al. *N Engl J Med*. 2010;362: 1374–82.
9. Mauri L, et al. *N Engl J Med*. 2014;371:2155–66.
10. Collet JP, et al. *Lancet*. 2014;384:1577–85.

Ongoing

11. REDUCE, NCT02118870
12. SMART-DATE, NCT01701453
13. DAPT-STEMI, NCT01459627
14. NIPPON, NCT01514227
15. GLOBAL LEADERS, NCT01813435
16. Preliminary Abstract: OPTIDUAL, NCT00822536

Randomized Trials of DAPT Duration

Short-Term DAPT Data



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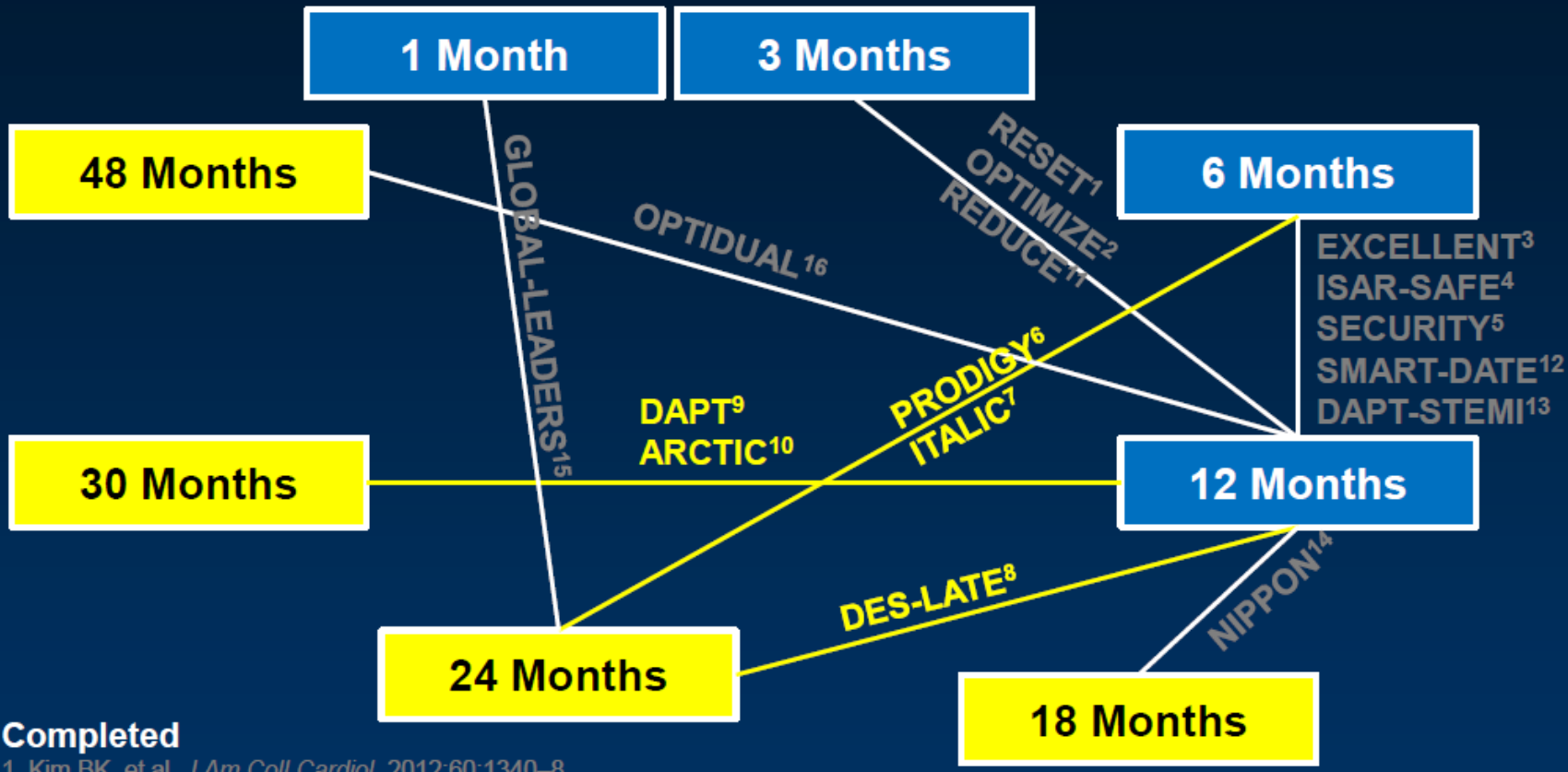
16. OPTIDUAL, NCT00822536

Randomized Trials of DAPT Duration

Longer Term DAPT Data



Completed

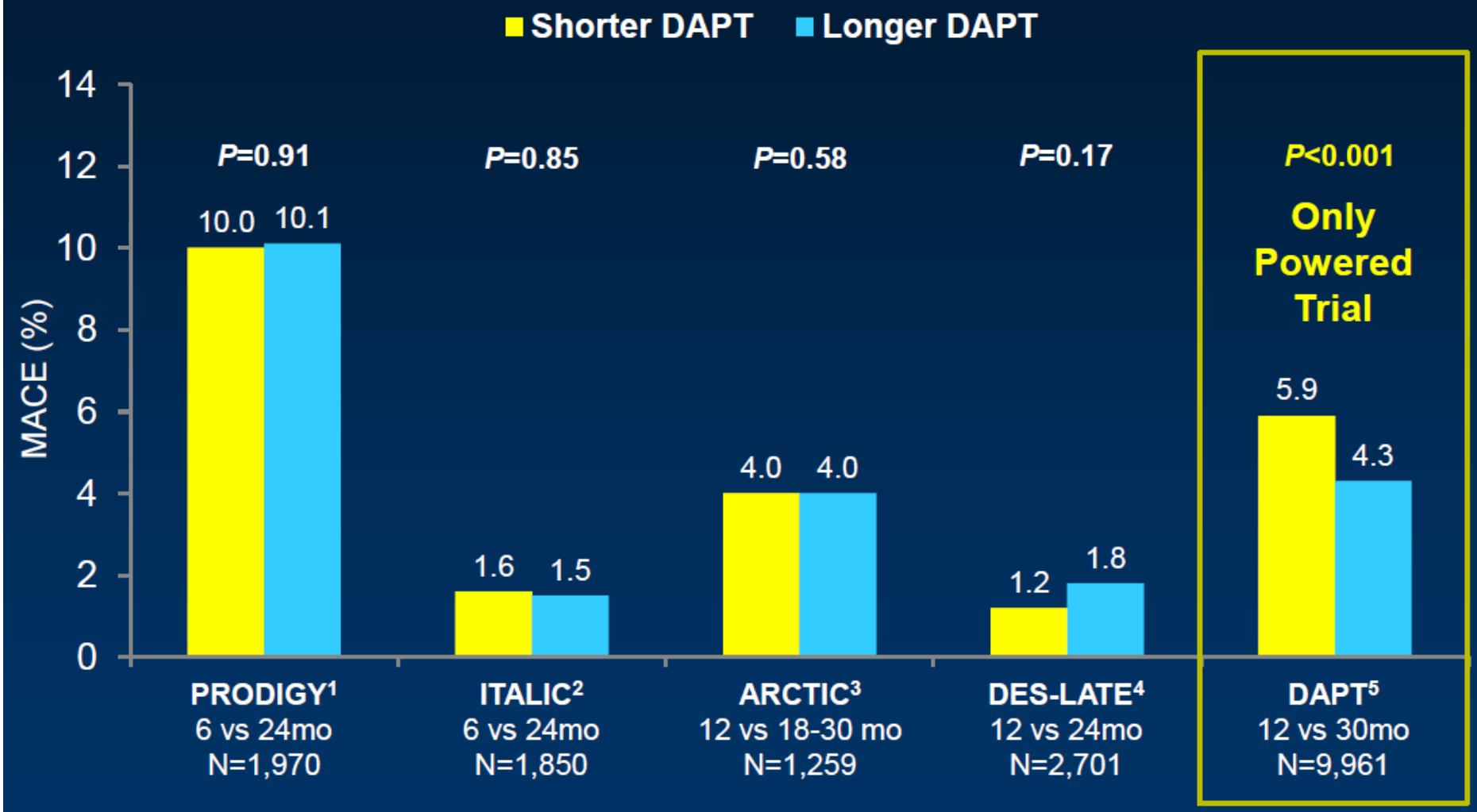
1. Kim BK, et al. *J Am Coll Cardiol* .2012;60:1340–8.
2. Feres F, et al. *JAMA*. 2013;310:2510–22.
3. Gwon HC, et al. *Circulation*. 2012;125:505–13.
4. Schulz-Schupke S, et al. *Eur Heart J* .2015;36(20):1252-63.
5. Colombo A, et al. *J Am Coll Cardiol* .2014;64:2086–97.
6. Valgimigli M,, et al. *Circulation*. 2012;125: 2015–26.
7. Gilard M, et al. *J Am Coll Cardiol*. 2015;65:777–86.
8. Park SJ, et al. *N Engl J Med*. 2010;362: 1374–82.
9. Mauri L, et al. *N Engl J Med*. 2014;371:2155–66.
10. Collet JP, et al. *Lancet*. 2014;384:1577–85.

Ongoing

11. REDUCE, NCT02118870
12. SMART-DATE, NCT01701453
13. DAPT-STEMI, NCT01459627
14. NIPPON, NCT01514227
15. GLOBAL LEADERS, NCT01813435
16. OPTIDUAL, NCT00822536

Long term DAPT: Randomized Trials

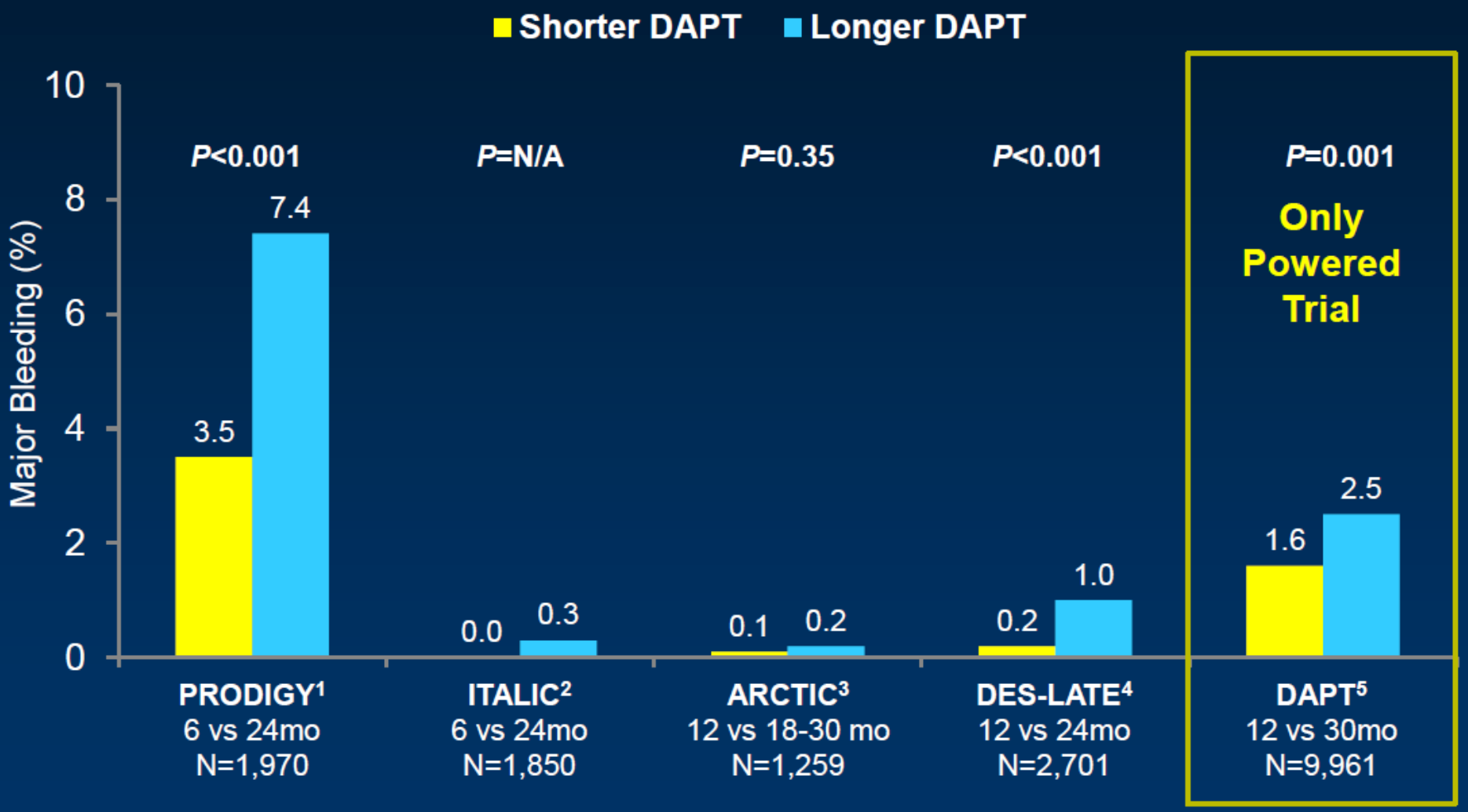
Primary Endpoint



[1] Valgimigli M,, et al. *Circulation*. 2012;125: 2015–26. [2] Gilard M, et al. *J Am Coll Cardiol*. 2015;65:777–86. [3] Collet JP, et al. *Lancet*. 2014;384:1577–85. [4] Park SJ, et al. *N Engl J Med*. 2010;362: 1374–82. [5] Mauri L, et al. *N Engl J Med*. 2014;371:2155–66.

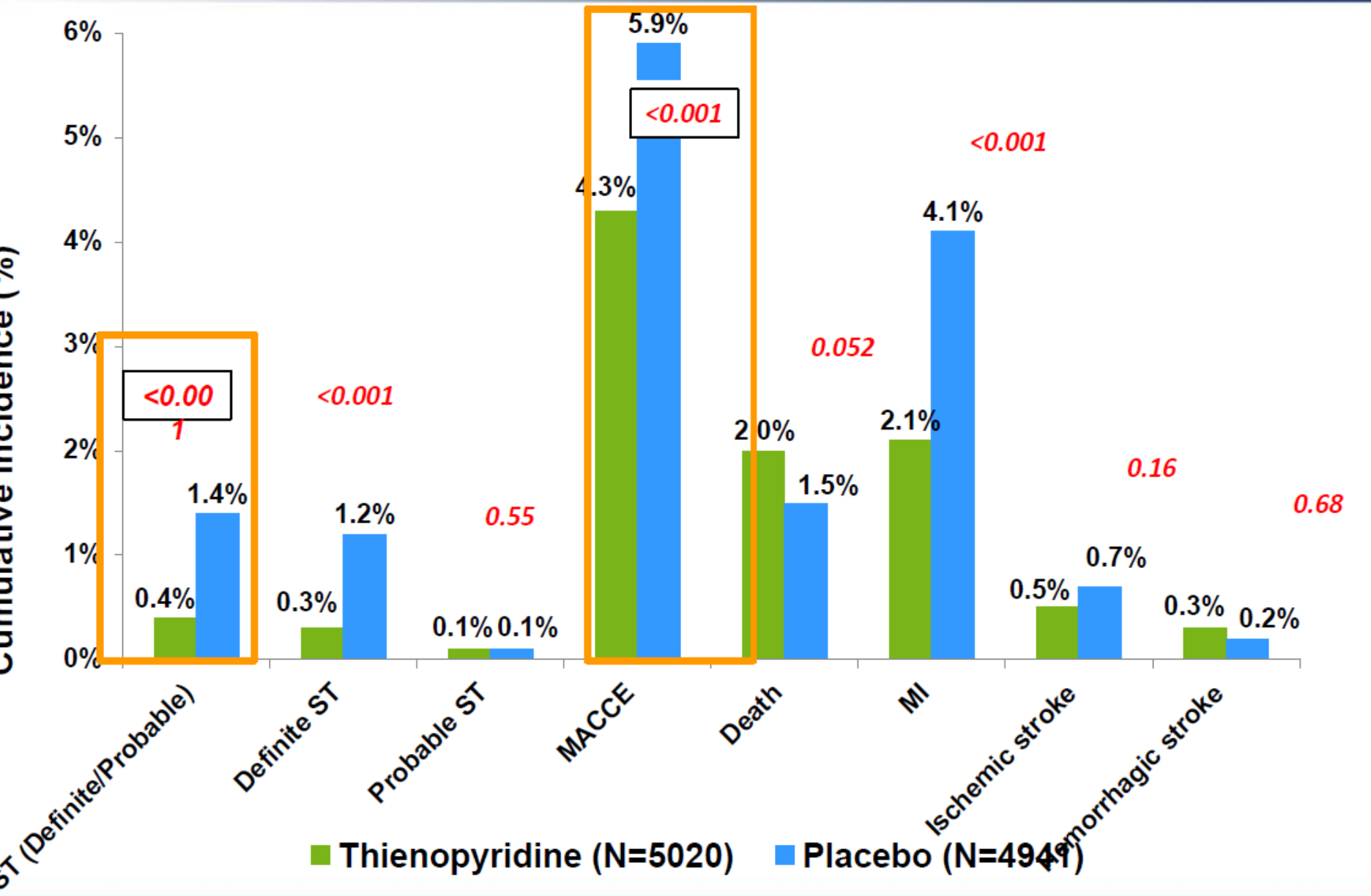
Long term DAPT: Randomized Trials

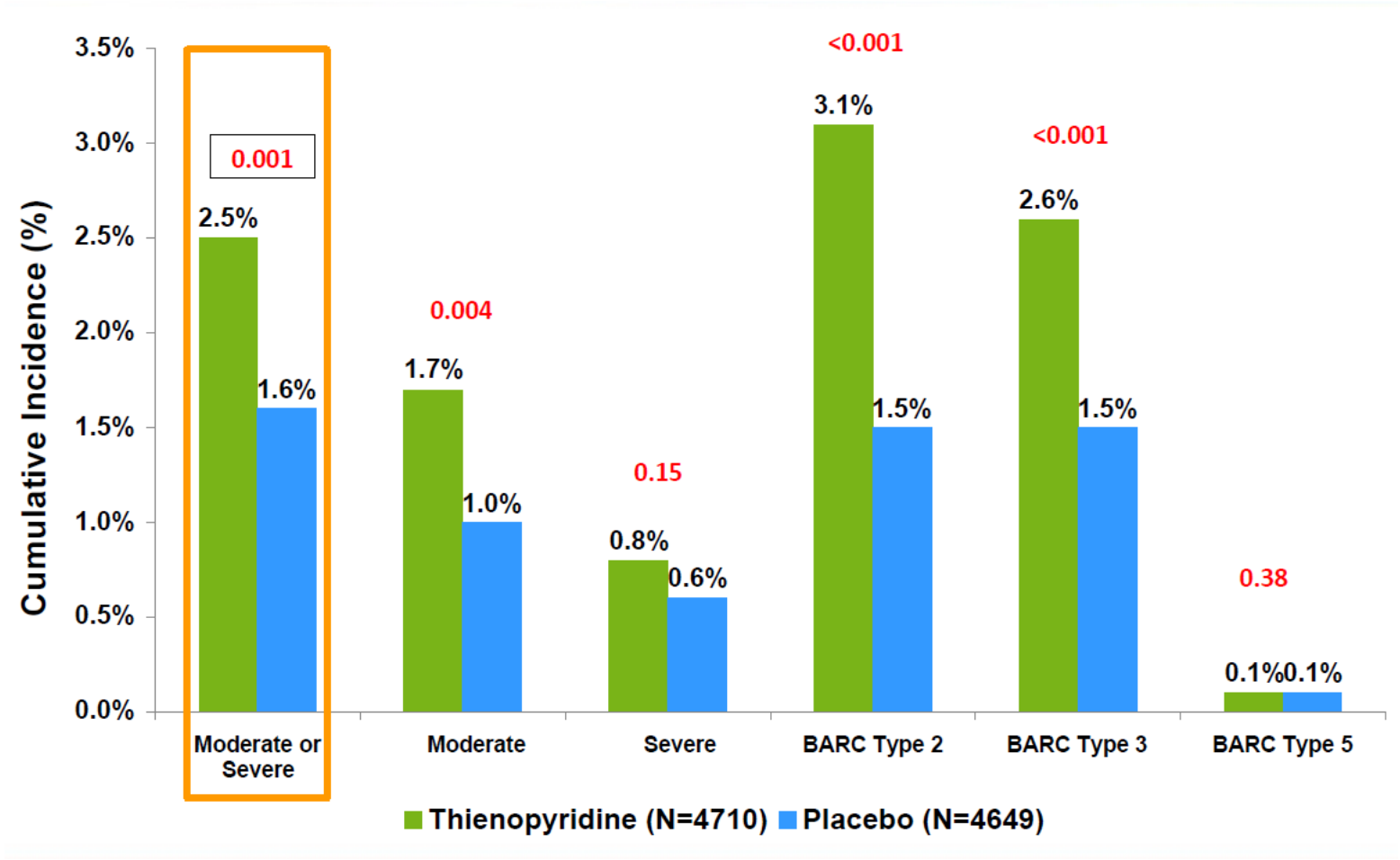
Longer DAPT Associated with More Bleeding



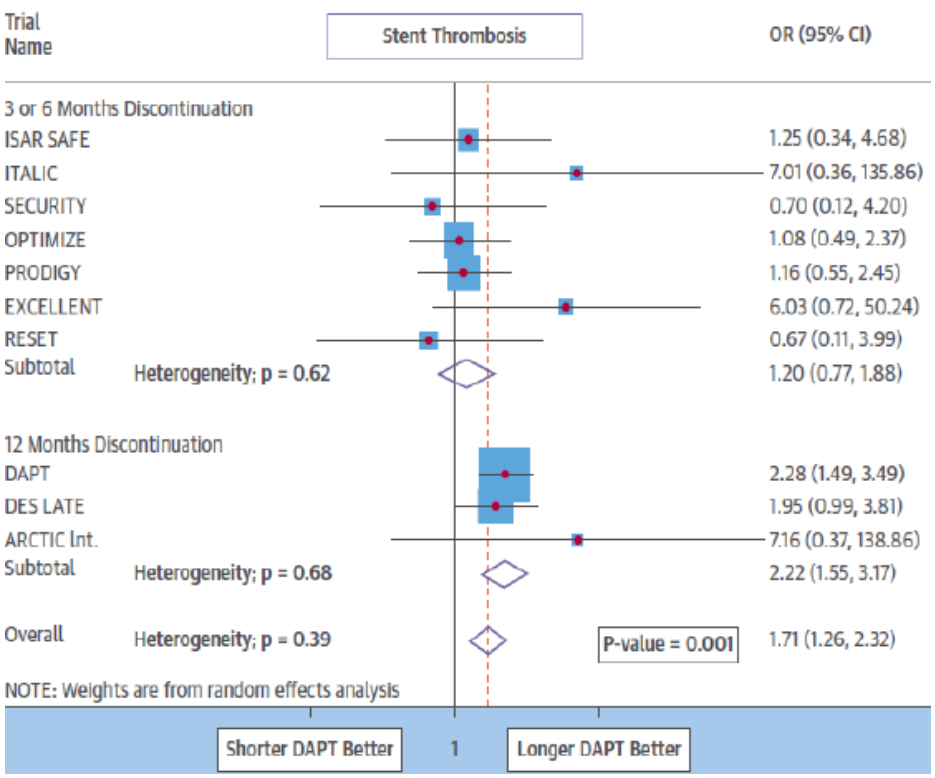
[1] Valgimigli M,, et al. *Circulation*. 2012;125: 2015–26. [2] Gilard M, et al. *J Am Coll Cardiol*. 2015;65:777–86. [3] Collet JP, et al. *Lancet*. 2014;384:1577–85. [4] Park SJ, et al. *N Engl J Med*. 2010;362: 1374–82. [5] Mauri L, et al. *N Engl J Med*. 2014;371:2155–66.

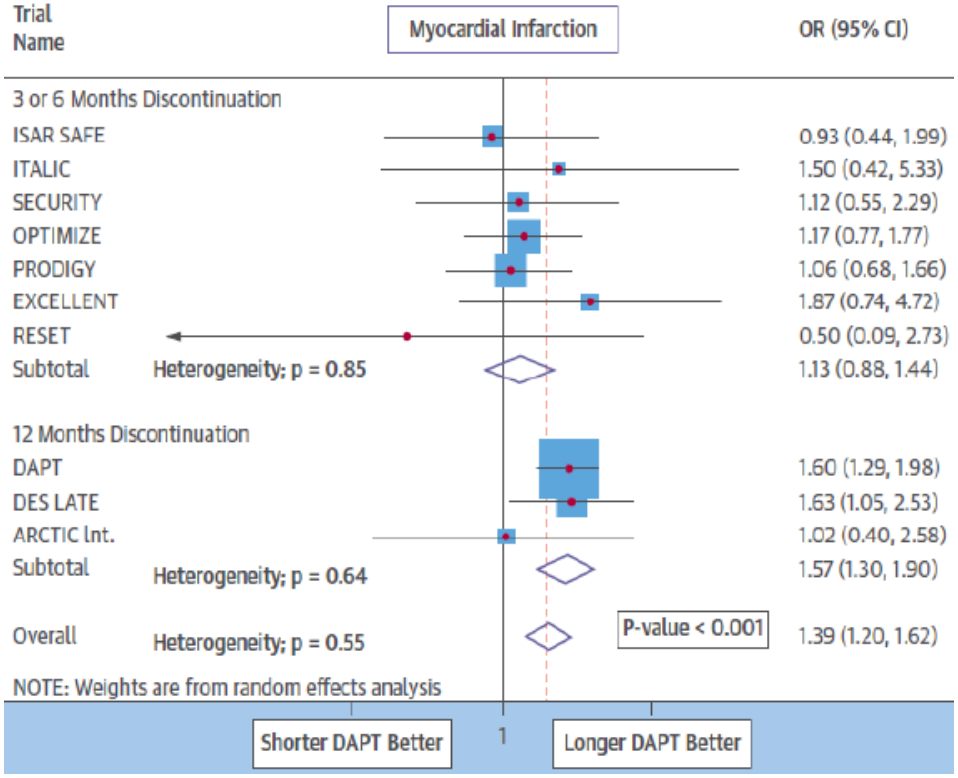
Co-Primary Effectiveness End Points & Components: 12-30 Months




Cumulative Incidence (%)
3.5%
3.0%
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
0.001
2.5%
1.6%
0.004
1.7%
1.0%
0.15
0.8%
0.6%
<0.001
3.1%
1.5%
<0.001
2.6%
1.5%
0.38
0.1%
0.1%
Moderate or Severe
Moderate
Severe
BARC Type 2
BARC Type 3
BARC Type 5
Thienopyridine (N=4710)
Placebo (N=4649)

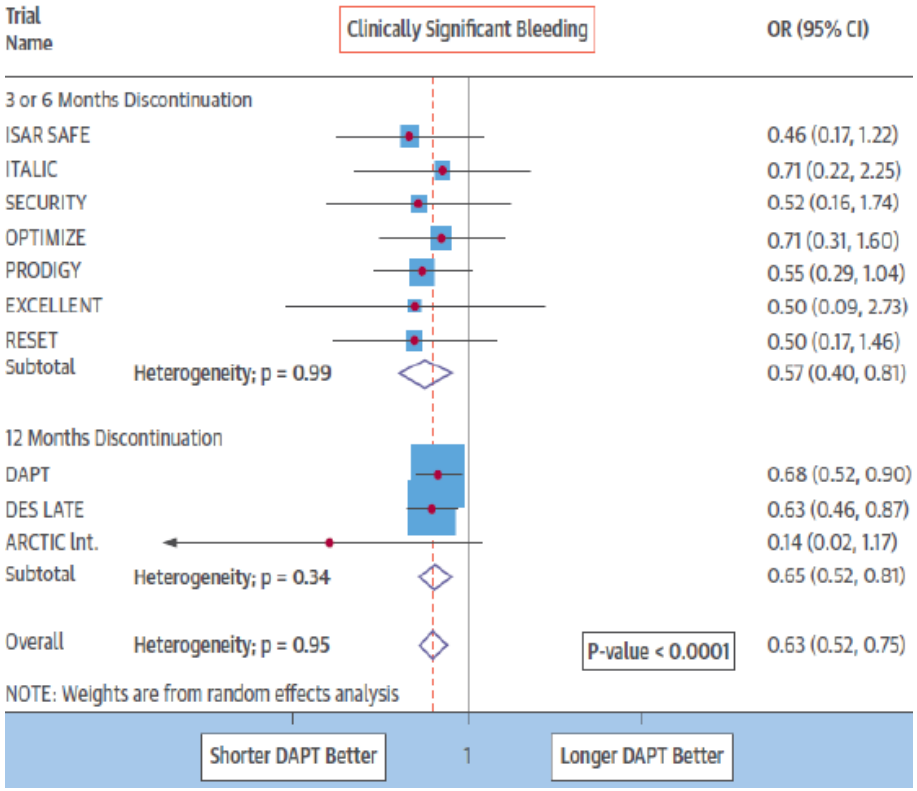
Uzatılmış DAPT: daha az stent trombozu ve miyokard infarktüsü

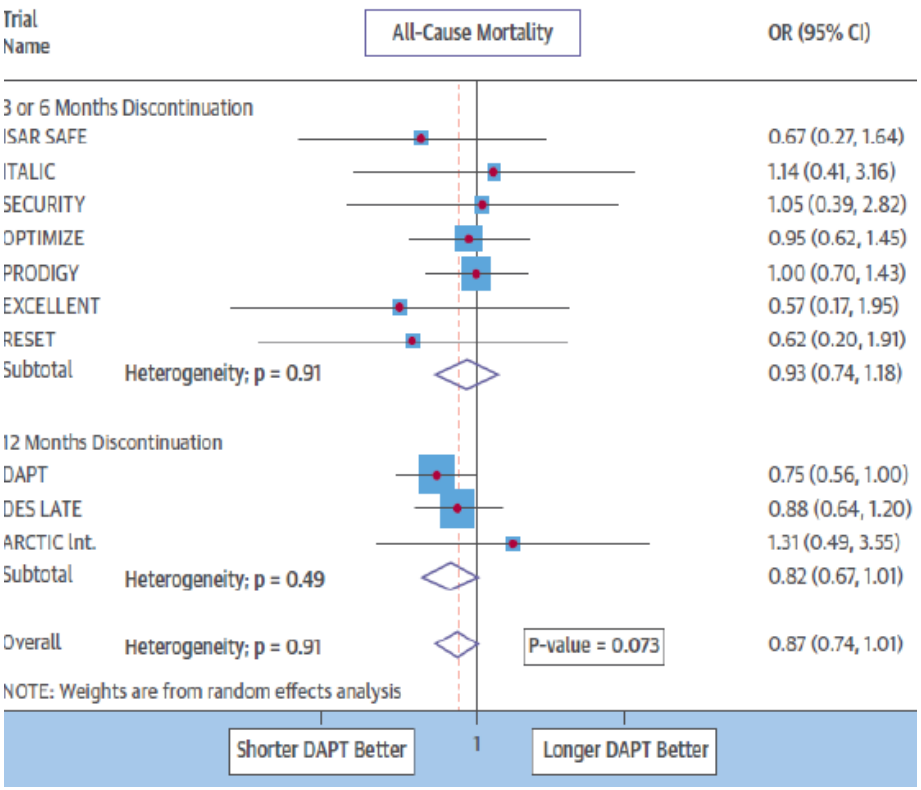




Giustino et al ; JACC 2015

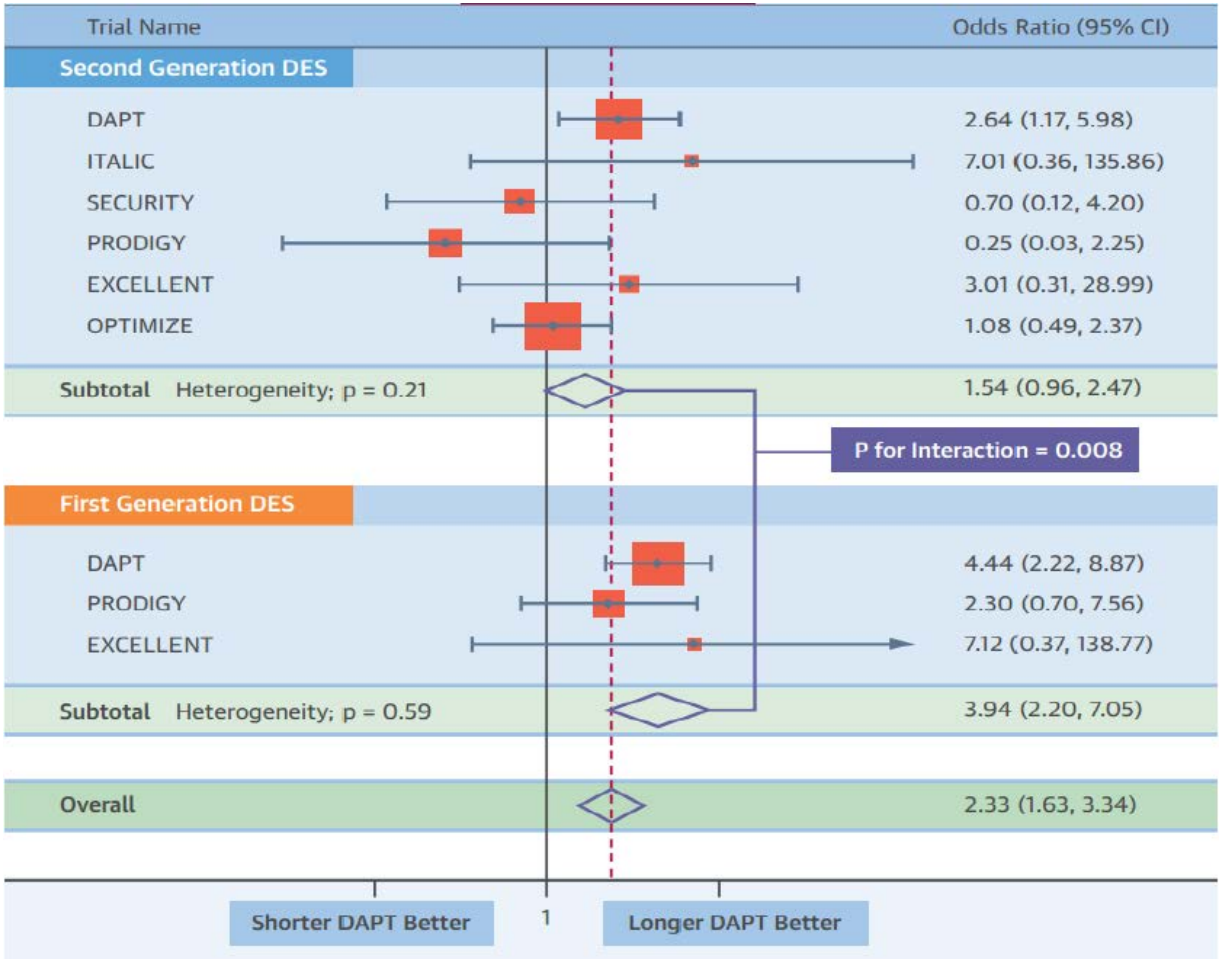
Kısaltılmış DAPT: klinik olarak daha az anlamlı kanama ve tüm nedenli mortalite riski





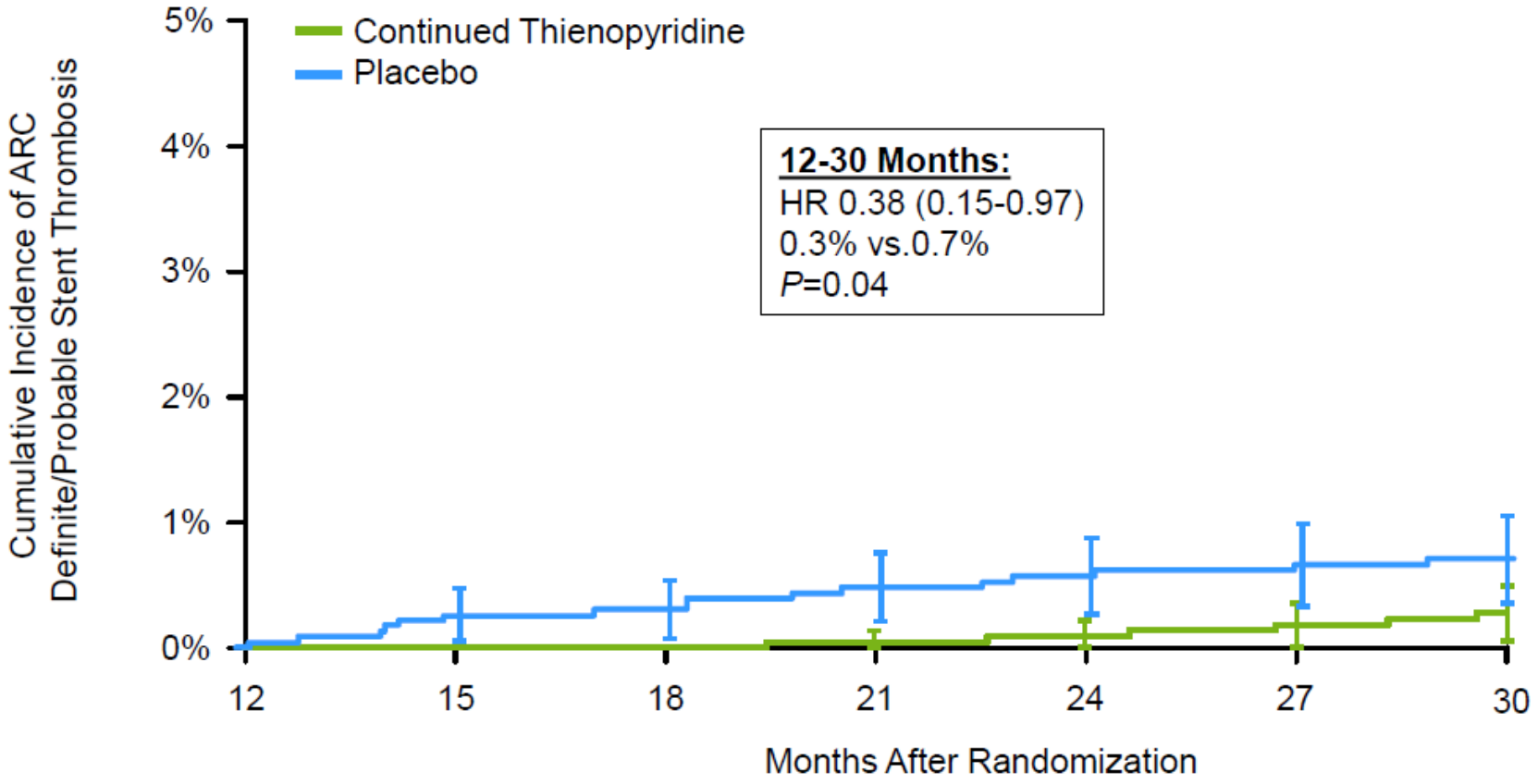
Giustino et al ; JACC 2015

1. ve 2. nesil DES'lerde
DAPT süresine göre stent trombozu riski



Giustino et al ; JACC 2015

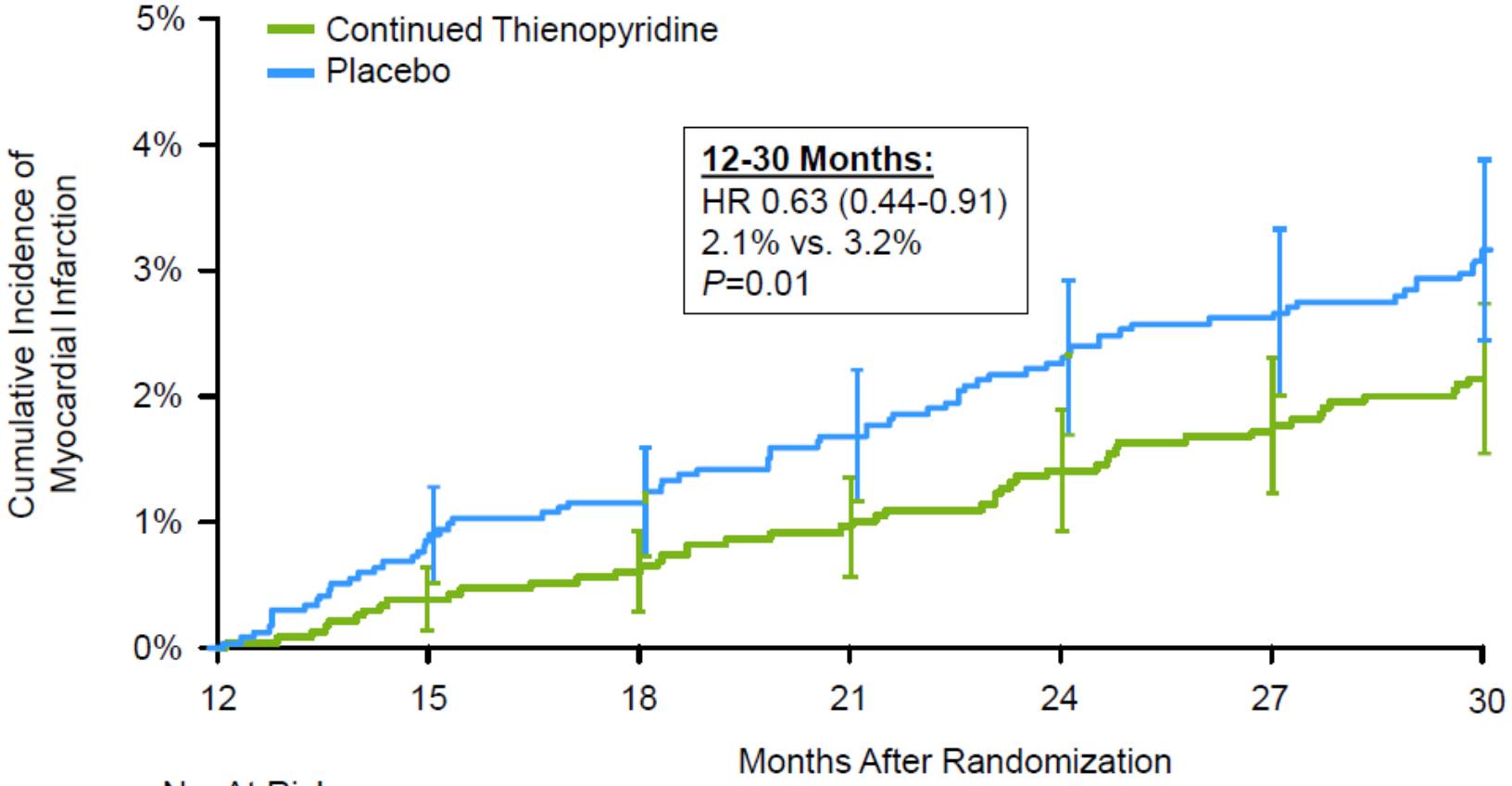
Everolimus-Eluting Stent-Treated Patients, Stent Thrombosis, N=4703



No. At Risk							
Continued Thienopyridine	2345	2299	2272	2255	2222	2181	2160
Placebo	2358	2314	2285	2263	2232	2213	2187

Everolimus-Eluting Stent-Treated Patients, Myocardial Infarction, N=4703

DAPT STUDY



No. At Risk							
Continued Thienopyridine	2345	2290	2259	2236	2196	2153	2127
Placebo	2358	2299	2267	2237	2196	2171	2137

2014 ESC/EACTS Guidelines on Myocardial Revascularization

Recommendations for PCI	Class	Level
DAPT is indicated for at least 1 month after BMS implantation	I	A
DAPT is indicated for 6 months after DES implantation	I	B
Shorter DAPT duration (< 6 mo) may be considered after DES implantation in patients at high bleeding risk	IIb	A
Life-long single antiplatelet therapy, usually aspirin, is recommended	I	A
Instruction of patients about the importance of complying with antiplatelet therapy is recommended	I	C
DAPT may be used for more than 6 months in patients at high ischemic risk and low bleeding risk	IIb	C

Windecker S, et al. *Eur Heart J*. 2014;35:2541-2619.

2016 ACC/AHA Guideline Focused Update on Duration of DAPT in Patients With CAD

PCI	0 Months		6 Months	12 Months
BMS	Class I ≥ 1 month (clopidogrel)	**No high risk of bleeding and no significant overt bleeding on DAPT**	Class IIb > 2 months may be reasonable	→
DES	Class I ≥ 6 months (clopidogrel)		Class IIb > 6 months may be reasonable	→

Levine GN, et al. *J Am Coll Cardiol*. 2016. [Epub ahead of print]

2016 ACC/AHA Guideline Focused Update on Duration of DAPT in Patients With CAD (cont)

Acute recent ACS (NSTEMI/STEMI)	12 Months	No high risk of bleeding and no significant overt bleeding on DAPT	Class IIb > 12 mo may be reasonable
Medical therapy	Class I ≥ 12 mo (clopidogrel or ticagrelor)		→
Lytic (STEMI)	Class I Min 4 days and ideally ≥ 12 mo (clopidogrel)		→
PCI (BMS/DES)	Class I ≥ 12 mo (clopidogrel, prasugrel or ticagrelor)		→
CABG	Resume P2y12 inhibitor to 1 y DAPT		

Levine GN, et al. *J Am Coll Cardiol*. 2016. [Epub ahead of print]

2016 ACC/AHA Guideline Focused Update on Duration of DAPT in Patients With CAD (cont)

Increased Ischemic Risk/Risk of Stent Thrombosis (May Favor Longer-Duration DAPT)

Increased ischemic risk

- Advanced age
- ACS presentation
- Multiple prior MIs
- Extensive CAD
- Diabetes mellitus
- CKD

Increased risk of stent thrombosis

- ACS
- Diabetes mellitus
- LVEF < 40%
- First-generation DES
- Stent undersizing
- Stent underdeployment
- Small stent diameter
- Greater stent length
- Bifurcation stents
- In-stent restenosis

Increased Bleeding Risk (May Favor Shorter-Duration DAPT)

History of bleeding

- OAC therapy
- Female sex
- Advanced age
- Low body weight
- CKD
- Diabetes mellitus
- Anemia
- Chronic steroid or NSAID therapy

Levine GN, et al. *J Am Coll Cardiol*. 2016. [Epub ahead of print]

DAPT Score

Variable	Points
Age ≥ 75 y	-2
Age 65 to < 75 y	-1
Age < 65 y	0
Current cigarette smoker	1
Diabetes mellitus	1
MI at presentation	1
Prior PCI or prior MI	1
Stent diameter < 3 mm	1
Paclitaxel-eluting stent	1
CHF or LVEF < 30%	2
Saphenous vein graft PCI	2

- A score of ≥ 2 is associated with a favorable benefit/risk ratio for prolonged DAPT while a score of < 2 is associated with an unfavorable benefit/risk ratio

Yeh RW, et al. *JAMA*. 2016;315:1735-1749.

Coronary Thrombosis and Major Bleeding After PCI With Drug-Eluting Stents

Risk Scores From PARIS

Usman Baber, MD, MS,[a] Roxana Mehran, MD,[a] Gennaro Giustino, MD,[a] David J. Cohen, MD, MSc,[b] Timothy D. Henry, MD,[c] Samantha Sartori, PhD,[a] Cono Ariti, MSc,[d] Claire Litherland, MS,[e] George Dangas, MD, PhD,[a] C. Michael Gibson, MD,[f] Mitchell W. Krucoff, MD,[g] David J. Moliterno, MD,[h] Ajay J. Kirtane, MD, SM,[e,i] Gregg W. Stone, MD,[e,i] Antonio Colombo, MD,[j] Alaide Chieffo, MD,[j] Annapoorna S. Kini, MD,[a] Bernhard Witzenbichler, MD,[k] Giora Weisz, MD,[l] Philippe Gabriel Steg, MD,[m] Stuart Pocock, PhD[d]

TABLE 4 Integer Risk Score for Major Bleeding

Parameter	Score
Age, yrs	
<50	0
50-59	+1
60-69	+2
70-79	+3
≥80	+4
BMI, kg/m^2	
<25	+2
25-34.9	0
≥35	+2
Current smoking	
Yes	+2
No	0
Anemia	
Present	+3
Absent	0
CrCl <60 ml/min	
Present	+2
Absent	0
Triple therapy on discharge	
Yes	+2
No	0

Abbreviations as in Table 1.

TABLE 5 Integer Risk Score for Coronary Thrombotic Events

Parameter	Score
Diabetes mellitus	
None	0
Non-insulin-dependent	+1
Insulin-dependent	+3
Acute coronary syndrome	
No	0
Yes, Tn-negative	+1
Yes, Tn-positive	+2
Current smoking	
Yes	+1
No	0
CrCl <60 ml/min	
Present	+2
Absent	0
Prior PCI	
Yes	+2
No	0
Prior CABG	
Yes	+2
No	0

Tn = troponin; other abbreviations as in Table 1.

J Am Coll Cardiol 2016;67:2224–34

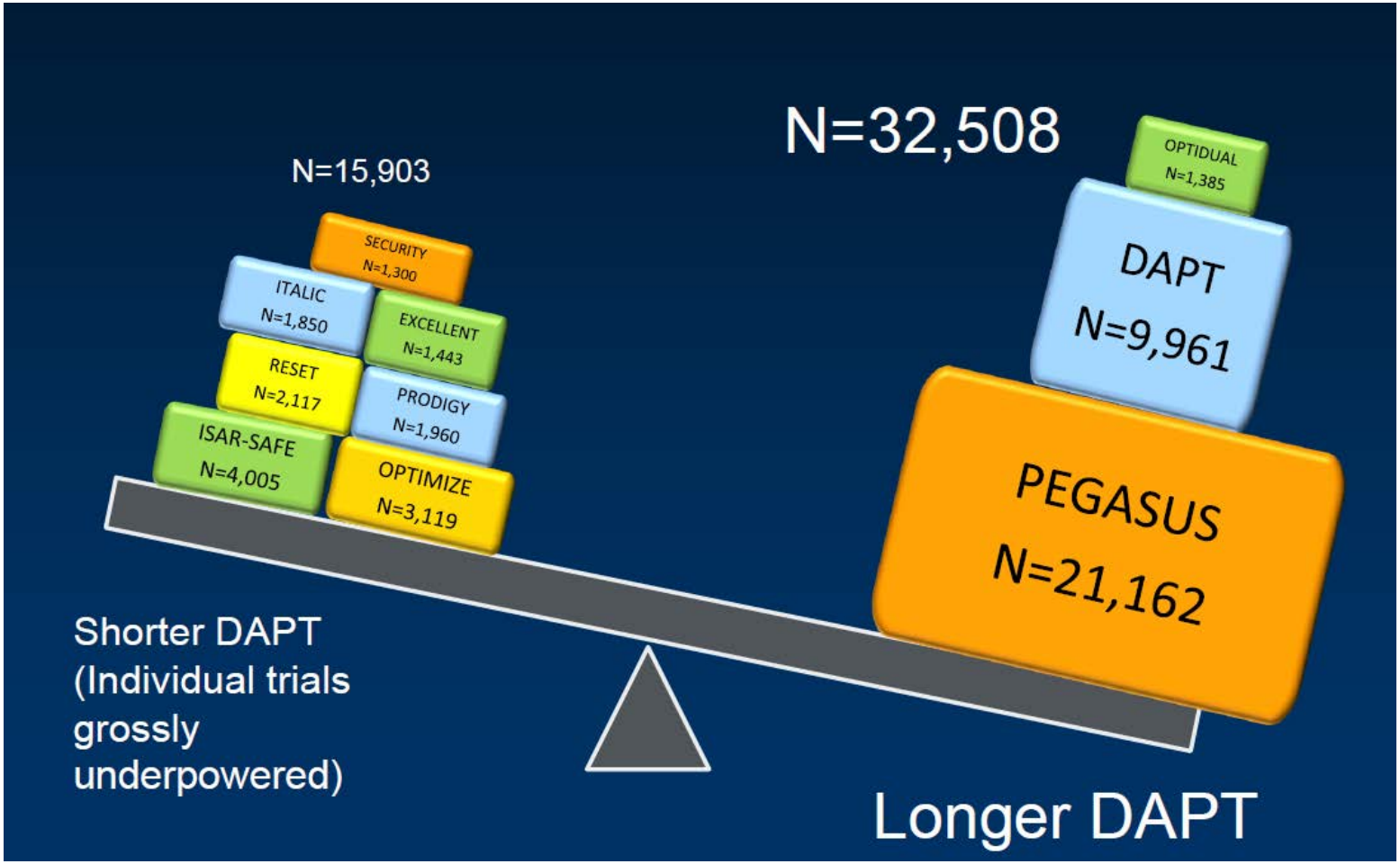
Individualized Modeling Approach for DAPT Duration

Vision or Confusion?*

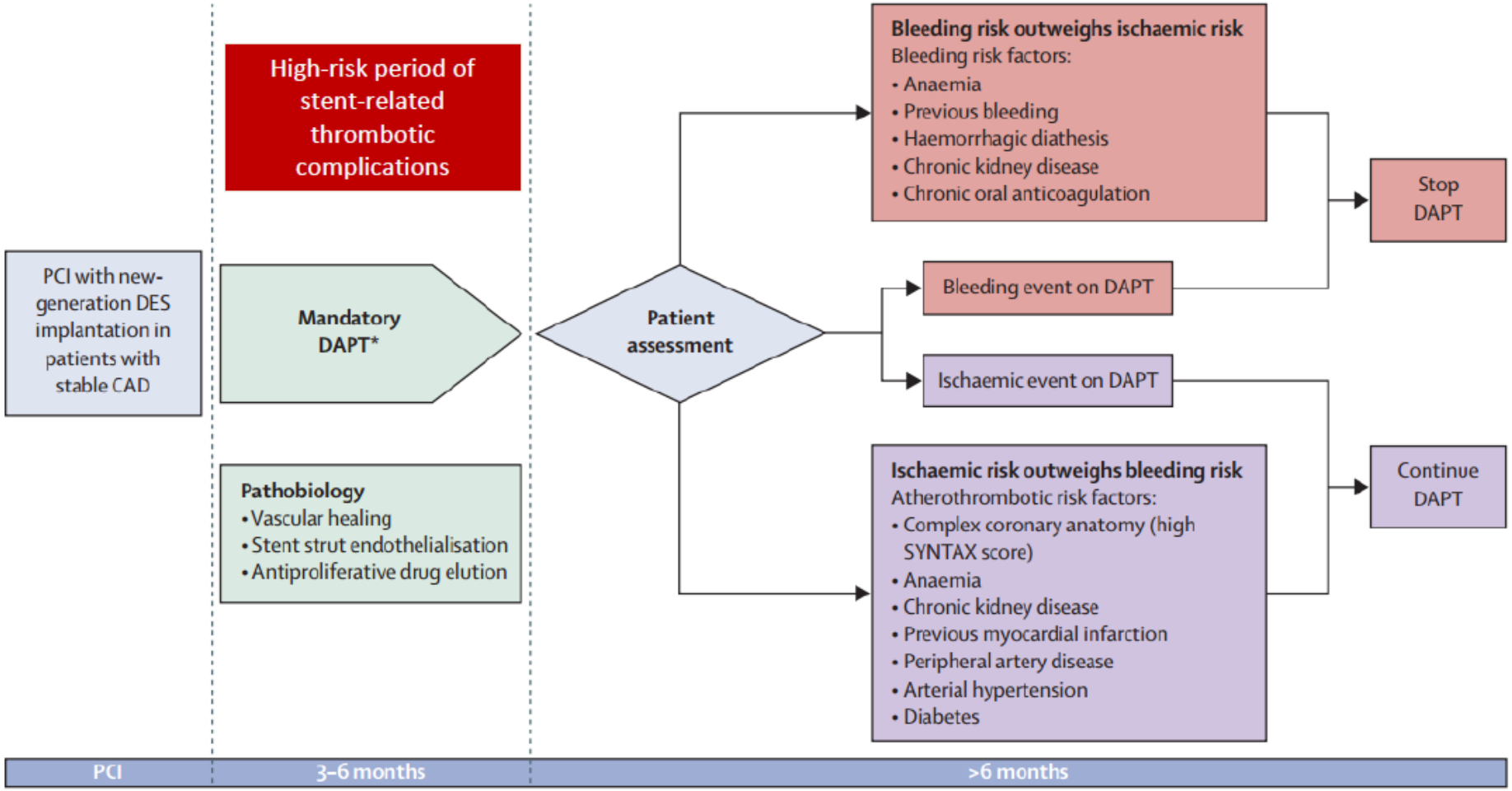
Jean-Philippe Collet, MD, PhD, Quentin Fischer, MD, Gilles Montalescot, MD, PhD

JACC VOL. 67, NO. 19, 2016
MAY 17, 2016:2235–6

Çalışma kanıtları ?



SİKH olgularında yeni nesil DES implantasyonu sonrasında DAPT algoritması



KTO girişimleri için ne farklı olabilir?

- Klinik prezantasyon
  - Çoğunluk KKAH
  - AKS ?
  - Kalp yetersizliği?
- Optimal medikal tedavi?
- Ek sorunlar, ek ilaçlar
- İskemi yoğunluğu?
- Önceden uygulanan girişimler (PKG, başarısız PKG, KABG..)

KTO girişimleri için ne farklı olabilir?

- KTO PKG'lerinde restenoz daha sık görülmektedir
  - ➢ Daha diffüz damar tutulumu
  - ➢ Hipoperfüzyona bağlı distal yatak fizyopatolojisindeki değişiklikler
  - ➢ Uzun stent segmentleri
  - ➢ Subintimal alan kullanımı

[1] Garcia S, Abdullah S, Banerjee S, Brilakis ES. Chronic total occlusions: patient selection and overview of advanced techniques. Curr Cardiol Rep 2013;15:334.
[2] George S, Cockburn J, Clayton TC, et al. Long-term follow-up of elective chronic total coronary occlusion angioplasty: analysis from the U.K. central cardiac audit database. J Am Coll Cardiol 2014;64:235–43.
[3] Michael TT, Mogabgab O, Alomar M, et al. Long-term outcomes of successful chronic total occlusion percutaneous coronary interventions using the antegrade and retrograde approach. J Interv Cardiol 2014;27:465–71.
[4] Brilakis ES, Kotsia A, Luna M, Garcia S, Abdullah SM, Banerjee S. The role of drug-eluting stents for the treatment of coronary chronic total occlusions. Expert Rev Cardiovasc Ther 2013;11:1349–58.

KTO girişimleri için ne farklı olabilir?

- KTO ya neden olan lezyon ve distal damar yatağındaki kronik değişiklikler ve bunların hemodinamik etkileri
- Antegrad/Retrograd tekniklerde daha agresif telleme, çapalama, balonlama, stentleme...
- Aşırı stent uzunlukları, overlappingler...
- STAR, CART vs agresif tekniklerde sub intimal pasaj sonucu damar bütünlüğü ve endotel fonksiyonundaki hasar
- Gecikmiş stent iyileşmesi
- Malappozisyon

KTO girişimleri için ne farklı olabilir?

- Komplikasyonlar ?
  - Tamponad
  - Perforasyon?
  - Diseksiyon?
  - Hematom?
  - Acil cerrahi gereksinimi?

KTO girişimleri sonrasında stent trombozu

- Non KTO lezyonlarda 2.generasyon DES lerin kullanımıyla < %0,2 / yıl

- KTO lezyonlarında % 1,3 / yıl

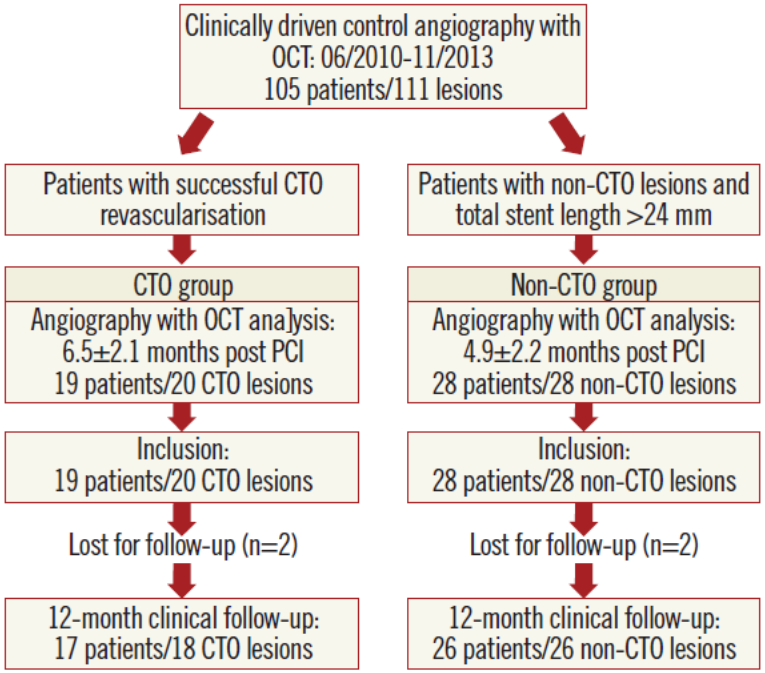
8. Kimura T, Morimoto T, Kozuma K, Honda Y, Kume T, Aizawa T, Mitsudo K, Miyazaki S, Yamaguchi T, Hiyoshi E, Nishimura E, Isshiki T; RESTART Investigators. Comparisons of baseline demographics, clinical presentation, and long-term outcome among patients with early, late, and very late stent thrombosis of sirolimus-eluting stents: observations from the Registry of Stent Thrombosis for Review and Reevaluation (RESTART). *Circulation*. 2010;122:52-61.

9. Syrseloudis D, Secco GG, Barrero EA, Lindsay AC, Ghione M, Kilickesmez K, Foin N, Martos R, Di Mario C. Increase in J-CTO lesion complexity score explains the disparity between recanalisation success and evolution of chronic total occlusion strategies: insights from a single-centre 10-year experience. *Heart*. 2013;99:474-9.

Delayed coverage of drug-eluting stents after interventional revascularisation of chronic total occlusions assessed by optical coherence tomography: the ALSTER-OCT-CTO registry

Christian-Hendrik Heeger[1], MD; Andreas Busjahn[2], PhD; Laura Hildebrand[1]; Maximillian Fenski[1]; Felix Lesche[1], MD; Felix Meincke[1], MD; Karl-Heinz Kuck[1], MD, FESC; Martin Walter Bergmann[1]*, MD, PhD, FESC

1. Department of Cardiology, Asklepios Clinic St. Georg, Hamburg, Germany; 2. Health TwiSt GmbH, Berlin, Germany



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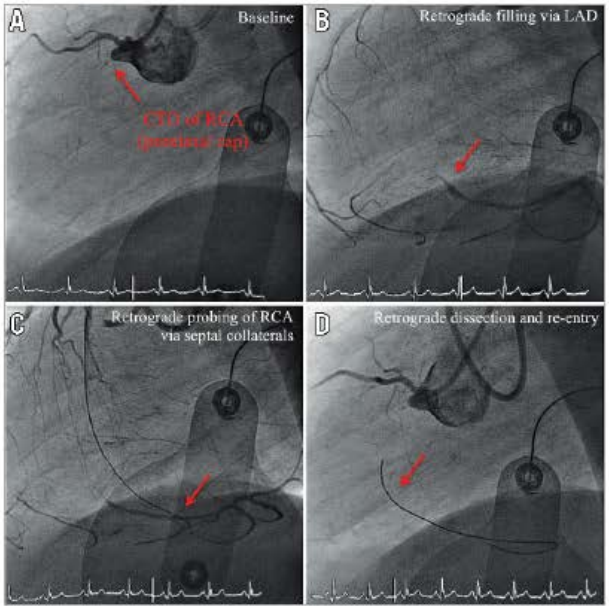
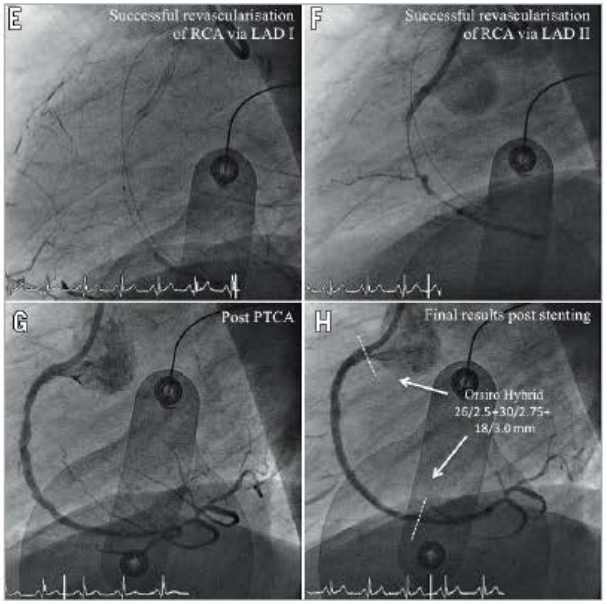
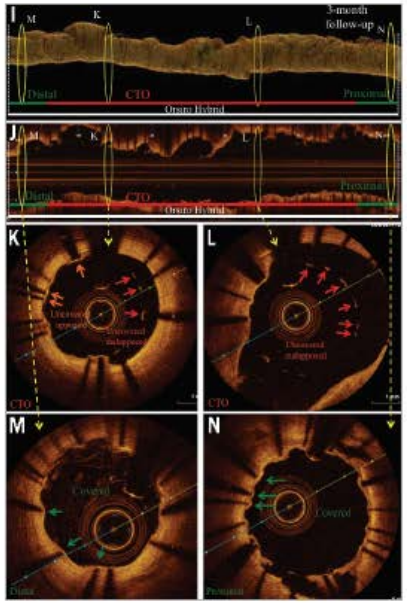






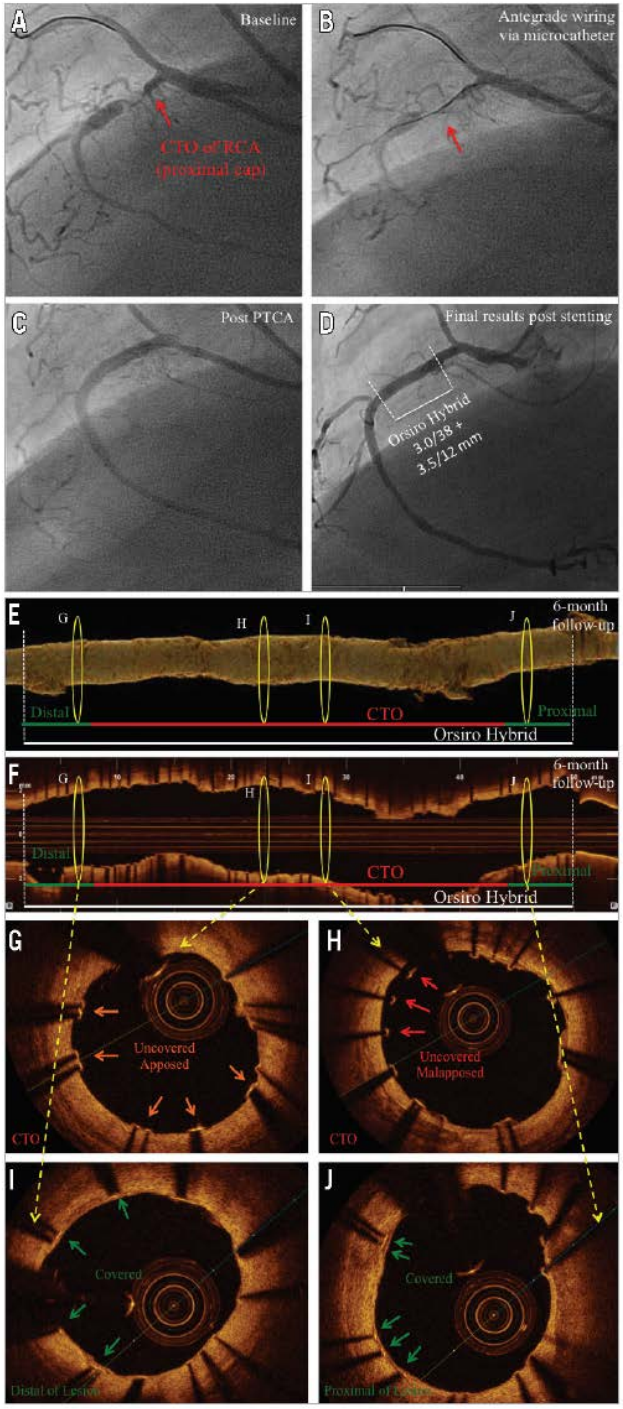
Analysis by OCT	CTO group	Control group	*p*
Lesion level			
Total number of analysed lesions, n	20	28	
Frequency of lesions with uncovered struts, n (%)	20 (100)	28 (100)	1
Frequency of lesions with ≥30% uncovered struts, n (%)	10 (50.0)	1 (3.6)	<0.001 (*)
Frequency of lesions with ≥5% malapposed struts, n (%)	8 (40.0)	2 (7.1)	0.01 (*)
Maximum length of segments with uncovered struts, mm	9.0±7.1	3.8±3.7	0.003 (*)
Maximum length of segments with malapposed struts, mm	5.4±5.9	2.5±2.6	0.019 (*)
Cross-section level			
Total number of analysed cross-sections, n	1,023	1,234	
Number of analysed cross-sections/lesion, n	51.2±22.6	44.1±16.4	0.409
Frequency of cross-sections with uncovered struts, %	56.3±30.4	43.1±19.1	0.026 (*)
Frequency of cross-sections with ≥30% uncovered struts, %	33.6±27.5	15.1±7.9	0.029 (*)
Frequency of cross-sections with ≥5% malapposed struts, %	26.1±21.5	11.0±9.7	0.004 (*)
Strut level			
Total number of analysed struts, n	9,219	10,724	
Number of analysed struts/lesion, n	461±230.2	383±178.3	0.255
Number of analysed struts/cross-section, n	8.9±2.1	9.3±4.1	0.577
Covered struts/patient, %	68.9±21.9	89.6±10.4	<0.001 (*)
Uncovered struts/patient, %	31.1±21.9	10.4±10.4	<0.001 (*)
Apposed uncovered struts/patient, %	20.2±16.2	7.5±8.7	0.001 (*)
Malapposed uncovered struts/patient, %	10.9±10.3	2.9±2.6	<0.001 (*)
Neointimal thickness of covered struts, µm	92.0±61.2	109.3±39.2	0.033 (*)

Analysis of DES implanted after CTO-PCI vs. DES implanted in non-CTO lesions (control). Values are mean±SD or n (%) as appropriate. The data are presenting evidence for delayed DES coverage after CTO-PCI compared to control.

- Kaplanmayan strut sayısı daha fazla
- Malappozisyon daha fazla
- Neotima kalınlığı daha az

Analysis by OCT	Antegrade wiring	Antegrade high-penetration wires	Retrograde dissection and re-entry	*p*
Lesion level				
Total number of analysed lesions, n	7	7	6	
Frequency of lesions with uncovered struts, %	7 (100)	7 (100)	6 (100)	1
Frequency of lesions with ≥30% uncovered struts, %	5 (71.4)	3 (42.8)	2 (33.3)	0.390
Frequency of lesions with ≥5% malapposed struts, %	3 (42.8)	3 (42.8)	2 (33.3)	0.935
Maximum length of segments with uncovered struts, mm	11.8±7.4	7.9±5.3	7.0±8.8	0.445
Maximum length of segments with malapposed struts, mm	4.9±2.7	5.7±5.3	5.6±3.7	0.964
Cross-section				
Total number of analysed cross-sections, n	283	376	364	
Number of analysed cross-sections/lesion, n	40.4±21.3	53.7±17.3	60.7±27.6	0.267
Frequency of cross-sections with uncovered struts, %	63.6±32.7	64.9±21.0	37.7±33.2	0.207
Frequency of cross-sections with ≥30% uncovered struts, %	46.2±30.2	30.6±16.3	22.3±32.8	0.292
Frequency of cross-sections with ≥5% malapposed struts, %	22.6±16.9	32.5±16.4	22.8±31.8	0.648
Strut level				
Total number of analysed struts, n	2,732	3,481	3,006	
Number of analysed struts/lesion, n	390.3±239.5	497.3±221.6	501.0±250.7	0.627
Number of analysed struts/cross-section, n	9.3±3.2	9.0±1.7	8.1±0.8	0.597
Covered struts/patient, %	63.7±24.6	72.3±11.6	71.9±20.9	0.162
Uncovered struts/patient, %	36.3±24.6	27.7±11.6	28.1±20.9	0.162
Apposed/uncovered struts/patient, %	24.3±17.8	18.1±9.0	17.0±9.4	0.187
Malapposed/uncovered struts/patient, %	12.0±10.7	9.6±7.2	11.1±14.2	0.912
Neointimal thickness of covered struts, µm	78.6±53.0	87.1±28.1	113.3±96.7	0.605

Values are mean±SD or n (%) as appropriate. No differences were found between the groups.


A
Baseline
CTO of RCA
(proximal cap)
B
Antegrade wiring
via microcatheter
C
Post PTCA
D
Final results post stenting
Orsiro Hybrid
3.0/38 +
3.5/32 mm
E
G
H
I
J
6-month
follow-up
Distal
CTO
Proximal
Orsiro Hybrid
F
6-month
follow-up
Distal
CTO
Orsiro Hybrid
G
Uncovered
Apposed
CTO
H
Uncovered
Malapposed
CTO
I
Covered
Distal of Lesion
J
Covered
Proximal of Lesion

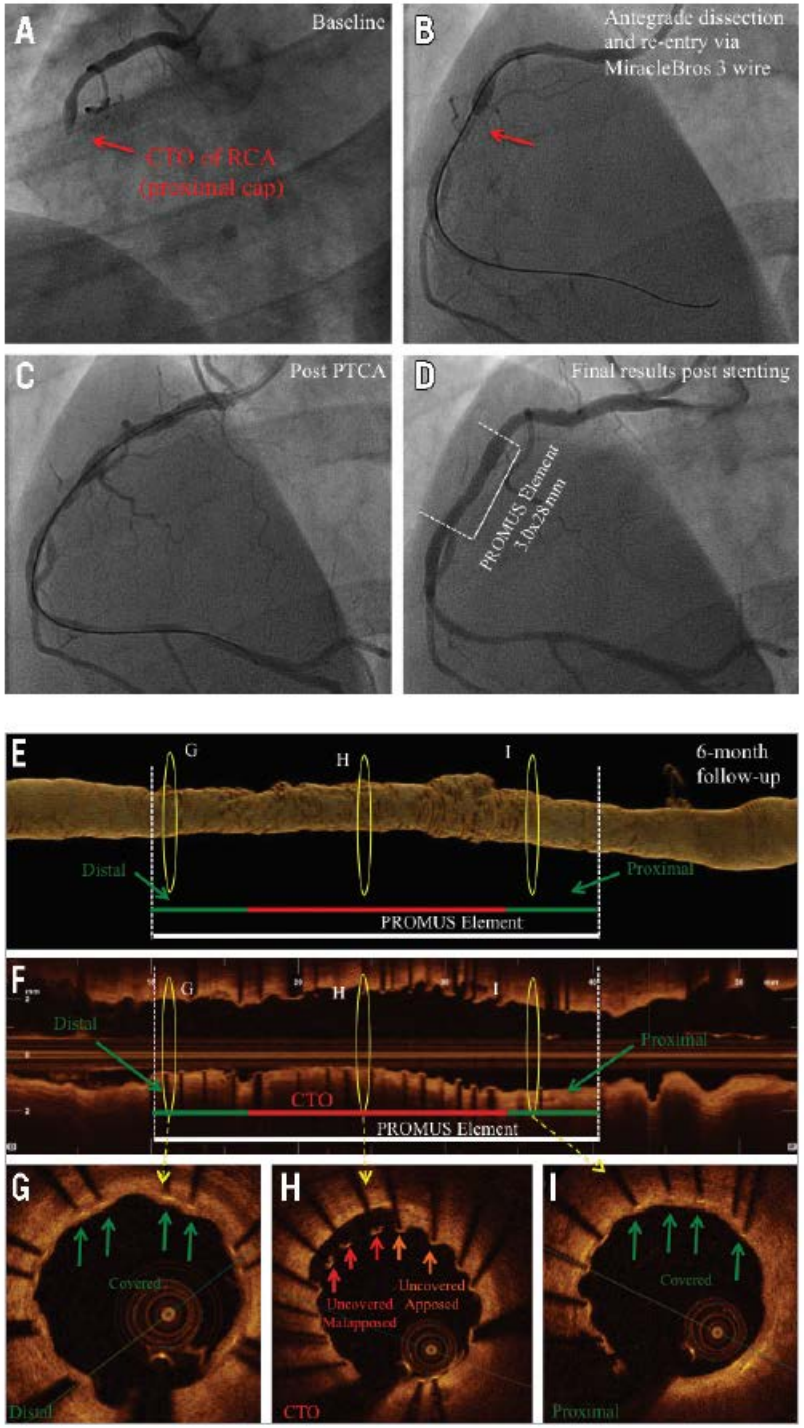

A
Baseline
CTO of RCA
(proximal cap)
B
Antegrade dissection
and re-entry via
MiracleBros 3 wire
C
Post PTCA
D
Final results post stenting
PROMUS Element
3.0x28 mm
E
G
H
I
6-month
follow-up
Distal
Proximal
PROMUS Element
F
G
H
I
Distal
Proximal
CTO
PROMUS Element
G
Covered
Distal
H
Uncovered
Uncovered
Apposed
Malapposed
CTO
I
Covered
Proximal

Table 4. Clinical follow-up after 12 months.

Characteristics	CTO group (n=19 patients)	Control group (n=28 patients)	*p*
12-month follow-up			
Lost to follow-up	2 (10.5)	2 (7.1)	1
Death	0 (0)	0 (0)	1
Unstable angina pectoris	2 (10.5)	5 (17.9)	0.7
NSTE-ACS	0 (0)	0 (0)	1
STEMI	0 (0)	0 (0)	1
Target vessel failure	1 (5.3)	0 (0)	0.4
Target lesion revascularisation	1 (5.3)	3 (10.7)	0.6
Late stent thrombosis	0 (0)	0 (0)	1
Major bleeding events	0 (0)	0 (0)	1
Minor bleeding events	0 (0)	0 (0)	1
Cerebrovascular events	0 (0)	0 (0)	1
Antiplatelet therapy			
Dual at 6 months	16 (84.2)	25 (89.3)	0.7
Dual at 12 months	15 (78.9)	18 (64.3)	0.34

Data are presented as number of events (n) and percentage of total number (%). No differences were found concerning the observed parameters.

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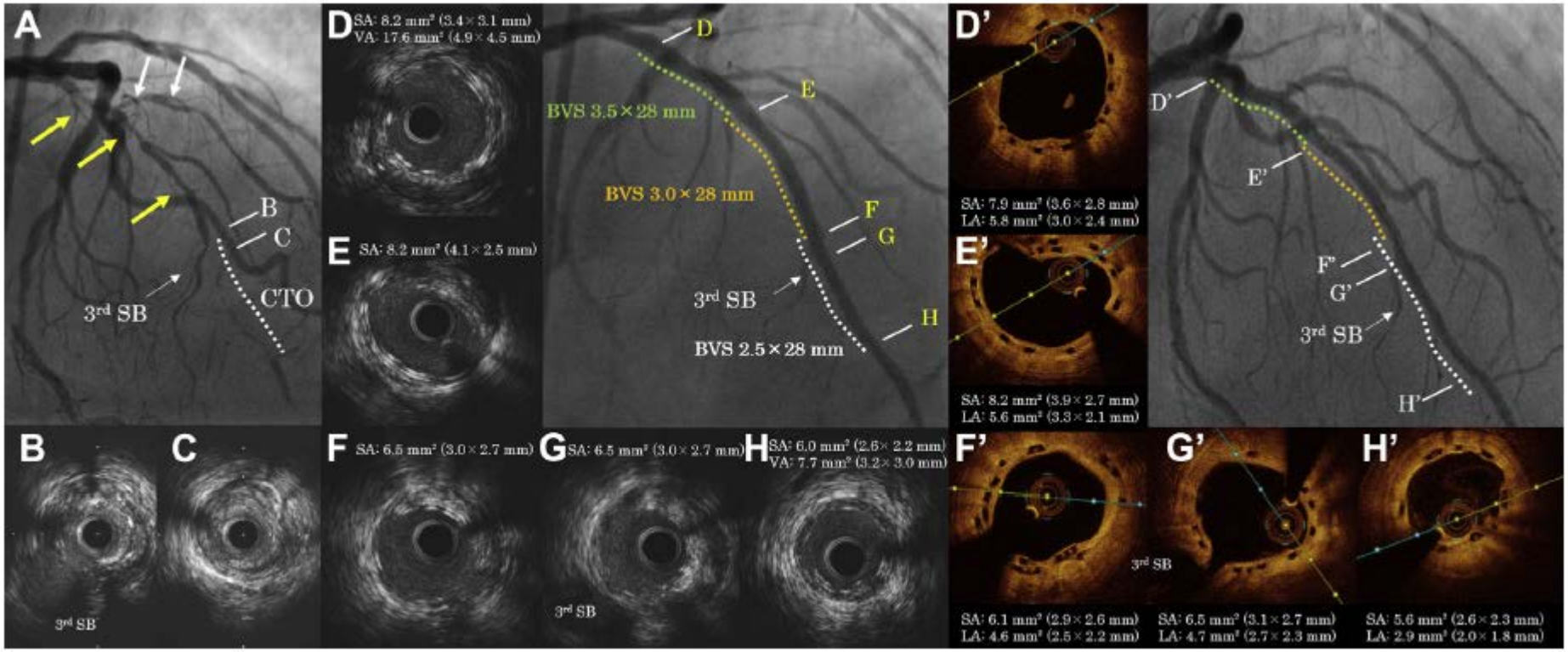
Case Report

Optimal Duration of Dual Antiplatelet Therapy After Implantation of Bioresorbable Vascular Scaffolds: Lessons From Optical Coherence Tomography

Katsumasa Sato, MD,[a,*] Vasileios F. Panoulas, PhD,[a,b,*] Toru Naganuma, MD,[a] Tadashi Miyazaki, MD,[a] Azeem Latib, MD,[a] and Antonio Colombo, MD[a]

[a] *Interventional Cardiology Unit, EMO-GVM Centro Cuore Columbus, Milan, Italy*

[b] *Imperial College London, National Heart and Lung Institute, London, United Kingdom*



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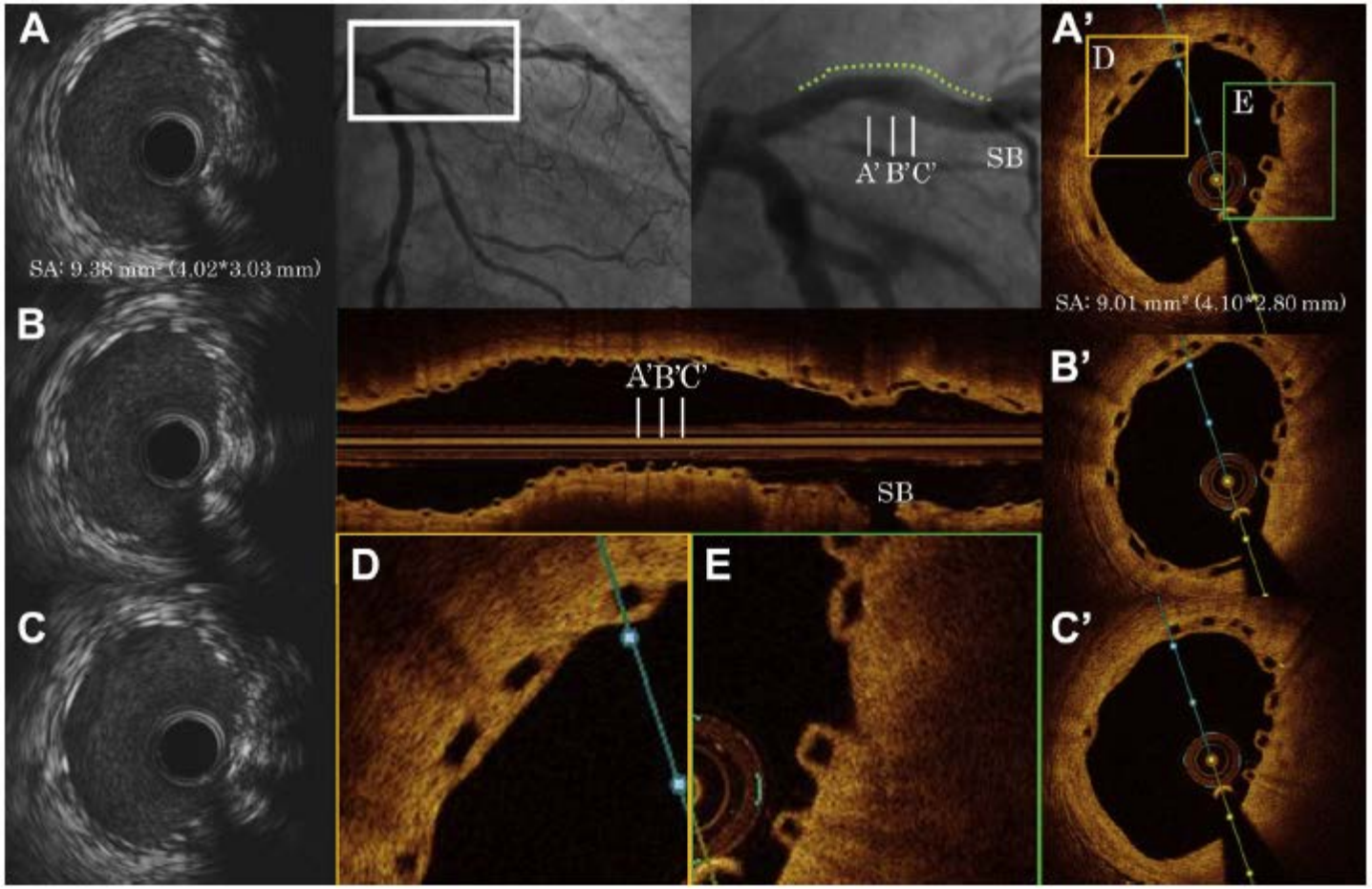
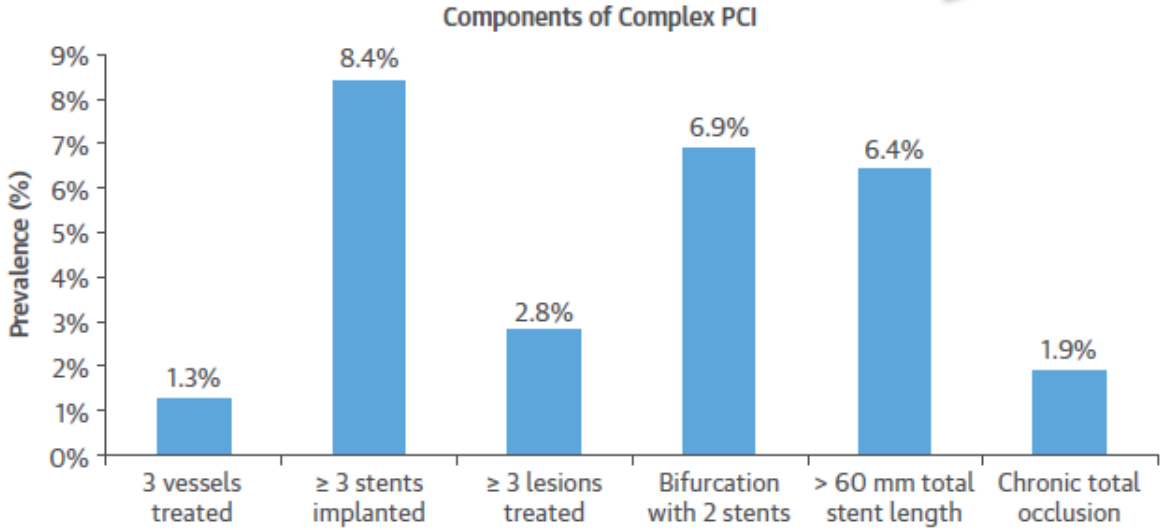


Efficacy and Safety of Dual Antiplatelet Therapy After Complex PCI

Gennaro Giustino, MD,[a,b,c] Alaide Chieffo, MD,[c] Tullio Palmerini, MD,[d] Marco Valgimigli, MD,
Fausto Feres, MD,[f] Alexandre Abizaid, MD,[f] Ricardo A. Costa, MD,[f] Myeong-Ki Hong, MD,
Byeong-Keuk Kim, MD, PhD,[g] Yangsoo Jang, MD, PhD,[g] Hyo-Soo Kim, MD, PhD,[h] Kyung Wo
Martine Gilard, MD,[i] Marie-Claude Morice, MD,[j] Fadi Sawaya, MD,[j] Gennaro Sardella, MD,[k]
Bjorn Redfors, MD, PhD,[b] Martin B. Leon, MD,[c,l] Deepak L. Bhatt, MD, MPH,[m] Gregg W. Sto
Antonio Colombo, MD[c]

6 RKÇ'dan 9577 hasta, %17,5'i kompleks PKG

FIGURE 1 Prevalence and Overlap of Complex PCI Components



Prevalence of complex PCI components in the overall population. PCI = percutaneous coronary intervention.

FIGURE 2 Effect of Procedural Complexity on Ischemic and Bleeding Outcomes

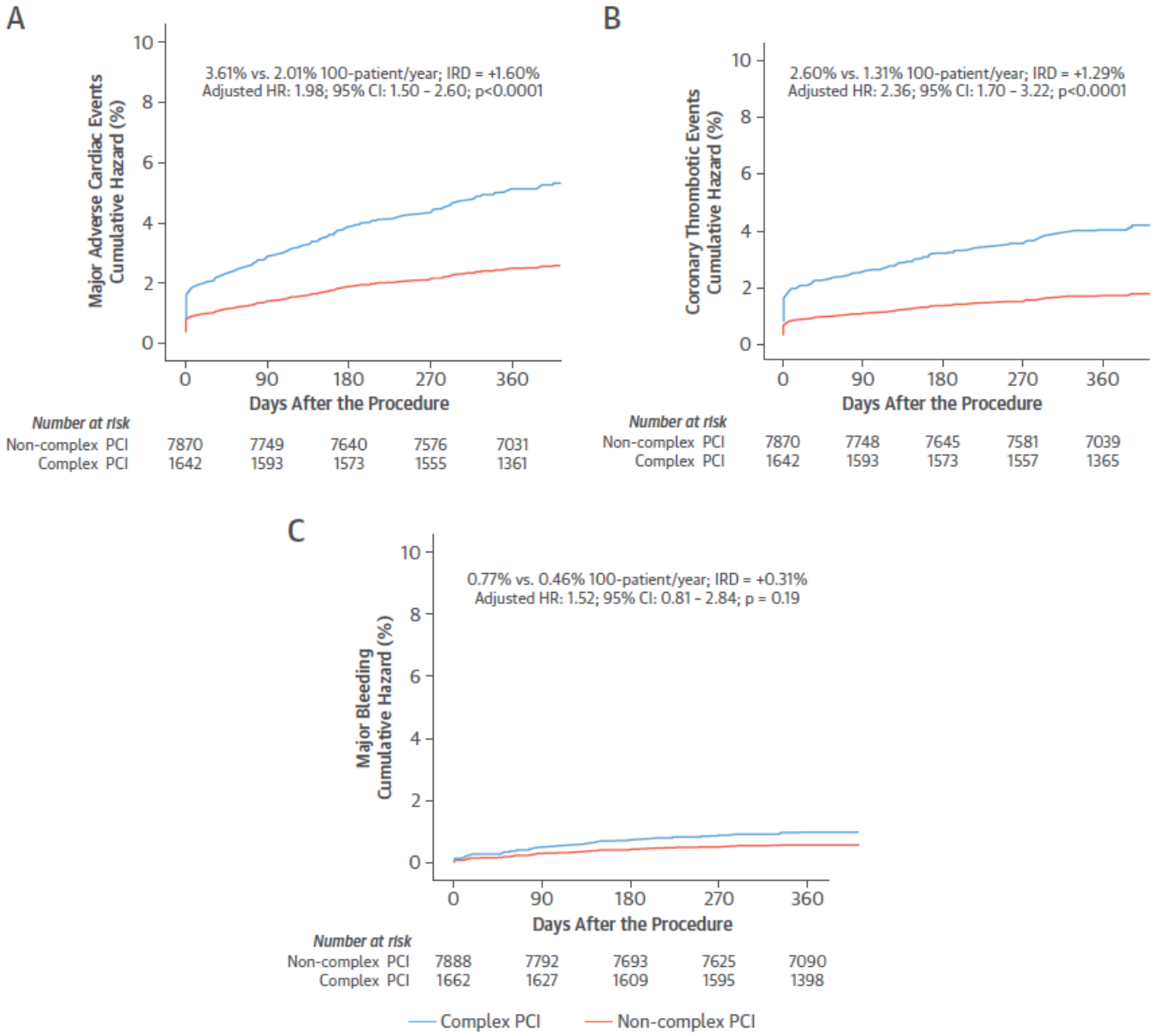


FIGURE 4 Intention-to-Treat Analysis for Long- Versus Short-Term DAPT in Patients With or Without Complex PCI

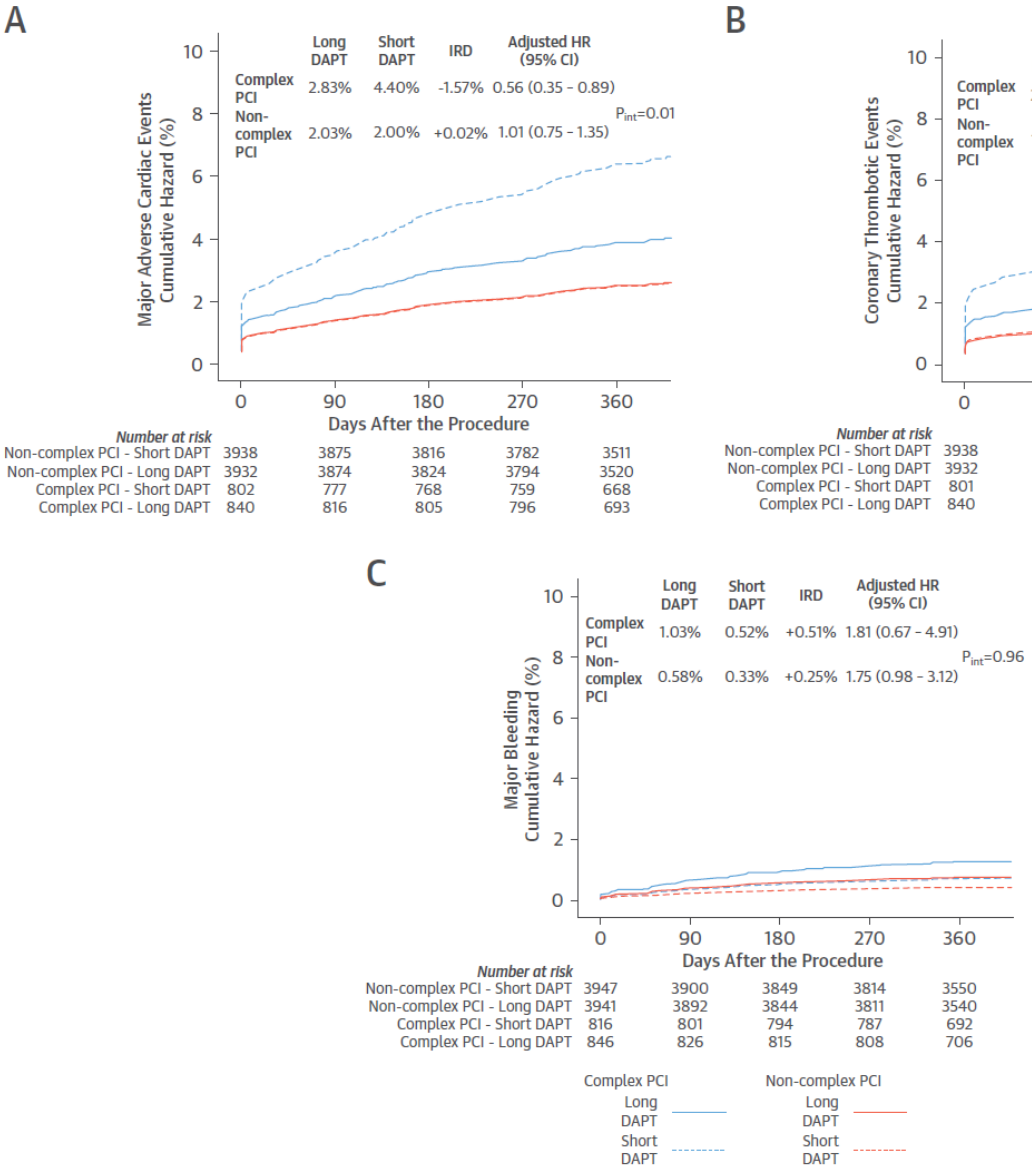
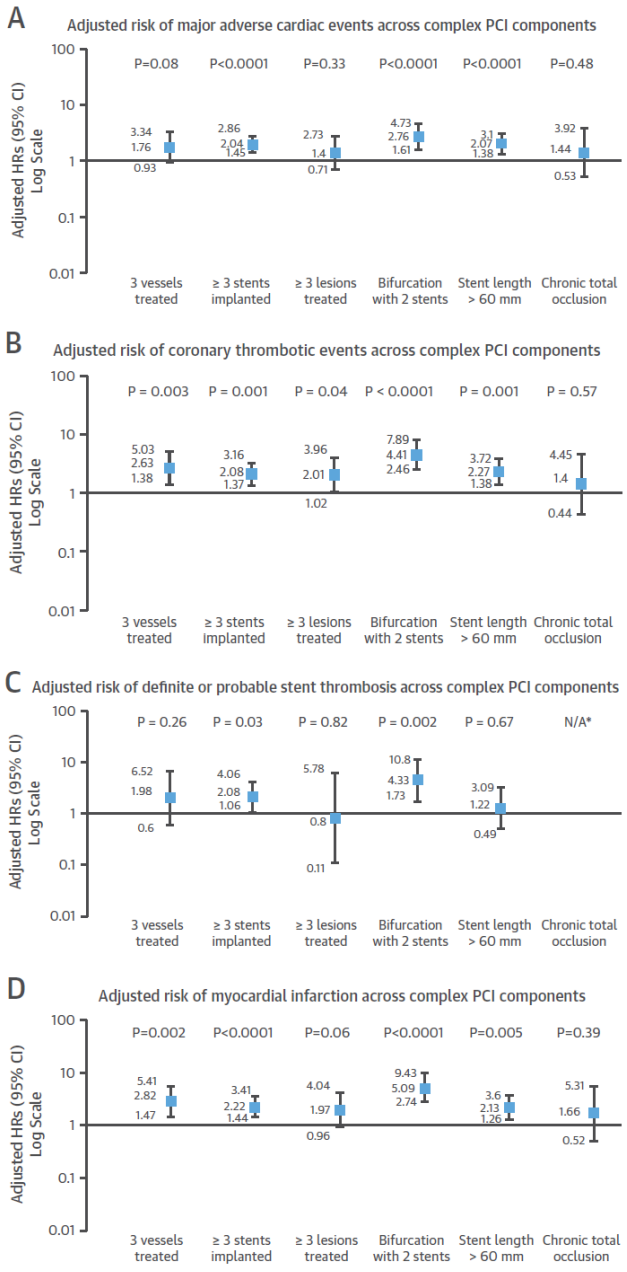
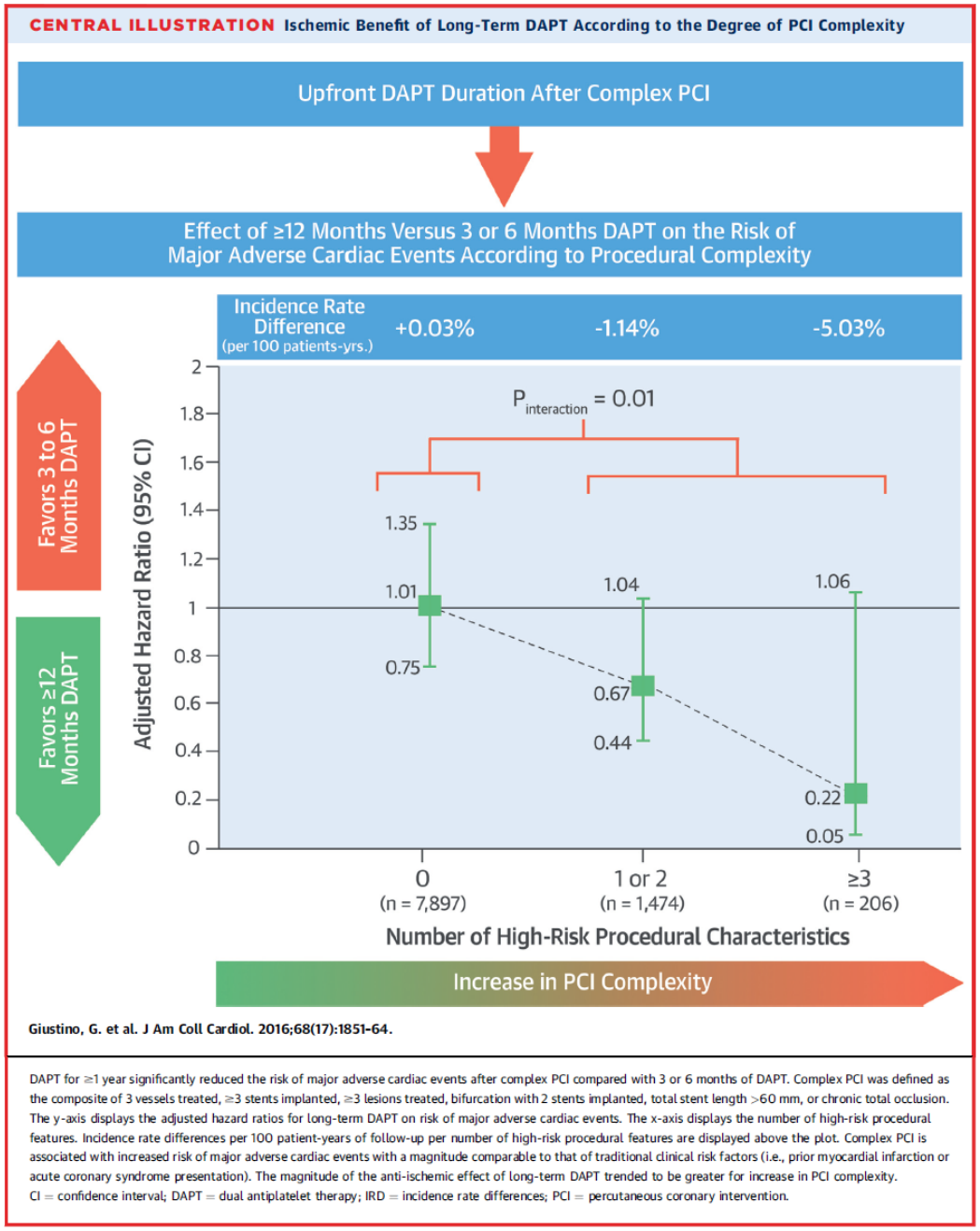


FIGURE 3 Effect of High-Risk Procedural Subsets on Ischemic Outcomes





- Kompleks PKG'da MACE daha fazla
- Kısa süreli DAPT grubuna göre uzun DAPT grubunda daha belirgin bir MACE azalması izlenmiş
- PKG kompleksliği arttıkça uzatılan DAPT koruyuculuğu artmaktadır.
- KTO için bu durum geçerli mi?

The AngiographiC Evaluation of the Everolimus-Eluting Stent in Chronic Total Occlusion (ACE-CTO) Study

- 3 yıl içerisinde yapılmış 100 olgu
  - Antegrad wiring 51
  - Antegrade dissection/reent 24
  - Retrograde 25
- Anjiyografik restenoz %46 (95% confidence interval [CI], 35%-57%).
- TVR %37
- TLR % 39

[14] Kotsia A, Navara R, Michael TT, et al. The AngiographiC evaluation of the everolimus-eluting stent in chronic Total occlusion (ACE-CTO) study. J Invasive Cardiol 2015;27: 393–400.

Optical coherence tomography findings after chronic total occlusion interventions: Insights from the "AngiographiC evaluation of the everolimus-eluting stent in chronic Total occlusions" (ACE-CTO) study (NCT01012869)☆,☆☆,★

Daniel P. Sherbet [a], Georgios Christopoulos [a], Aris Karatasakis [a], Barbara Anna Danek [a], Anna Kotsia [a], Rachita Navara [a], Tesfaldet T. Michael [a], Michele Roesle [a], Bavana V. Rangan [a], Donald Haagen [a], Santiago Garcia [b], Calin Maniu [c], Ashish Pershad [d], Shuaib M. Abdullah [a], Jeffrey L. Hastings [a], Dharam J. Kumbhani [a], Michael Luna [a], Tayo Addo [a], Subhash Banerjee [a], Emmanouil S. Brilakis [a,*]

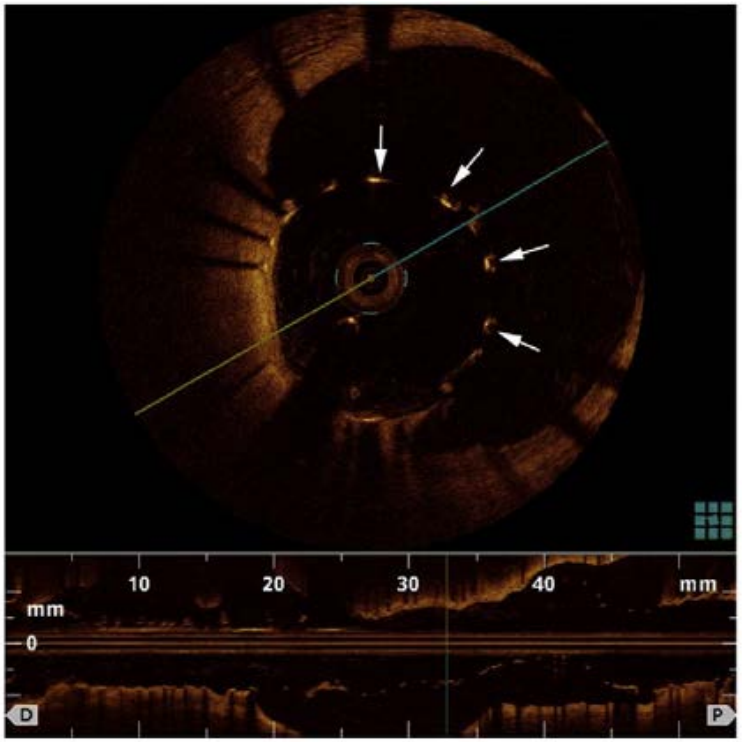


Fig. 1. Example of incomplete stent apposition in one study patient in whom an aneurysm formed within the CTO stented segment. White arrows show the stent struts within the vessel lumen.

- Hastaların %90'ında en az bir ya da daha fazla «malapposed strut»
- «%9,3'ünde tamamı malapposed»
- ???

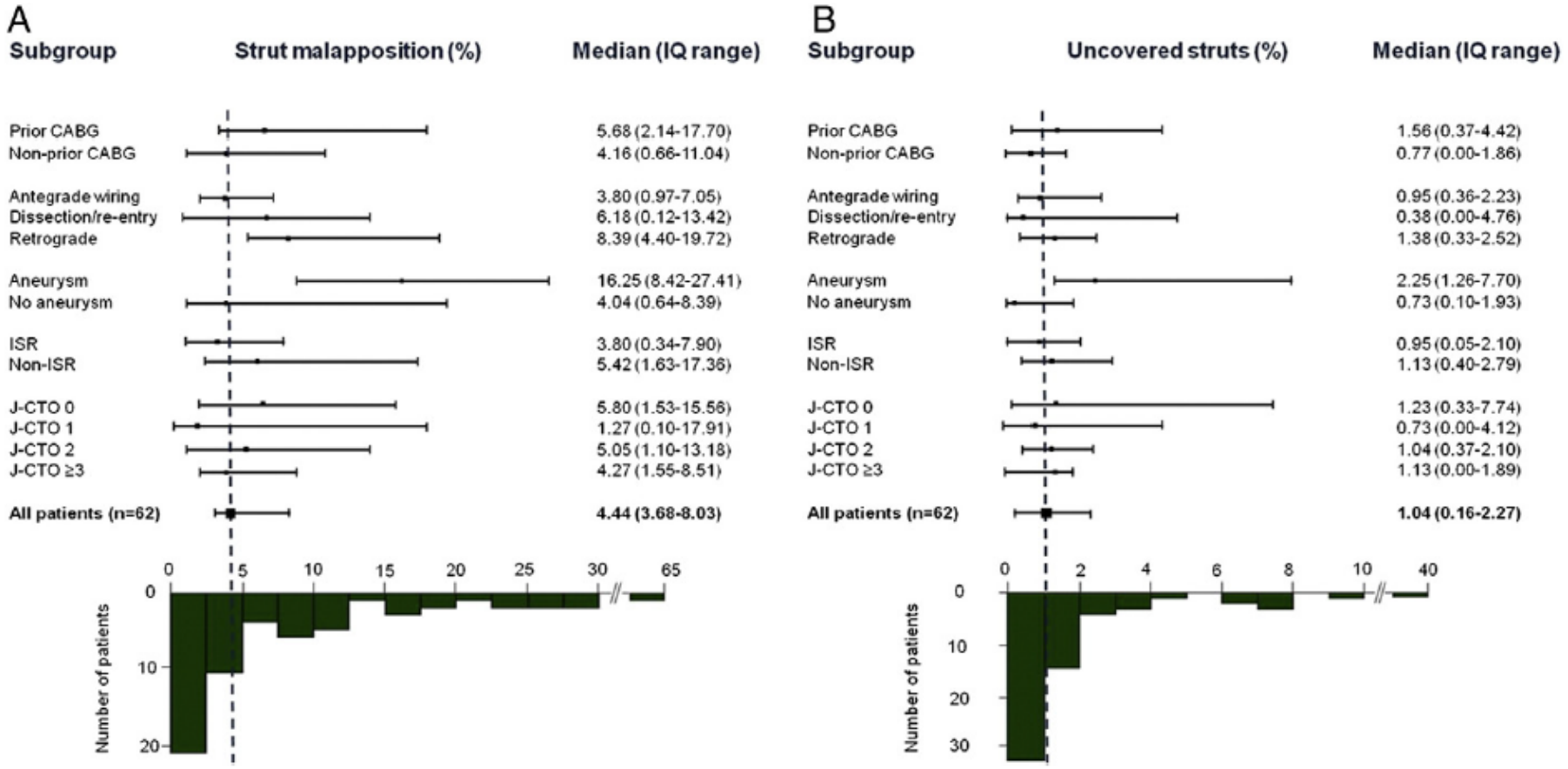


Fig. 2. Prevalence of strut malapposition (panel A) and incomplete strut coverage (panel B) in various patient and lesion subgroups. CABG: coronary artery bypass graft surgery; ISR: in-stent restenosis.

Yeni ajanlar?

- P2Y12 Inhibitors Utilization in Bifurcation and Chronic Total Occlusion PCI (P2BiTO)
- TIcaGrEloR and ABSORB Bioresorbable Vascular Scaffold Implantation for Recovery of Vascular Function After Successful Chronic Total Occlusion Recanalization (TIGER-BVS)

Özet ve yorum

- KTO girişimi sırasında veriler daha çok klopidogrel ile
- KTO girişimi sonrasında optimal DAPT tedavisi için kılavuzların önerdiği süreler yeterli olabilir
- Yeni nesil DES'lerin kullanıldığı SİKH'larında bu süre 6 ay
- AKS endikasyonu olduğunda bu süre 12 ay
- Teknikler arasında büyük fark yok
- Kanama riski bu seçimleri yapmada en önemli noktalardan biri

Özet ve yorum

- ANCAK sınırlı OCT verileri dikkate alındığında
  - Stent sayılarının ≥3 ,
  - uzunluğunun >30-35 mm,
  - multipl overlaplerin olduğu
  - ya da işleme bifurkasyon, çok damar, vb eşlik ettiği olgularda
- bu süreyi ≥12 ay mevcut OCT verileri düşünüldüğünde mantıklı görülmektedir.
- Ancak OCT = Uzun dönem klinik tüm sonuçlar?