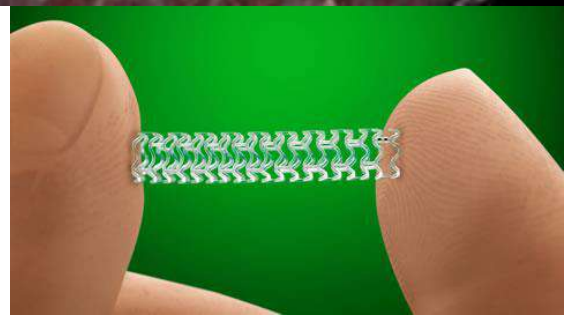
9th CHALLENGES in CARDIOLOGY

JUNE 28th - 29th 2019

Palace Hotel Monte Real



Myocardial revascularization: today & tomorrow

Pedro de Araújo Gonçalves, MD, PhD

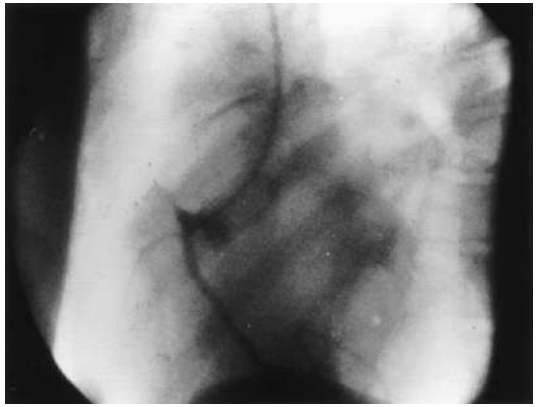
Hospital de Santa Cruz, CHLO

Hospital da Luz, Luz-Saúde

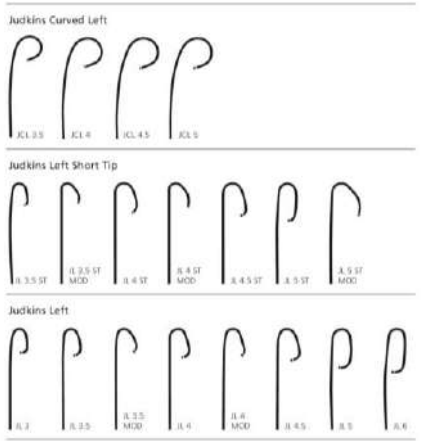
Faculdade de Ciências Médicas – UNL

Associação Portuguesa de Intervenção Cardiovascular

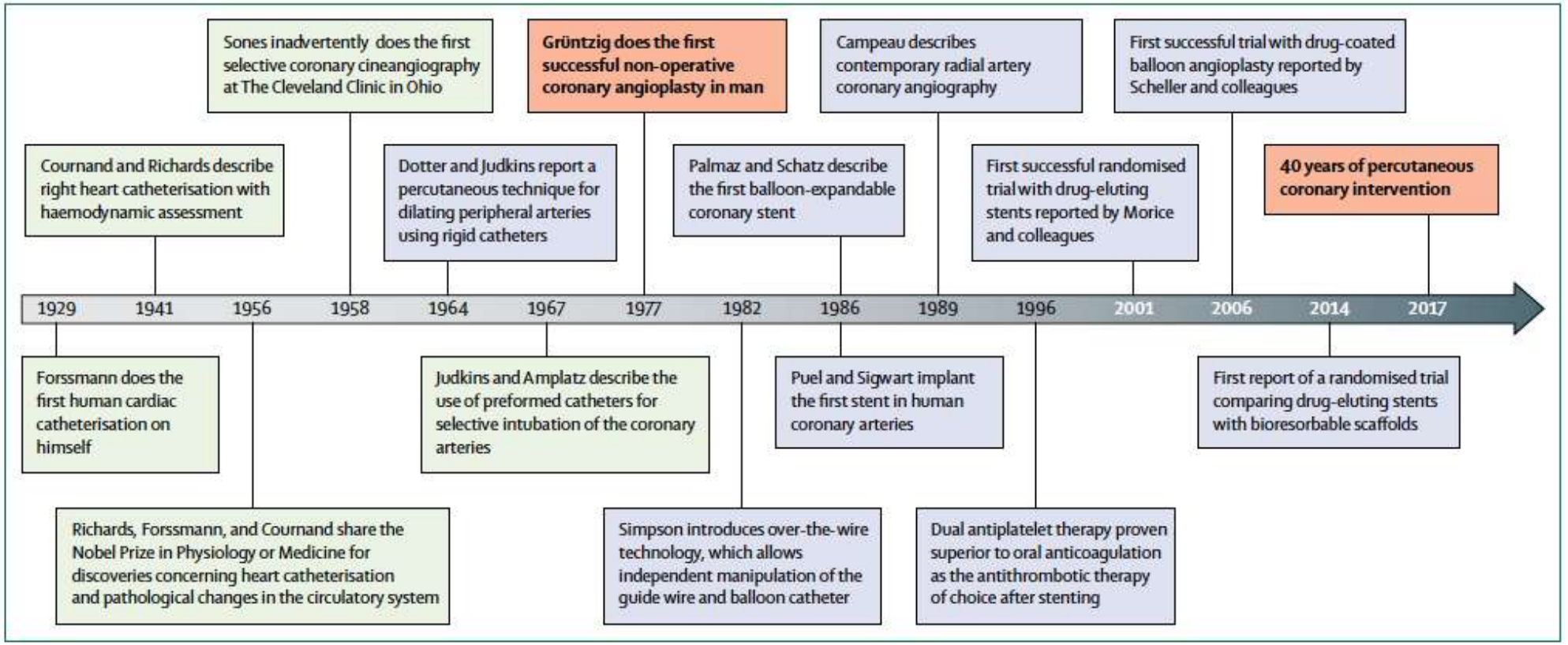
Past



1958 – Sones, 1st selective coronary angiography



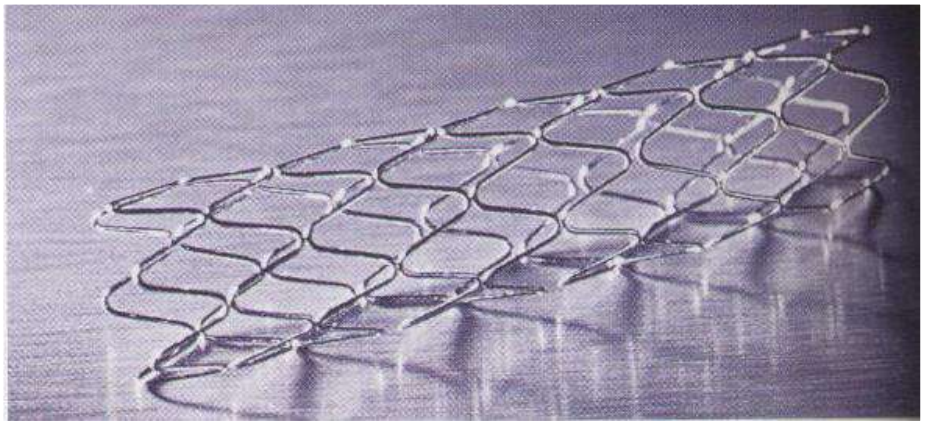
1967 – Judkins, preformed catheters



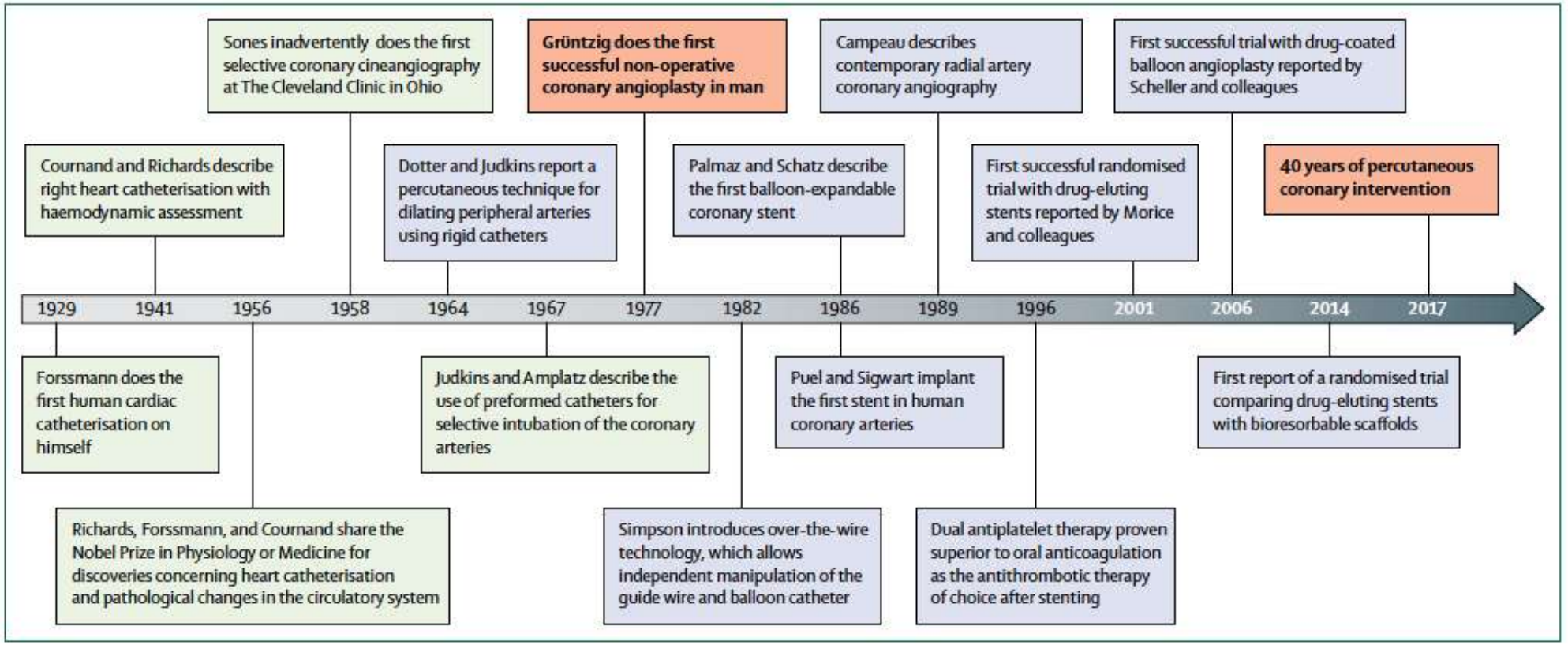
Byrne, RA. Lancet 2017; 390: 781-92

Past

1977 – Gruntzig, 1st balloon angioplasty

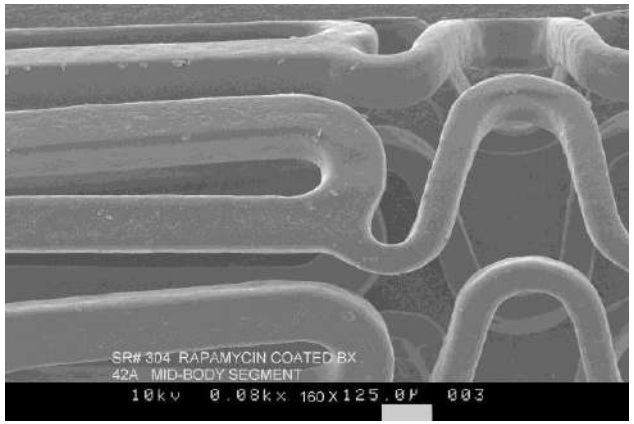


1986 – 1st coronary stent

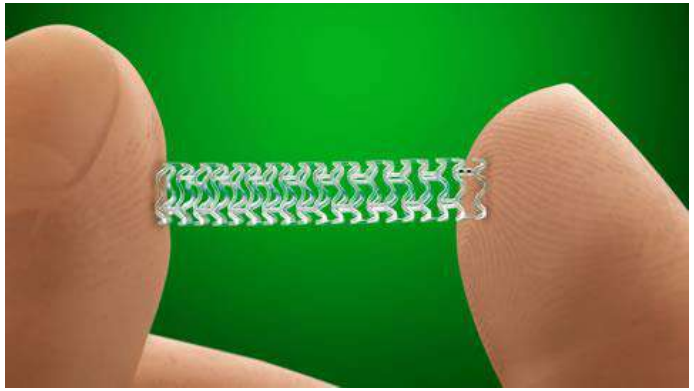


Byrne, RA. Lancet 2017; 390: 781-92

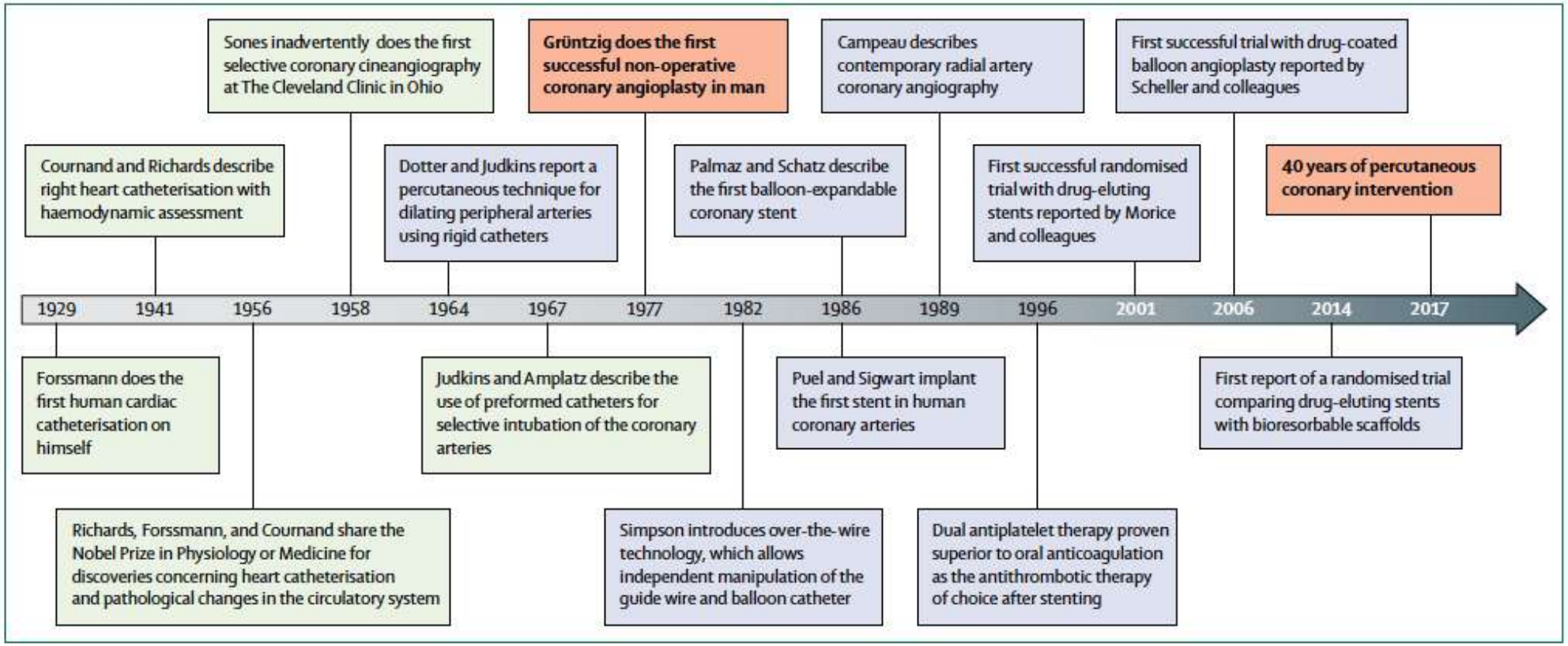
Past



2001- 1st Drug eluting stent

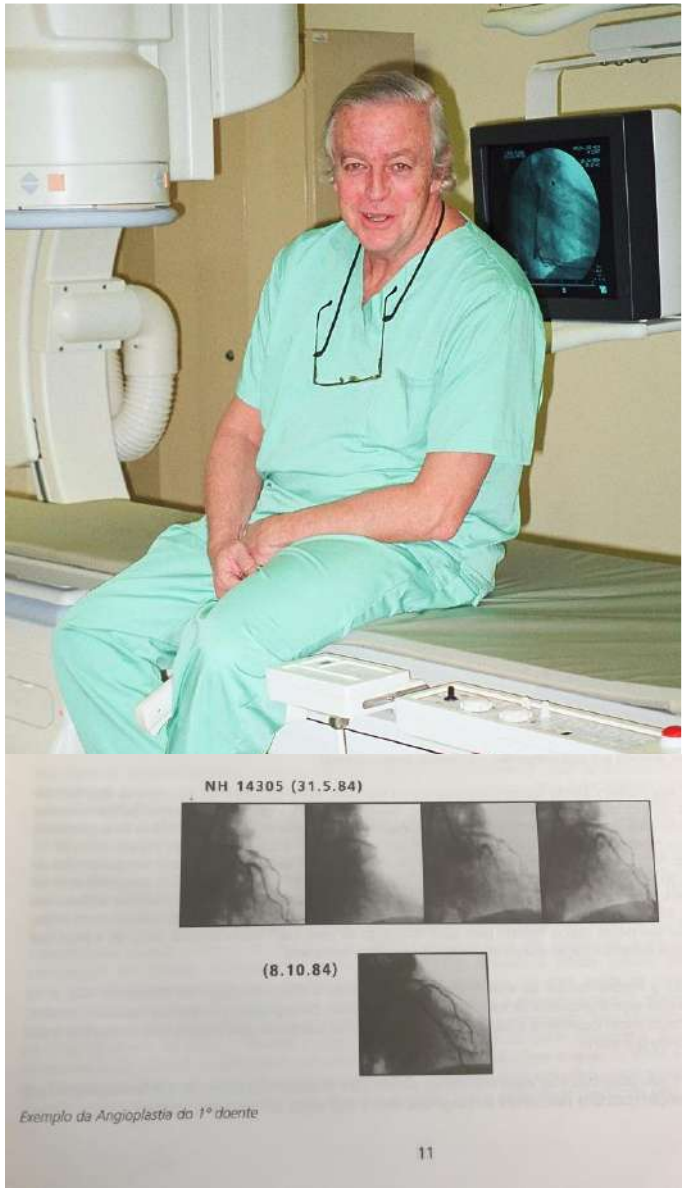


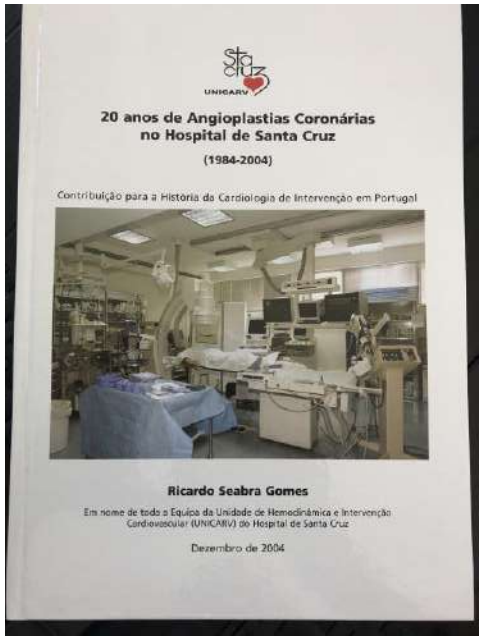
2014- 1st Bioresorbable stent (Absorb)

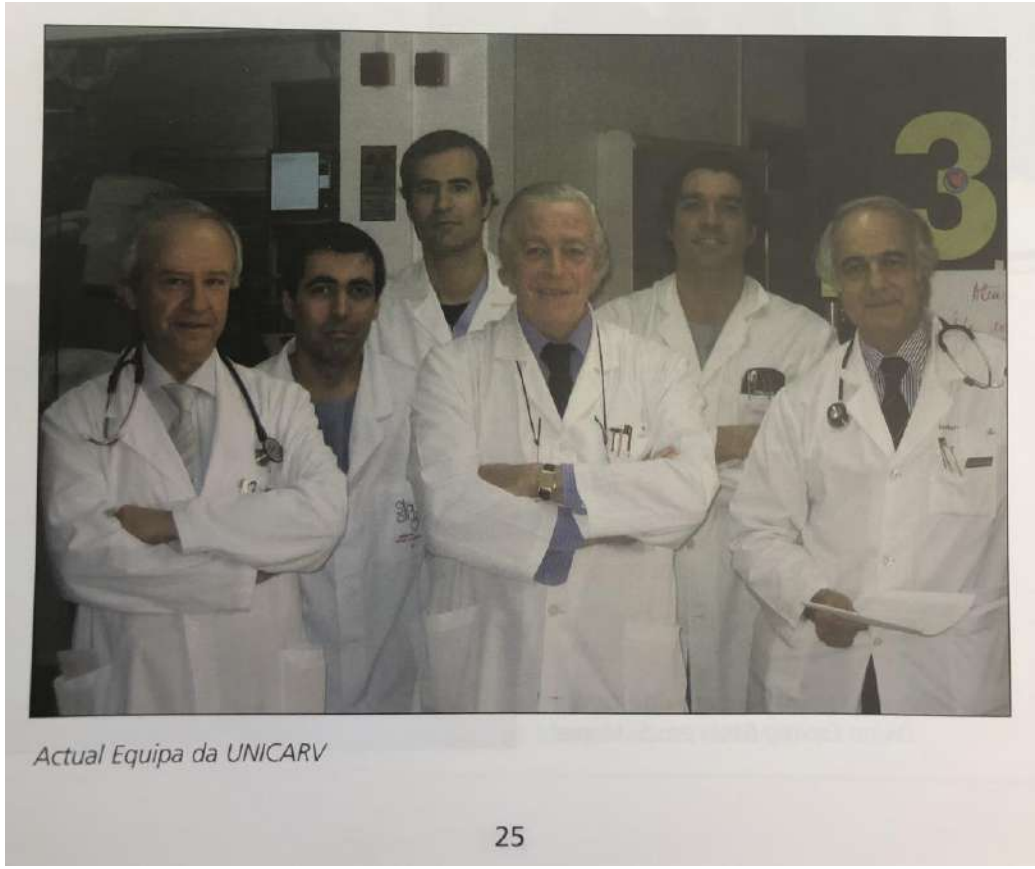


Byrne, RA. Lancet 2017; 390: 781-92

Past







1984- 1º stent in Portugal

2004- 20 anos angioplastia em Portugal

Byrne, RA. Lancet 2017; 390: 781-92

Present

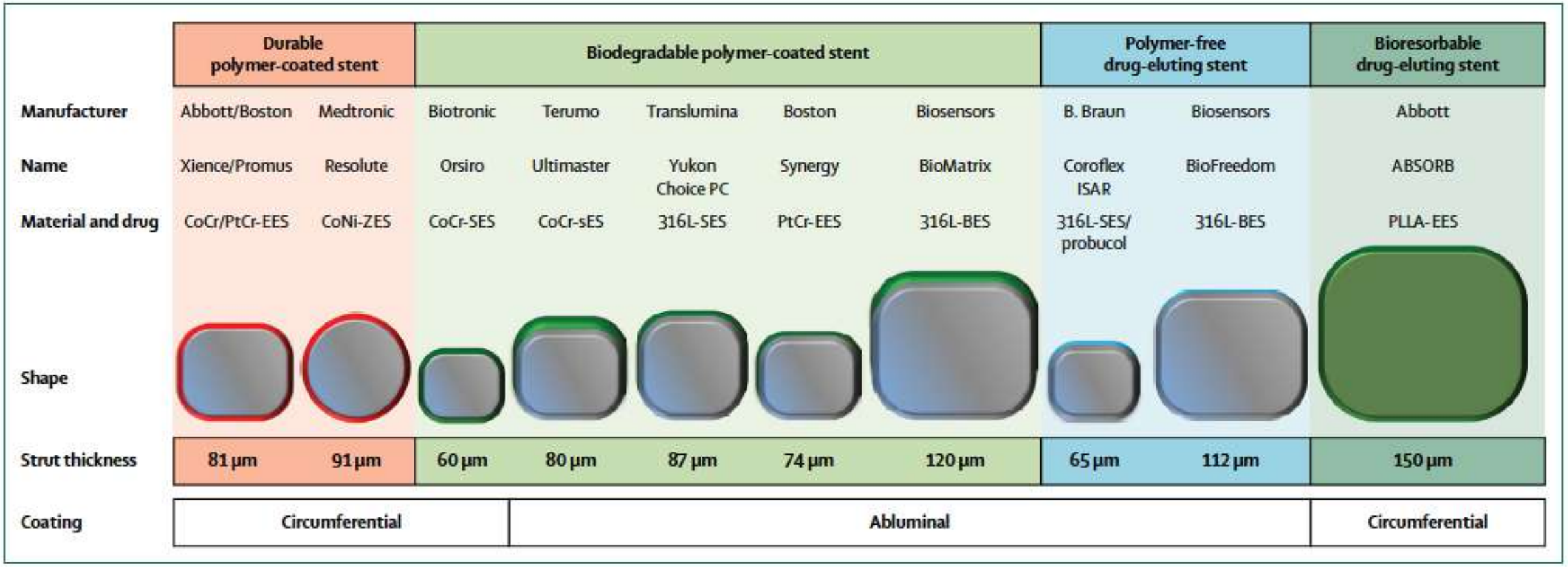
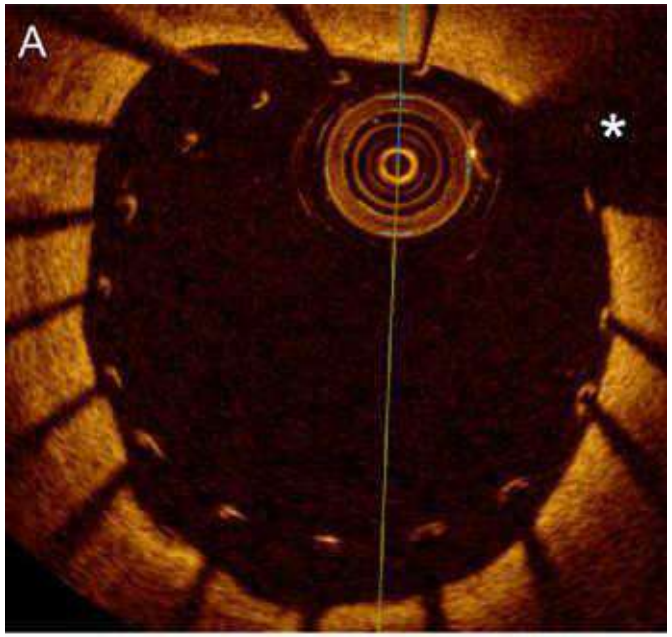


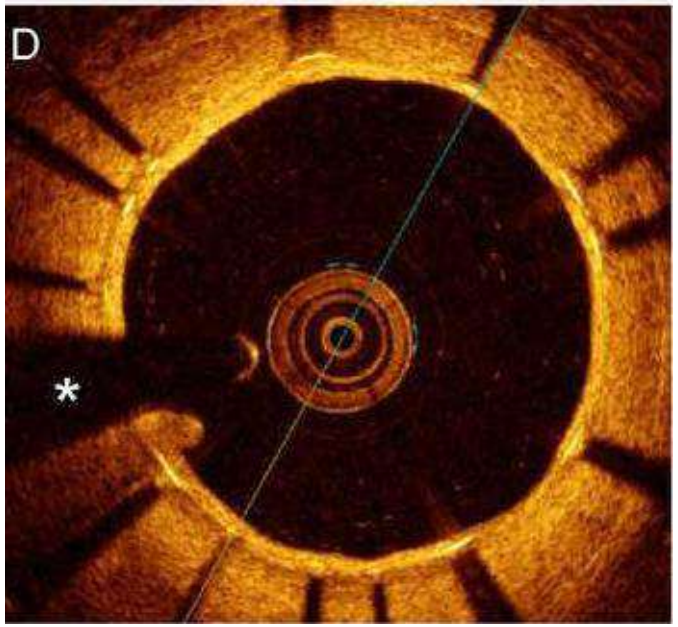
***Figure 3*: Overview of principal characteristics of selected drug-eluting stents and scaffolds**

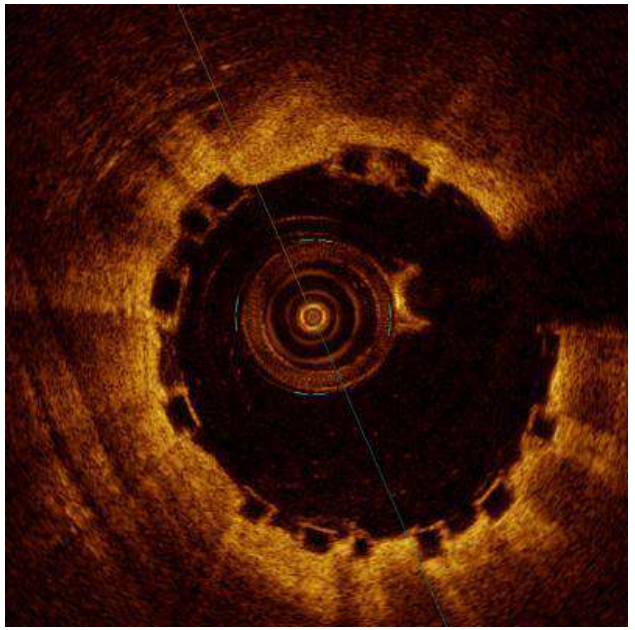
Devices shown have Conformité Européene-mark approval for use and published trial data from large-scale randomised clinical trials (>1500 enrolled patients) with follow-up of at least 2 years. CoCr=cobalt chromium. PtCR=platinum chromium. EES=everolimus-eluting stent. CoNi=cobalt nickel. ZES=zotarolimus-eluting stent. SES=sirolimus-eluting stent. 316L=marine-grade stainless steel. BES=biolimus A9-eluting stent. PLLA=poly-L-lactic acid

Byrne, RA. Lancet 2017; 390: 781-92

Strut thickness and endothelialisation - OCT







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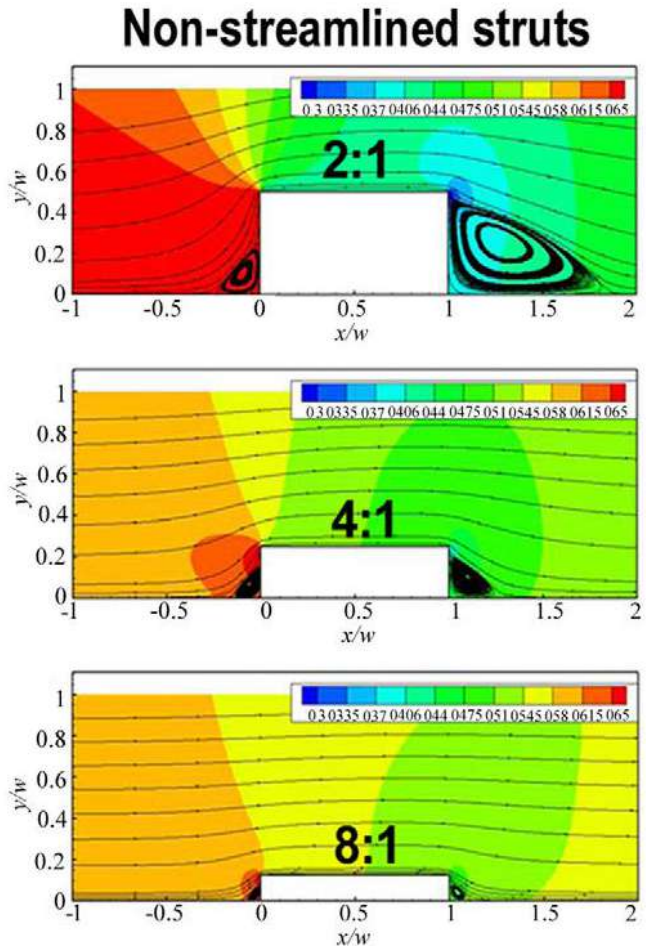
ISSN 0735-1097/$36.00
doi:10.1016/j.jacc.2011.10.903

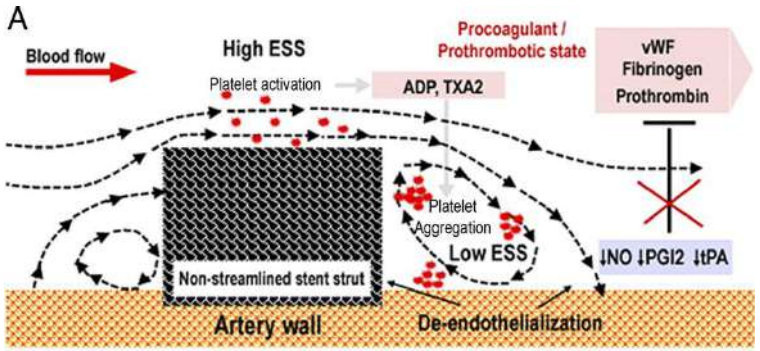
FOCUS ISSUE: TRANSCATHETER CARDIOVASCULAR THERAPEUTICS State-of-the-Art Paper

Role of Endothelial Shear Stress in Stent Restenosis and Thrombosis

Pathophysiologic Mechanisms and Implications for Clinical Translation

Konstantinos C. Koskinas, MD, MSc,*† Yiannis S. Chatzizisis, MD, PhD,*†
Antonios P. Antoniadis, MD, PhD,*† George D. Giannoglou, MD, PhD*
Thessaloniki, Greece; and Boston, Massachusetts





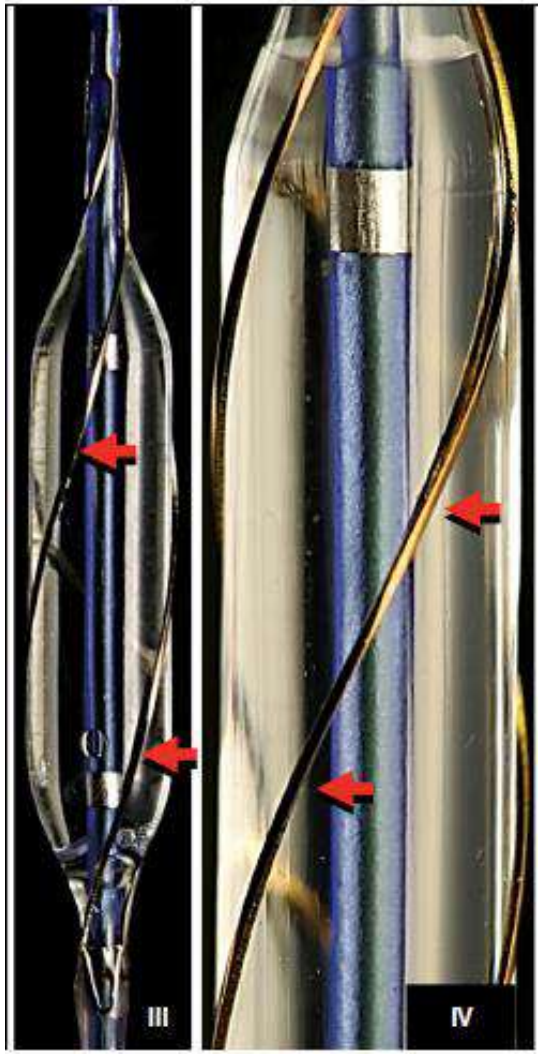
Koskinas KC, et al. JACC 2012; 59 (15): 1337-1349

T-Mobile
07:22
92%
Minneapolis
Clear
-12°
Visible Heart Laboratory
University of Minnesota

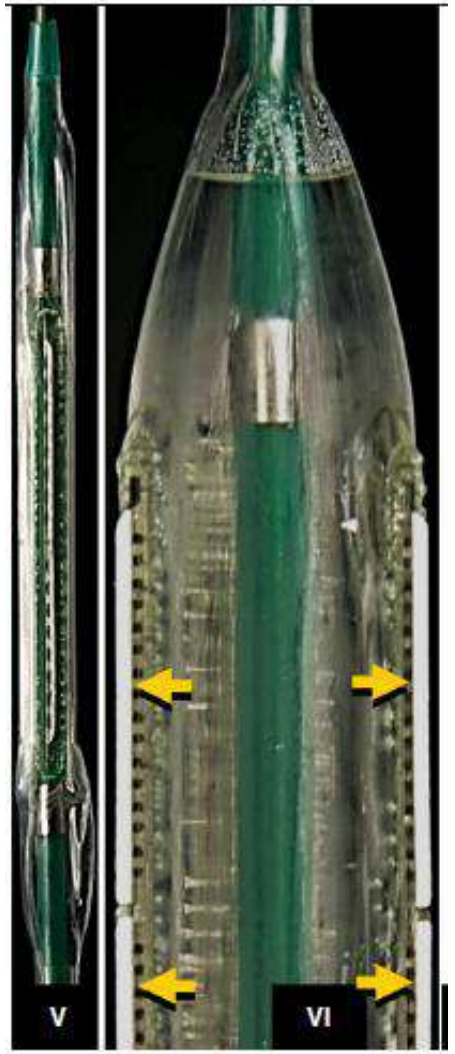
Visible Heart Laboratory
University of Minnesota

Past & Present

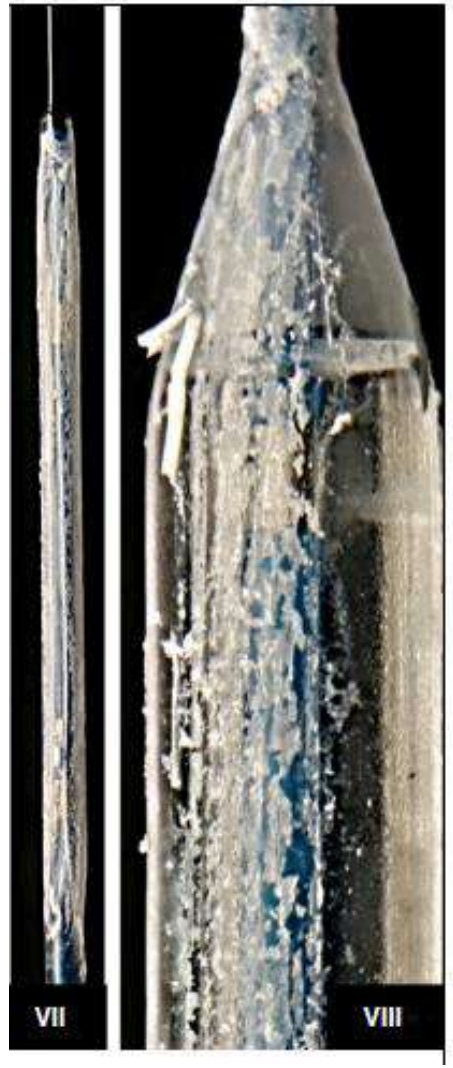
Angioplasty balloon
(before and after inflation)



Scoring balloon
(helical nitinol)



Cutting balloon
(angiotomes)



Drug-eluting balloon

Byrne, RA. Lancet 2017; 390: 781-92

apic

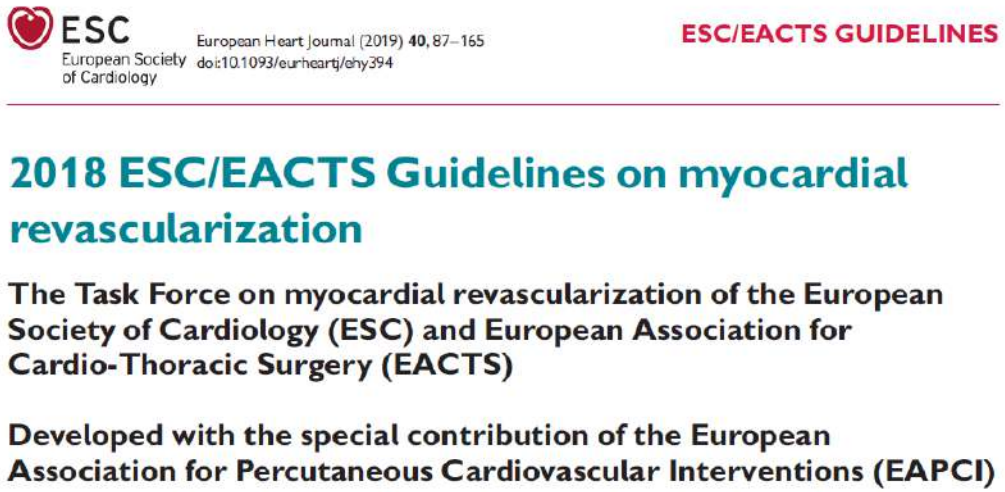
ASSOCIAÇÃO PORTUGUESA DE INTERVENÇÃO CARDIOVASCULAR

sociedade portuguesa de cardiologia

D@CL Coronary

D@CL #19 – DEB em Vasos Nativos – Hospital Garcia de Orta (28/6/2019)

Many toys…what about indications for PCI?



ESC European Society of Cardiology

European Heart Journal (2019) 40, 87–165
doi:10.1093/eurheartj/ehy394

ESC/EACTS GUIDELINES

2018 ESC/EACTS Guidelines on myocardial revascularization

The Task Force on myocardial revascularization of the European Society of Cardiology (ESC) and European Association for Cardio-Thoracic Surgery (EACTS)

Developed with the special contribution of the European Association for Percutaneous Cardiovascular Interventions (EAPCI)

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Indications for revascularization in patients with stable angina or silent ischaemia

Extent of CAD (anatomical and/or functional)		Class[a]	Level[b]
For prognosis	Left main disease with stenosis >50%.[c 68–71]	I	A
	Proximal LAD stenosis >50%.[c 62,68,70,72]	I	A
	Two- or three-vessel disease with stenosis >50% with impaired LV function (LVEF ≤35%).[c 61,62,68,70,73–83]	I	A
	Large area of ischaemia detected by functional testing (>10% LV) or abnormal invasive FFR.[d 24,59,84–90]	I	B
	Single remaining patent coronary artery with stenosis >50%.[c]	I	C

© ESC 2018

Past...!

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European Heart Journal (2019) 40, 87–165
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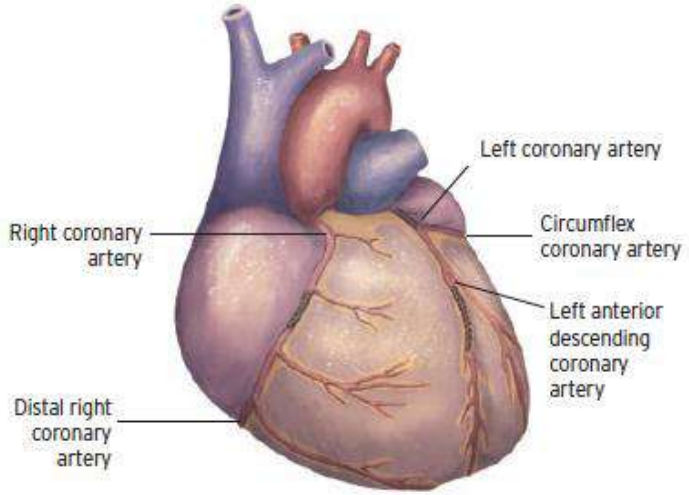
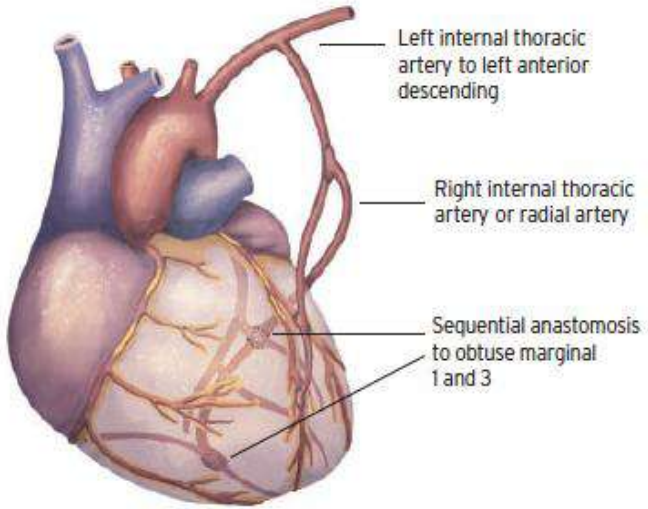
Developed with the special contribution of the European Association for Percutaneous Cardiovascular Interventions (EAPCI)

PCI



CABG



FAVOURS PCI

Clinical characteristics

Presence of severe co-morbidity (not adequately reflected by scores)

Advanced age/frailty/reduced life expectancy

Restricted mobility and conditions that affect the rehabilitation process

FAVOURS CABG

Clinical characteristics

Diabetes

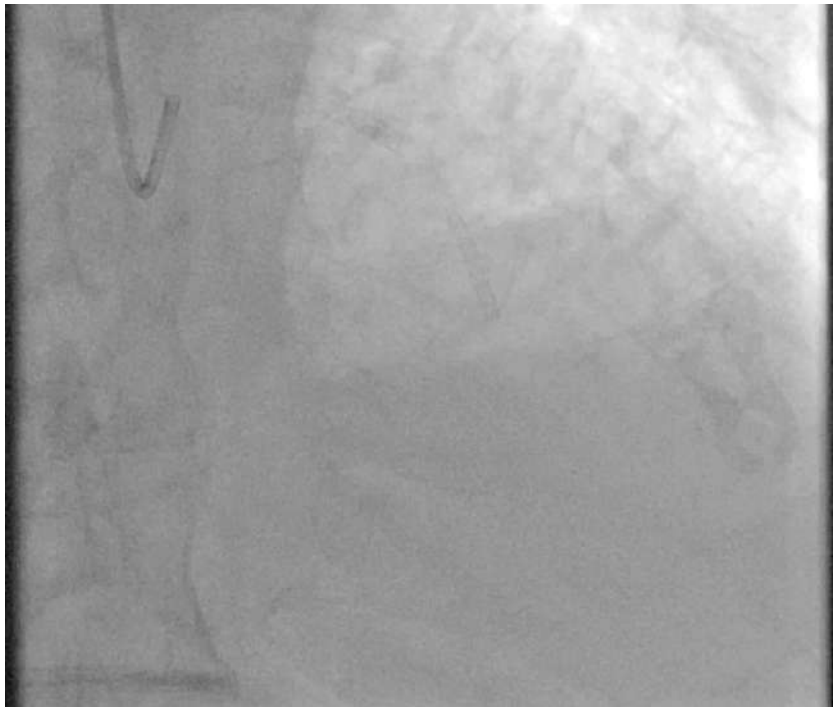
Reduced LV function (EF ≤35%)

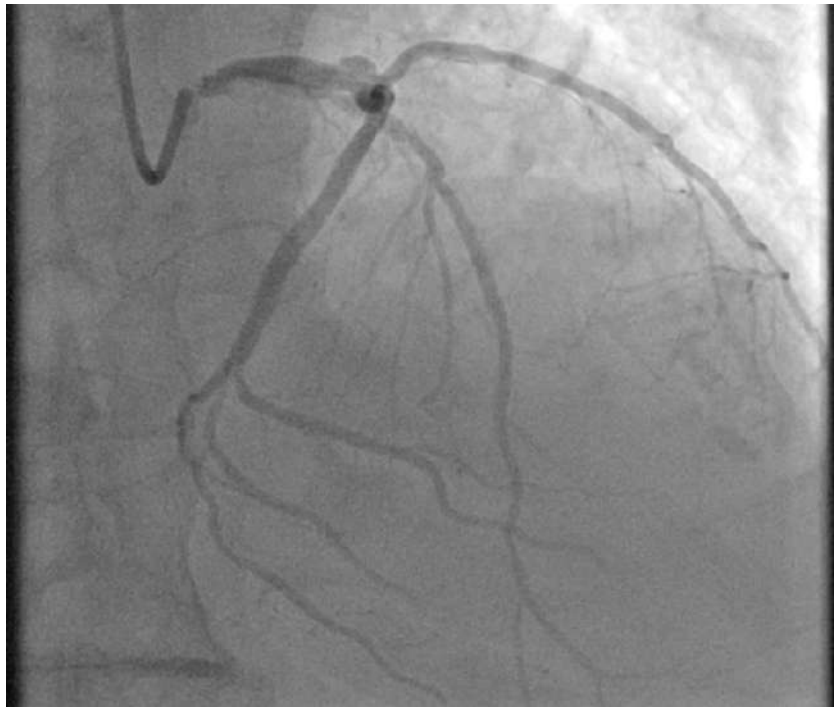
Contraindication to DAPT

Recurrent diffuse in-stent restenosis

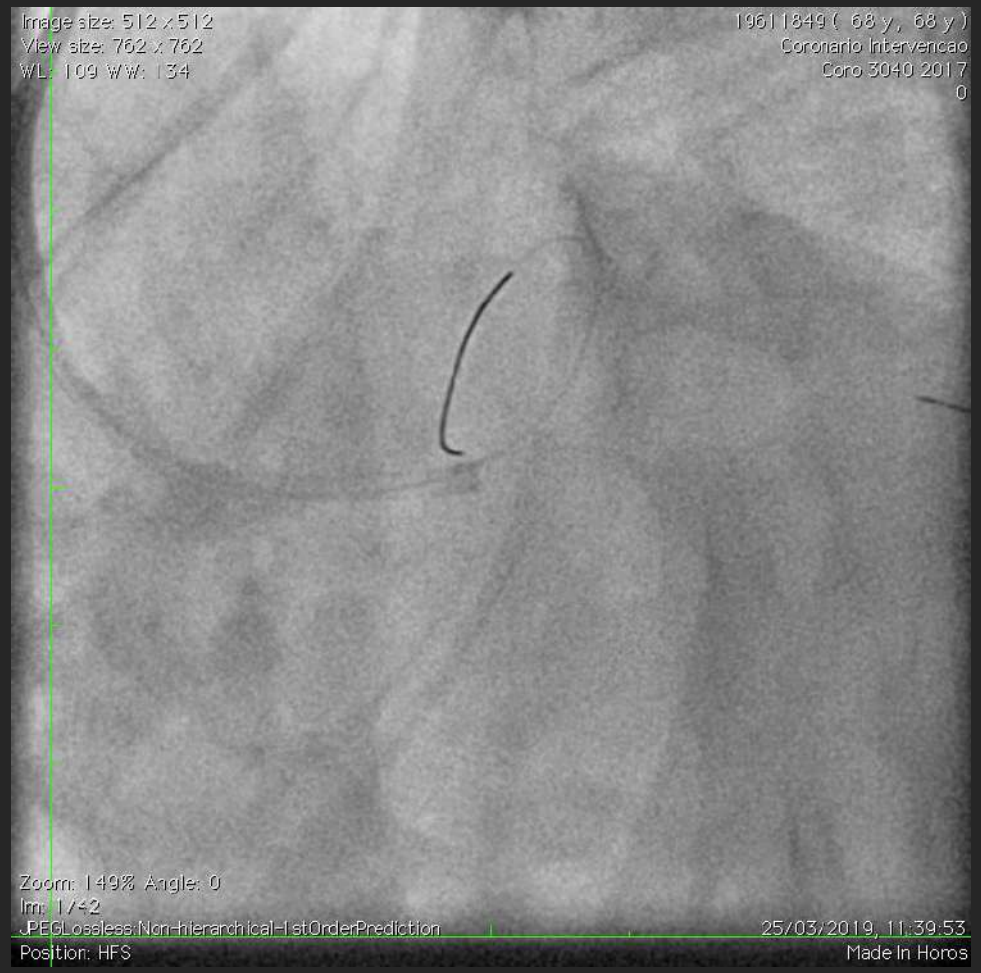
©ESC 2018

What about left main?





Left main CAD				
Left main disease with low SYNTAX score (0 - 22).[69,121,122,124,145–148]	I	A	I	A
Left main disease with intermediate SYNTAX score (23 - 32).[69,121,122,124,145–148]	I	A	IIa	A
Left main disease with high SYNTAX score (≥33).[c] [69,121,122,124,146–148]	I	A	III	B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Coronario Intervencao
Coro 3040 2017
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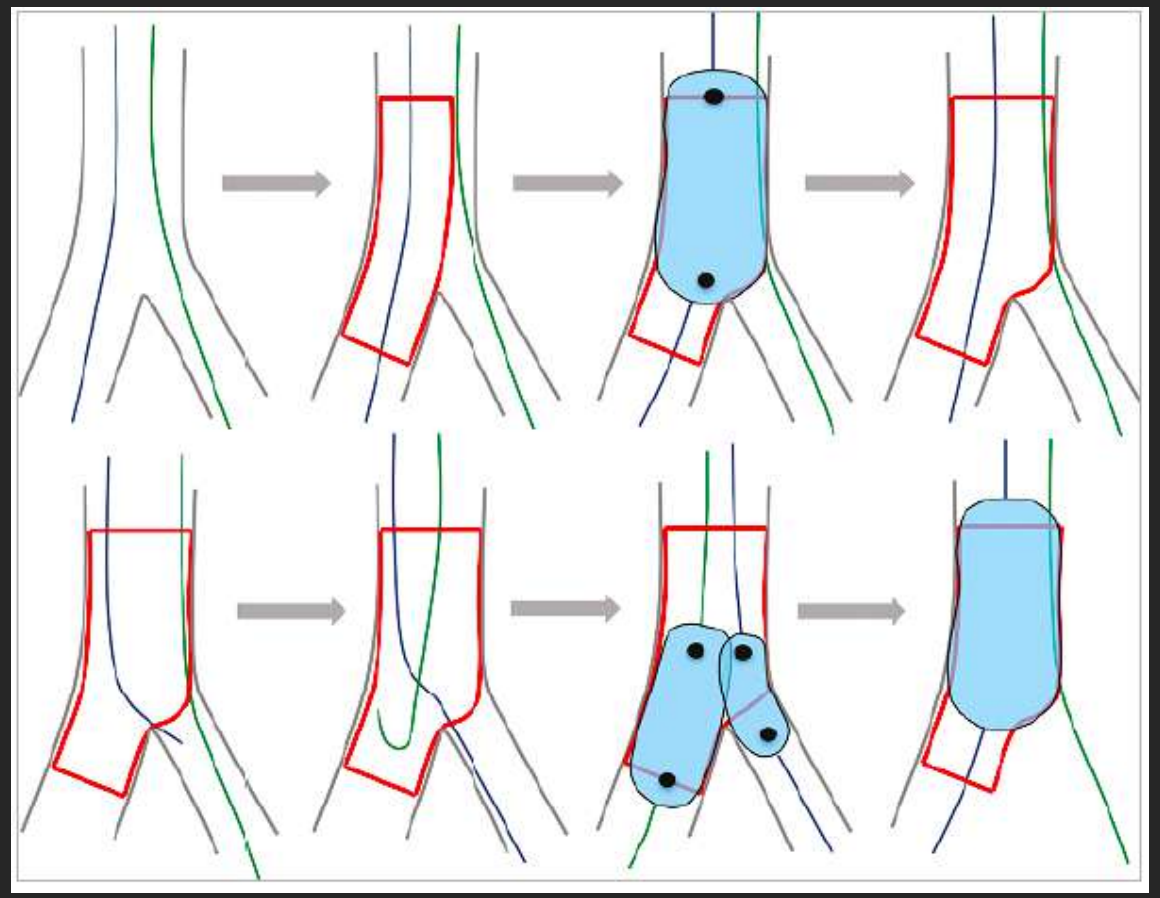
Made In Horos



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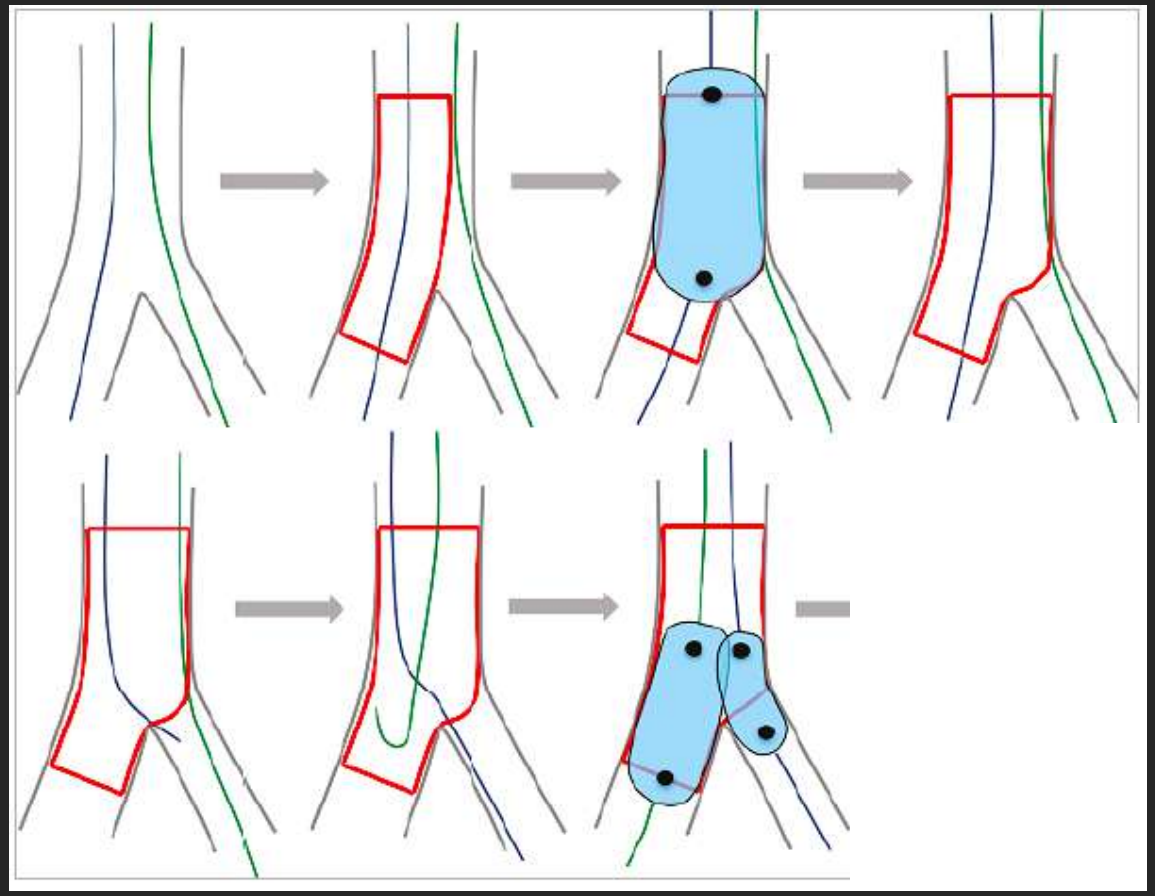

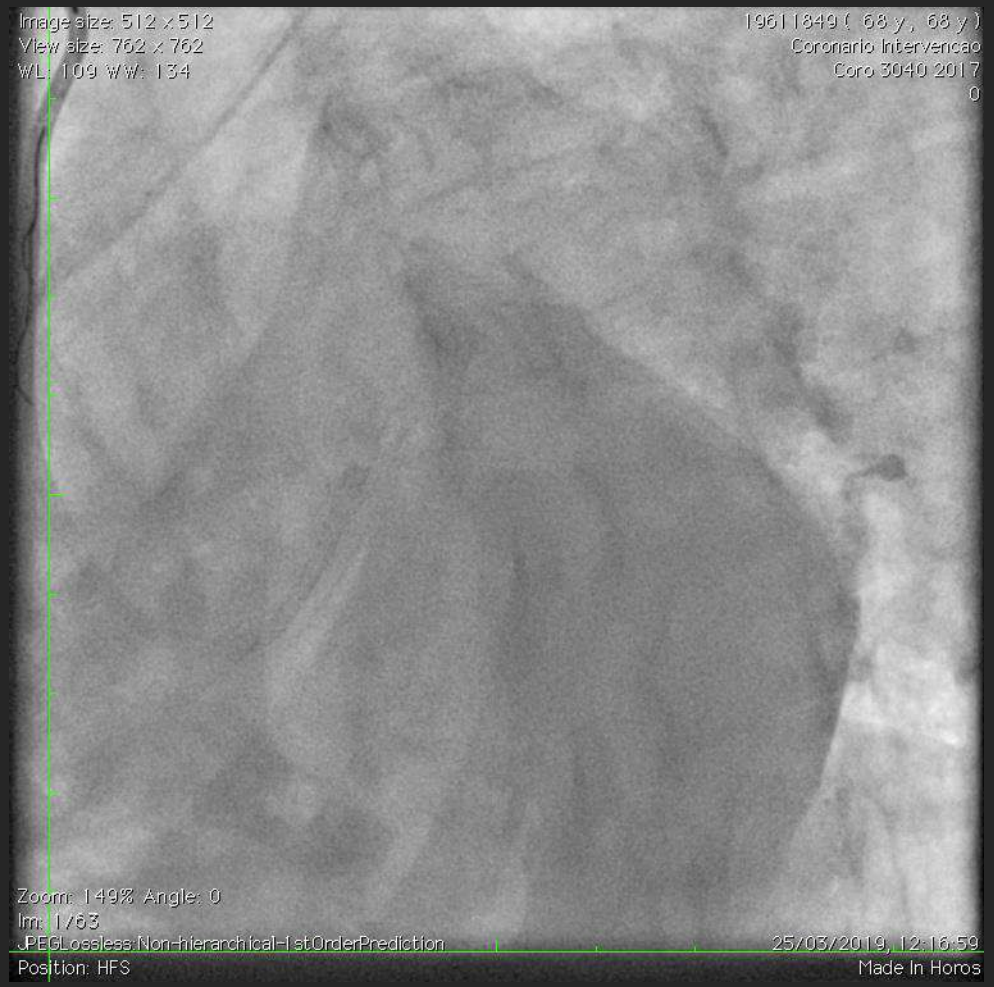
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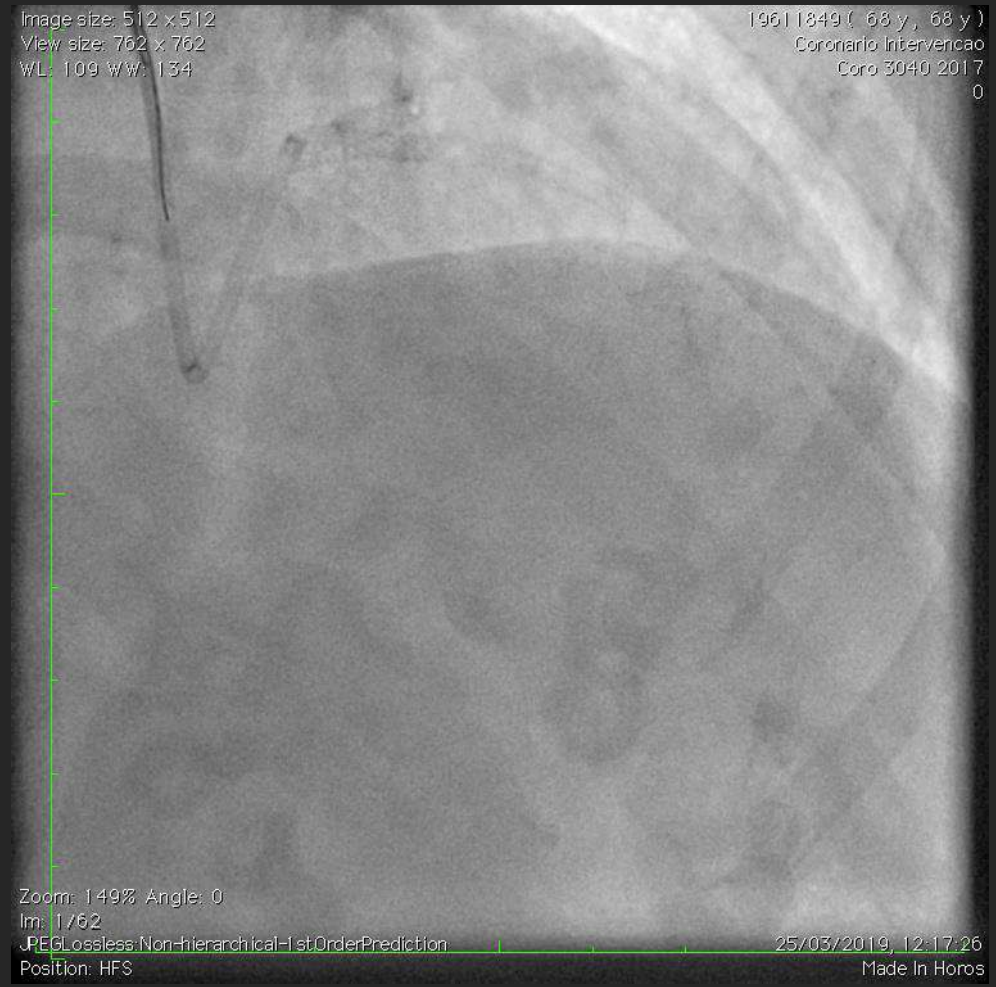
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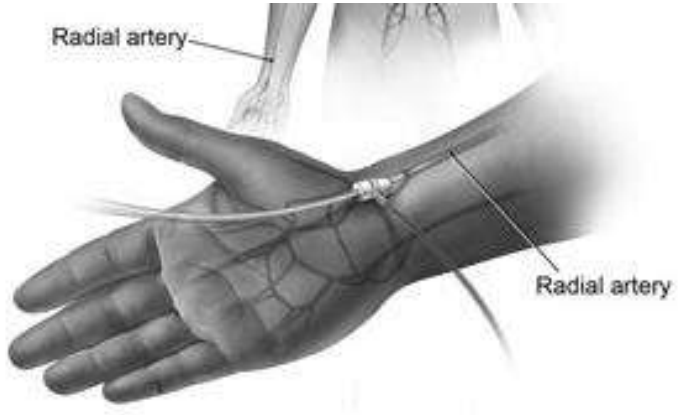
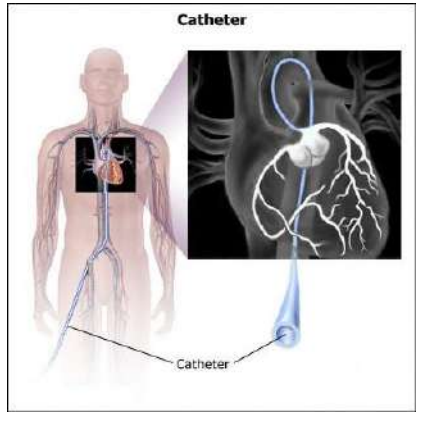
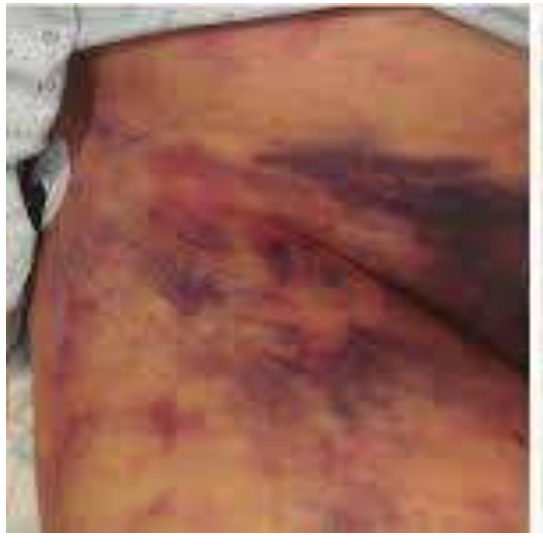
Made In Horos

Radial



Femoral





Present...!

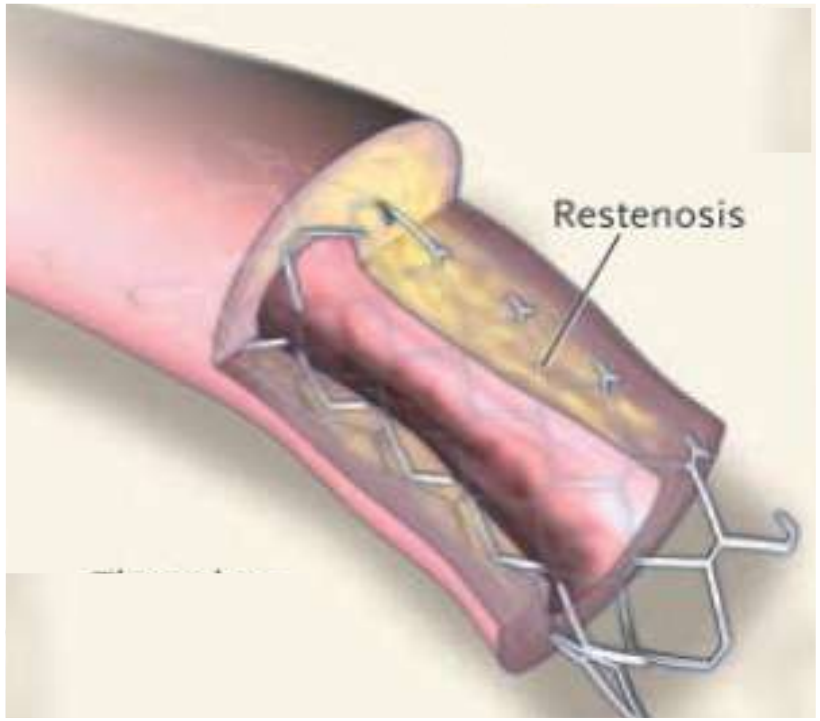
But stents can have restenosis and thrombosis…

Yes, but much less than before!

Stent limitations

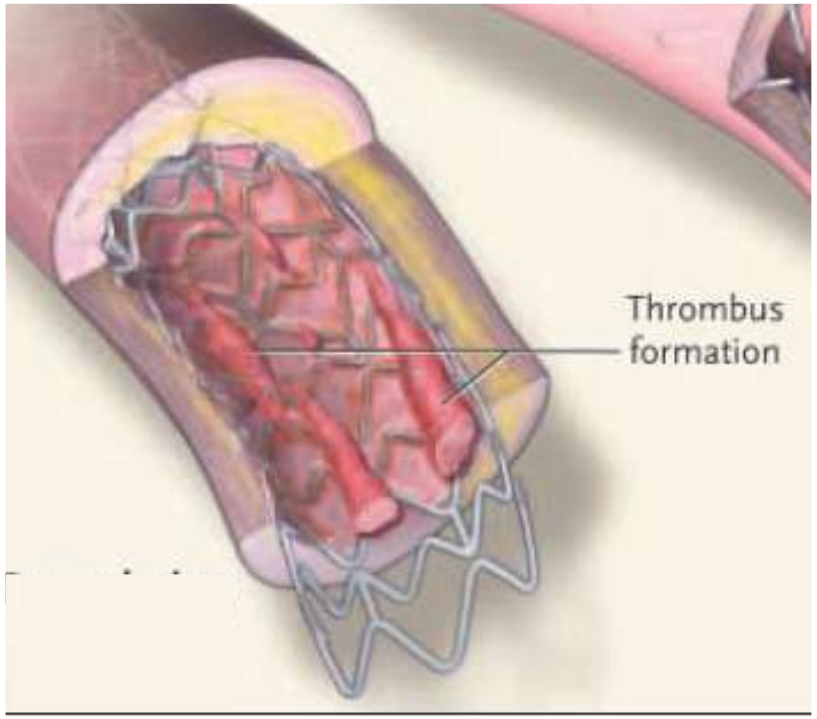
Restenosis

Neointima hiperplasia
<5% with 2ndG DES

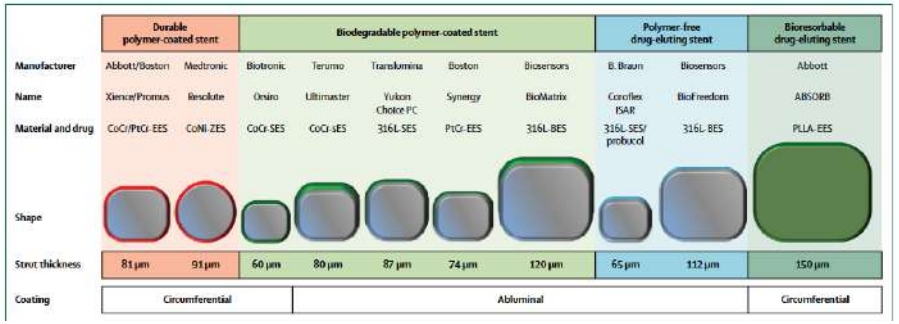


Thrombosis

Severe complication
Rare (<1%) with 2ndG DES



BIO-RESORT Trial
n=3514 pts
n=1506 pts with small vessel
Sirolimus vs Everolimus vs Zotarolimus



Research

JAMA Cardiology | Original Investigation

Outcomes in Patients Treated With Thin-Strut, Very Thin-Strut, or Ultrathin-Strut Drug-Eluting Stents in Small Coronary Vessels

A Prespecified Analysis of the Randomized BIO-RESORT Trial

Rosaly A. Buiten, MD; Eline H. Ploumen, MD; Paolo Zocca, MD; Carine J. M. Doggen, PhD; Liefke C. van der Heijden, MD, PhD; Marlies M. Kok, MD, PhD; Peter W. Danse, MD, PhD; Carl E. Schotborgh, MD; Martijn Scholte, MD; Frits H. A. F. de Man, MD, PhD; Gerard C. M. Linssen, MD, PhD; Clemens von Birgelen, MD, PhD

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The Journal of the American Medical Association

D Target lesion revascularization

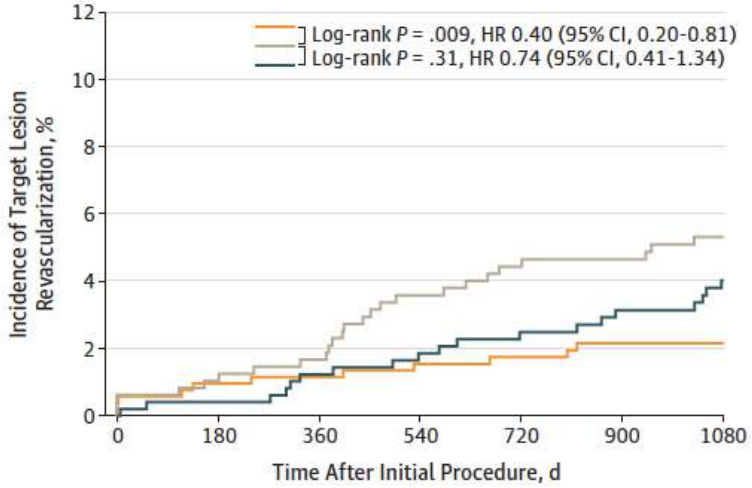


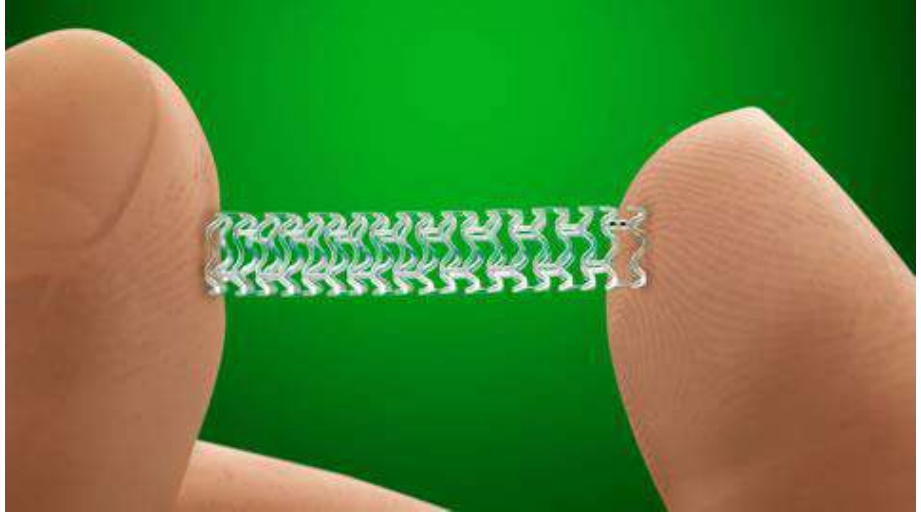
Table 2. Clinical Event Rates During 3 Years of Follow-up

Follow-up	No. (%) SES (n = 525)	EES (n = 496)	ZES (n = 485)	HR (95% CI) SES vs ZES	P Value Log Rank SES vs ZES	HR (95% CI) EES vs ZES	P Value Log Rank EES vs ZES
Until 1-y follow-up							
Cardiac death	4 (0.8)	5 (1.0)	6 (1.2)	0.62 (0.17-2.18)	.45	0.81 (0.25-2.67)	.73
Target vessel MI	13 (2.5)	11 (2.2)	14 (2.9)	0.86 (0.40-1.82)	.68	0.77 (0.35-1.69)	.51
TLR	6 (1.2)	6 (1.2)	8 (1.7)	0.69 (0.24-1.99)	.49	0.73 (0.52-2.10)	.56
TLF	21 (4.0)	21 (4.3)	24 (5.0)	0.81 (0.45-1.45)	.47	0.85 (0.74-1.53)	.59
Definite or probable ST	2 (0.4)	3 (0.6)	4 (0.8)	0.46 (0.09-2.52)	.36	0.73 (0.16-3.27)	.68
Definite ST	2 (0.4)	2 (0.4)	2 (0.4)	0.92 (0.13-6.55)	.94	0.98 (0.14-6.93)	.98
Until 2-y follow-up							
Cardiac death	7 (1.3)	9 (1.8)	10 (2.1)	0.65 (0.25-1.70)	.37	0.88 (0.36-2.17)	.78
Target vessel MI	14 (2.7)	13 (2.7)	19 (4.0)	0.68 (0.34-1.35)	.27	0.67 (0.33-1.35)	.26
TLR	9 (1.7)	12 (2.5)	21 (4.4)	0.39 (0.18-0.85)	.01	0.56 (0.27-1.13)	.10
TLF	27 (5.2)	32 (6.5)	42 (8.7)	0.59 (0.36-0.95)	.03	0.74 (0.47-1.17)	.20
Definite or probable ST	3 (0.6)	6 (1.2)	7 (1.5)	0.40 (0.10-1.53)	.16	0.84 (0.28-2.50)	.75
Definite ST	2 (0.4)	3 (0.6)	5 (1.1)	0.37 (0.07-1.90)	.21	0.59 (0.14-2.46)	.46
Until 3-y follow-up[a]							
Cardiac death	12 (2.4)	12 (2.5)	12 (2.5)	0.92 (0.42-2.06)	.85	0.98 (0.44-2.18)	.96
Target vessel MI	17 (3.3)	19 (3.9)	20 (4.2)	0.78 (0.41-1.50)	.46	0.93 (0.50-1.74)	.81
TLR	11 (2.1)	19 (4.0)	25 (5.3)	0.40 (0.20-0.81)	.009	0.74 (0.41-1.34)	.31
TLF	36 (7.0)	46 (9.5)	48 (10.0)	0.68 (0.44-1.05)	.08	0.93 (0.62-1.39)	.72
Definite or probable ST	3 (0.6)	7 (1.5)	7 (1.5)	0.40 (0.10-1.53)	.16	0.98 (0.34-2.79)	.97
Definite ST	2 (0.4)	4 (0.8)	5 (1.1)	0.37 (0.07-1.90)	.21	0.78 (0.21-2.92)	.72

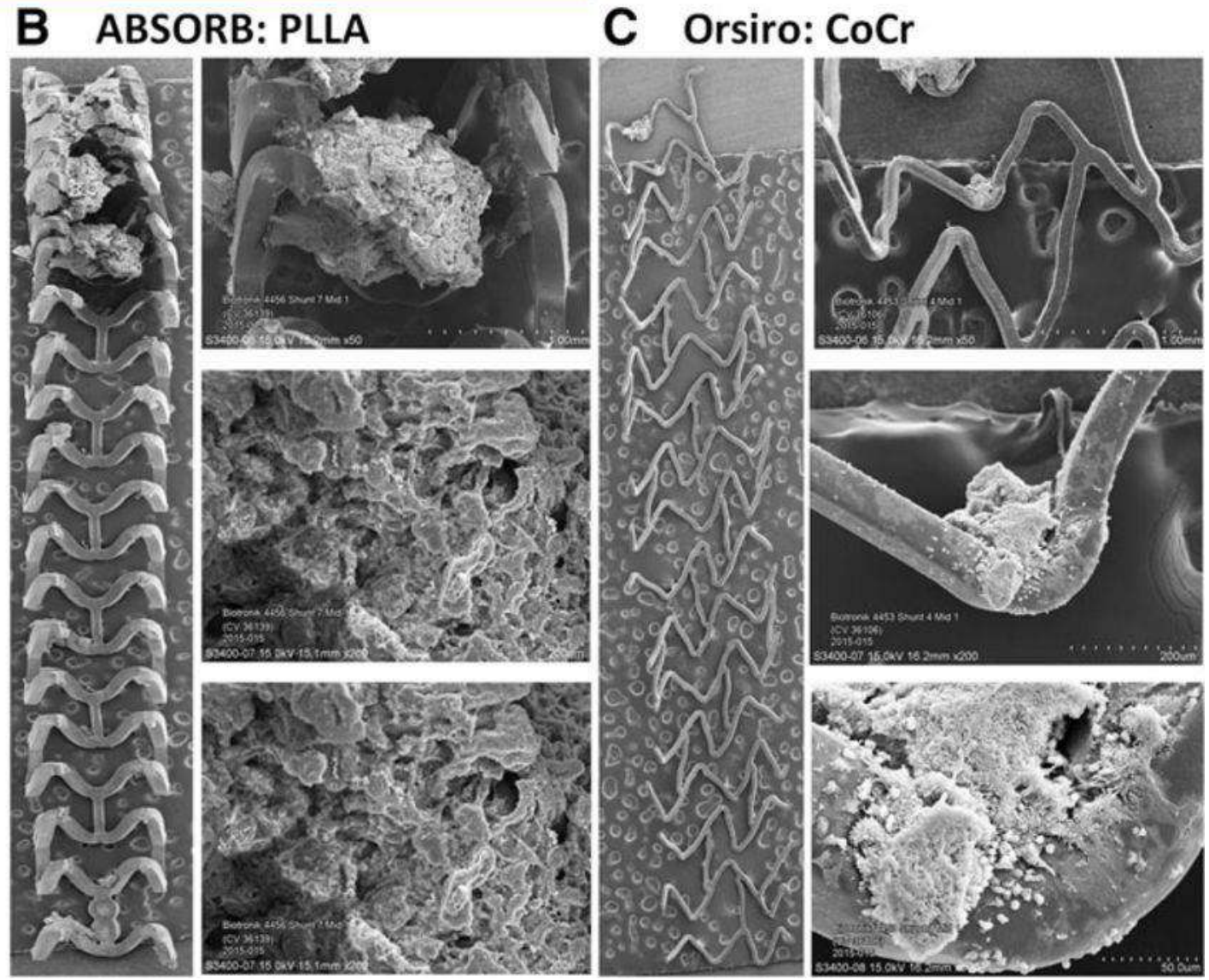
TLR <5%
Sirolimus < Everolimus < Zotarolimus

Stent thrombosis <1%
Sirolimus < Everolimus < Zotarolimus

Bioresorbable stents



Bioresorbable Scaffolds



Waksman R et al. CIRC CV INTERVENTIONS 2017:.116.004762)

BMC Cardiovascular Disorders 2016

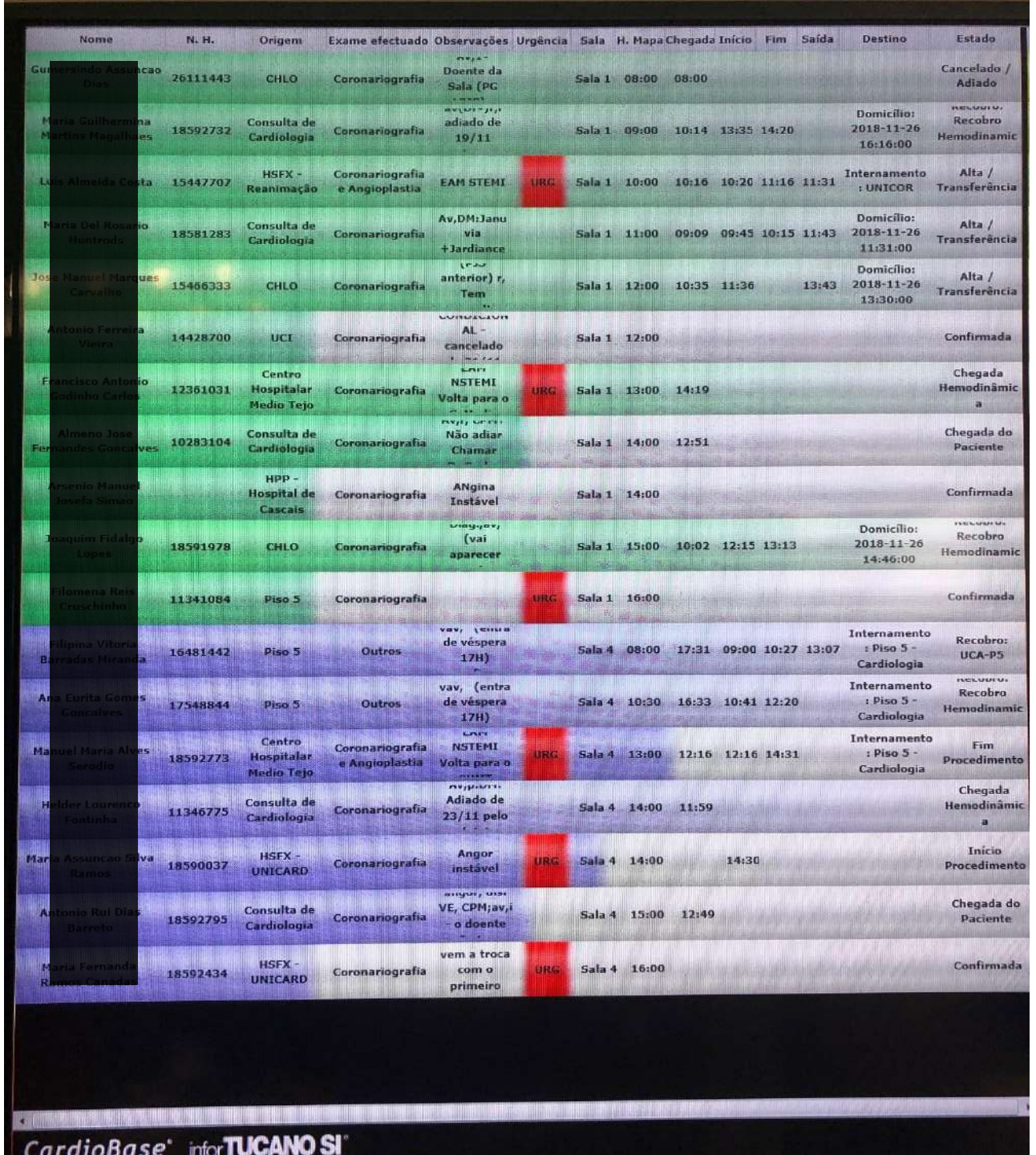
Present…
more than balloons & stents

Volume of procedures is increasing

Structural heart interventions (“Outros”)

- TAVI
- Mitraclip
- Closure of LAA, AD, PFO
- …

Proportion of diagnostic cath vs intervention

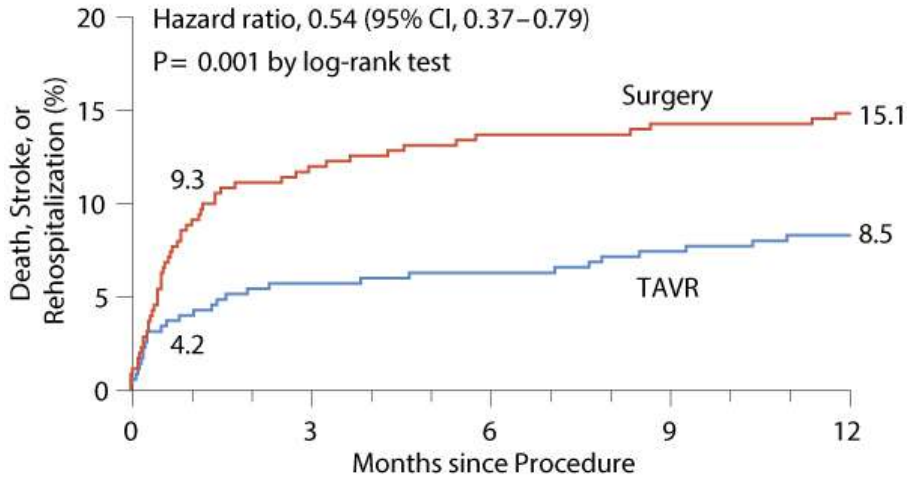


Nome	N. H.	Origem	Exame efectuado	Observações	Urgência	Sala	H. Mapa	Chegada	Início	Fim	Saída	Destino	Estado
[redacted]	26111443	CHLO	Coronariografia	Doente da Sala (PG		Sala 1	08:00	08:00					Cancelado / Adiado
[redacted]	18592732	Consulta de Cardiologia	Coronariografia	adiado de 19/11		Sala 1	09:00	10:14	13:35	14:20		Domicílio: 2018-11-26 16:16:00	Recobro: Recobro Hemodinamic
[redacted]	15447707	HSFX - Reanimação	Coronariografia e Angioplastia	EAM STEMI	URG	Sala 1	10:00	10:16	10:20	11:16	11:31	Internamento : UNICOR	Alta / Transferência
[redacted]	18581283	Consulta de Cardiologia	Coronariografia	Av,DM:Janu via +Jardiance		Sala 1	11:00	09:09	09:45	10:15	11:43	Domicílio: 2018-11-26 11:31:00	Alta / Transferência
[redacted]	15466333	CHLO	Coronariografia	anterior) r, Tem		Sala 1	12:00	10:35	11:36		13:43	Domicílio: 2018-11-26 13:30:00	Alta / Transferência
[redacted]	14428700	UCI	Coronariografia	AL - cancelado		Sala 1	12:00						Confirmada
[redacted]	12361031	Centro Hospitalar Medio Tejo	Coronariografia	NSTEMI Volta para o	URG	Sala 1	13:00	14:19					Chegada Hemodinâmica
[redacted]	10283104	Consulta de Cardiologia	Coronariografia	Não adiar Chamar		Sala 1	14:00	12:51					Chegada do Paciente
[redacted]		HPP - Hospital de Cascais	Coronariografia	ANgina Instável		Sala 1	14:00						Confirmada
[redacted]	18591978	CHLO	Coronariografia	(vai aparecer		Sala 1	15:00	10:02	12:15	13:13		Domicílio: 2018-11-26 14:46:00	Recobro: Recobro Hemodinamic
[redacted]	11341084	Piso 5	Coronariografia		URG	Sala 1	16:00						Confirmada
[redacted]	16481442	Piso 5	Outros	vav, (entra de véspera 17H)		Sala 4	08:00	17:31	09:00	10:27	13:07	Internamento : Piso 5 - Cardiologia	Recobro: UCA-P5
[redacted]	17548844	Piso 5	Outros	vav, (entra de véspera 17H)		Sala 4	10:30	16:33	10:41	12:20		Internamento : Piso 5 - Cardiologia	Recobro: Recobro Hemodinamic
[redacted]	18592773	Centro Hospitalar Medio Tejo	Coronariografia e Angioplastia	NSTEMI Volta para o	URG	Sala 4	13:00	12:16	12:16	14:31		Internamento : Piso 5 - Cardiologia	Fim Procedimento
[redacted]	11346775	Consulta de Cardiologia	Coronariografia	Adiado de 23/11 pelo		Sala 4	14:00	11:59					Chegada Hemodinâmica
[redacted]	18590037	HSFX - UNICARD	Coronariografia	Angor instável	URG	Sala 4	14:00		14:30				Início Procedimento
[redacted]	18592795	Consulta de Cardiologia	Coronariografia	VE, CPM;av,i o doente		Sala 4	15:00	12:49					Chegada do Paciente
[redacted]	18592434	HSFX - UNICARD	Coronariografia	vem a troca com o primeiro	URG	Sala 4	16:00						Confirmada

CardioBase inforTUCANO SI

www.medscape.com

TAVR Low-Risk Studies Get Standing Ovation at ACC



NEJM 2019

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Transcatheter Aortic-Valve Replacement with a Balloon-Expandable Valve in Low-Risk Patients

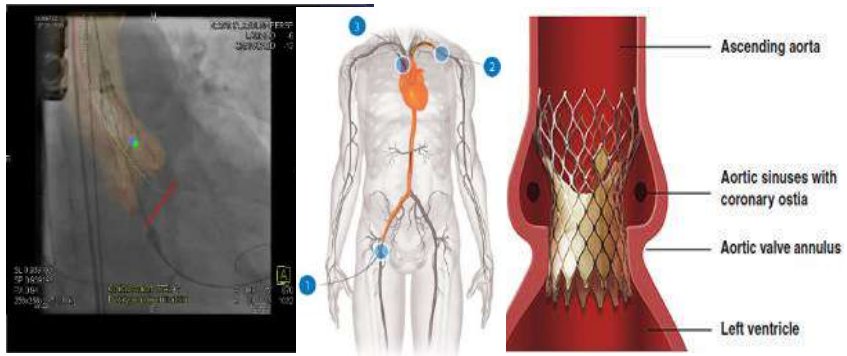
M.J. Mack, M.B. Leon, V.H. Thourani, R. Makkar, S.K. Kodali, M. Russo, S.R. Kapadia, S.C. Malaisrie, D.J. Cohen, P. Pibarot, J. Leipsic, R.T. Hahn, P. Blanke, M.R. Williams, J.M. McCabe, D.L. Brown, V. Babaliaros, S. Goldman, W.Y. Szeto, P. Genereux, A. Pershad, S.J. Pocock, M.C. Alu, J.G. Webb, and C.R. Smith, for the PARTNER 3 Investigators*

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Transcatheter Aortic-Valve Replacement with a Self-Expanding Valve in Low-Risk Patients

Jeffrey J. Popma, M.D., G. Michael Deeb, M.D., Steven J. Yakubov, M.D., Mubashir Mumtaz, M.D., Hemal Gada, M.D., Daniel O'Hair, M.D., Tanvir Bajwa, M.D., John C. Heiser, M.D., William Merhi, D.O., Neal S. Kleiman, M.D., Judah Askew, M.D., Paul Sorajja, M.D., Joshua Rovin, M.D., Stanley J. Chetcuti, M.D., David H. Adams, M.D., Paul S. Teirstein, M.D., George L. Zorn III, M.D., John K. Forrest, M.D., Didier Tchétché, M.D., Jon Resar, M.D., Antony Walton, M.D., Nicolo Piazza, M.D., Ph.D., Basel Ramlawi, M.D., Newell Robinson, M.D., George Petrossian, M.D., Thomas G. Gleason, M.D., Jae K. Oh, M.D., Michael J. Boulware, Ph.D., Hongyan Qiao, Ph.D., Andrew S. Mugglin, Ph.D., and Michael J. Reardon, M.D., for the Evolut Low Risk Trial Investigators*



BRIEF

TAVR called 'game changing' in studies of low-risk patients

TAVI

SAVR

ESC European Society of Cardiology European Heart Journal (2017) 00, 1–53 doi:10.1093/eurheartj/ehx391

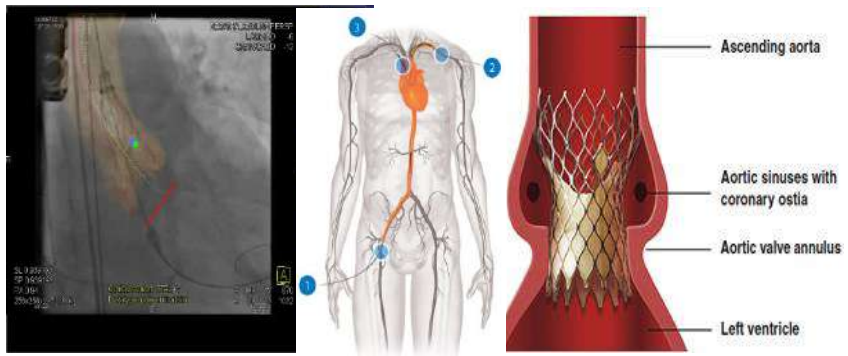
ESC/EACTS GUIDELINES

2017 ESC/EACTS Guidelines for the management of valvular heart disease

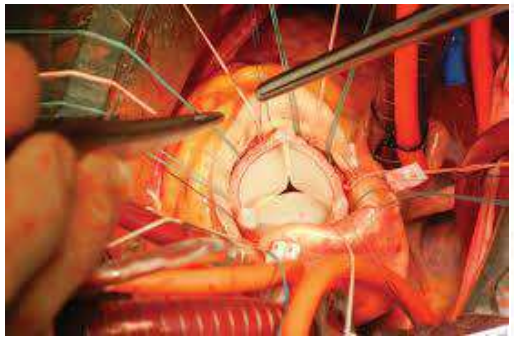
The Task Force for the Management of Valvular Heart Disease of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS)

Authors/Task Force Members: Helmut Baumgartner* (ESC Chairperson) (Germany), Volkmar Falk*[1] (EACTS Chairperson) (Germany), Jeroen J. Bax (The Netherlands), Michele De Bonis[1] (Italy), Christian Hamm (Germany), Per Johan Holm (Sweden), Bernard Iung (France), Patrizio Lancellotti (Belgium), Emmanuel Lansac[1] (France), Daniel Rodriguez Muñoz (Spain), Raphael Rosenhek (Austria), Johan Sjögren[1] (Sweden), Pilar Tornos Mas (Spain), Alec Vahanian (France), Thomas Walther[1] (Germany), Olaf Wendler[1] (UK), Stephan Windecker (Switzerland), Jose Luis Zamorano (Spain)

Document Reviewers: Marco Roffi (CPG Review Coordinator) (Switzerland), Ottavio Alfieri[1] (EACTS Review Coordinator) (Italy), Stefan Agewall (Norway), Anders Ahlsson[1] (Sweden), Emanuele Barbato (Italy), Héctor Bueno (Spain), Jean-Philippe Collet (France), Ioan Mircea Coman (Romania), Martin Czerny (Germany), Victoria Delgado (The Netherlands), Donna Fitzsimons (UK), Thierry Folliguet[1] (France),



vs



	Favours TAVI	Favours SAVR
Clinical characteristics		
STS/EuroSCORE II <4% (logistic EuroSCORE I <10%)[a]		+
STS/EuroSCORE II ≥4% (logistic EuroSCORE I ≥10%)[a]	+	
Presence of severe comorbidity (not adequately reflected by scores)	+	
Age <75 years		+
Age ≥75 years	+	
Previous cardiac surgery	+	
Frailty[b]	+	
Restricted mobility and conditions that may affect the rehabilitation process after the procedure	+	
Suspicion of endocarditis		+
Anatomical and technical aspects		
Favourable access for transfemoral TAVI	+	
Unfavourable access (any) for TAVI		+
Sequelae of chest radiation	+	
Porcelain aorta	+	
Presence of intact coronary bypass grafts at risk when sternotomy is performed	+	
Expected patient–prosthesis mismatch	+	
Severe chest deformation or scoliosis	+	
Short distance between coronary ostia and aortic valve annulus		+
Size of aortic valve annulus out of range for TAVI		+
Aortic root morphology unfavourable for TAVI		+
Valve morphology (bicuspid, degree of calcification, calcification pattern) unfavourable for TAVI		+
Presence of thrombi in aorta or LV		+
Cardiac conditions in addition to aortic stenosis that require consideration for concomitant intervention		
Severe CAD requiring revascularization by CABG		+
Severe primary mitral valve disease, which could be treated surgically		+
Severe tricuspid valve disease		+
Aneurysm of the ascending aorta		+
Septal hypertrophy requiring myectomy		+

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JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY
VOL. 71, NO. 12, 2018
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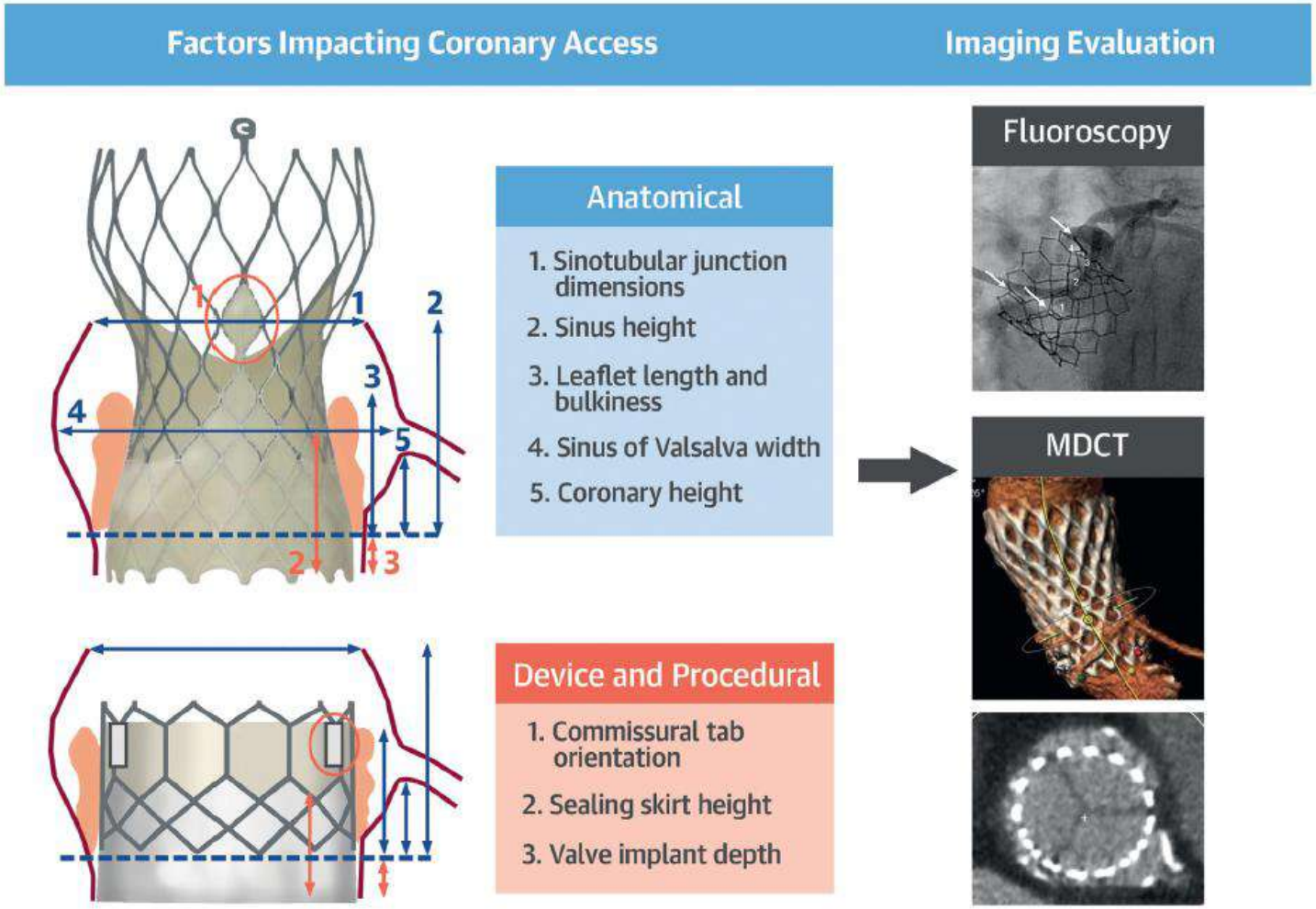
THE PRESENT AND FUTURE

STATE-OF-THE-ART REVIEW

Coronary Angiography and Percutaneous Coronary Intervention After Transcatheter Aortic Valve Replacement

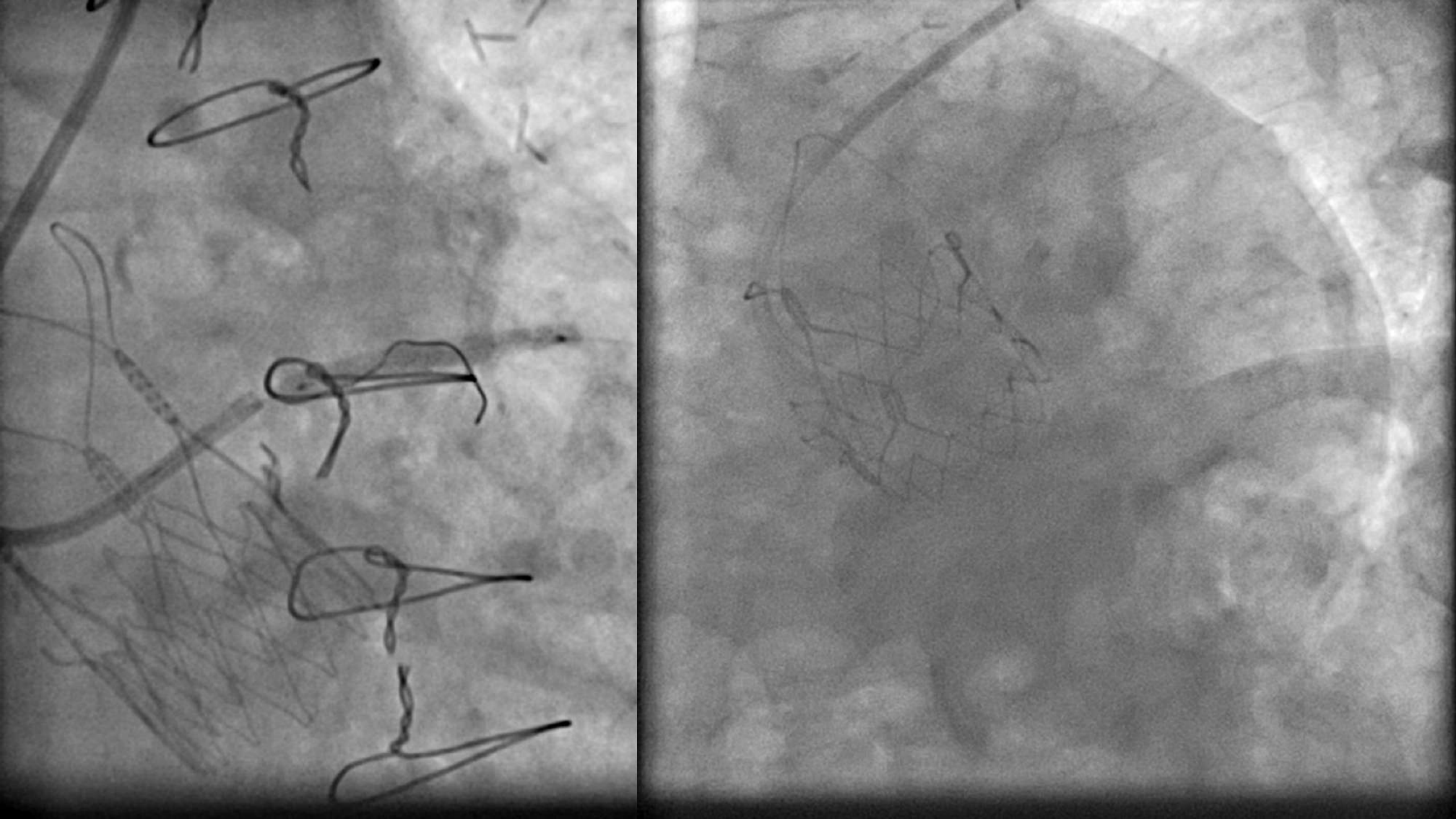
Matias B. Yudi, MBBS,[a] Samin K. Sharma, MD,[a] Gilbert H.L. Tang, MD, MSc, MBA,[b] Annapoorna Kini, MD[a]

CENTRAL ILLUSTRATION Coronary Reaccess After TAVR



Yudi, M.B. et al. J Am Coll Cardiol. 2018;71(12):1360-78.

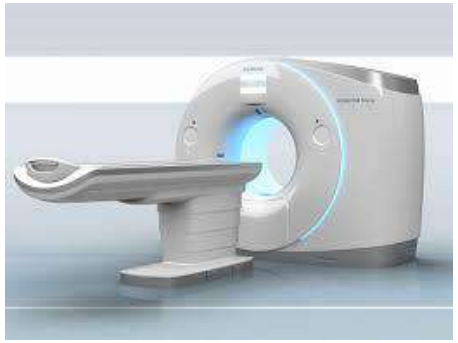
Summary of factors impacting coronary access and imaging evaluation after TAVR. MDCT = multidetector computed tomography; TAVR = transcatheter aortic valve replacement.



Present…
more than balloons & stents

Should we keep scheduling patients for diagnostic cath?

Proportion of diagnostic cath vs intervention



vs

Nome	N. H.	Origem	Exame efectuado	Observações	Urgência	Sala	H. Mapa	Chegada	Início	Fim	Saída	Destino	Estado
[redacted]	26111443	CHLO	Coronariografia	Doente da Sala (PG		Sala 1	08:00	08:00					Cancelado / Adiado
[redacted]	18592732	Consulta de Cardiologia	Coronariografia	adiado de 19/11		Sala 1	09:00	10:14	13:35	14:20		Domicílio: 2018-11-26 16:16:00	Recobro: Recobro Hemodinamic
[redacted]	15447707	HSFX - Reanimação	Coronariografia e Angioplastia	EAM STEMI	URG	Sala 1	10:00	10:16	10:20	11:16	11:31	Internamento : UNICOR	Alta / Transferência
[redacted]	18581283	Consulta de Cardiologia	Coronariografia	Av,DM:Janu via +Jardiance		Sala 1	11:00	09:09	09:45	10:15	11:43	Domicílio: 2018-11-26 11:31:00	Alta / Transferência
[redacted]	15466333	CHLO	Coronariografia	anterior) r, Tem		Sala 1	12:00	10:35	11:36		13:43	Domicílio: 2018-11-26 13:30:00	Alta / Transferência
[redacted]	14428700	UCI	Coronariografia	AL - cancelado		Sala 1	12:00						Confirmada
[redacted]	12361031	Centro Hospitalar Medio Tejo	Coronariografia	NSTEMI Volta para o	URG	Sala 1	13:00	14:19					Chegada Hemodinâmica
[redacted]	10283104	Consulta de Cardiologia	Coronariografia	Não adiar Chamar		Sala 1	14:00	12:51					Chegada do Paciente
[redacted]		HPP - Hospital de Cascais	Coronariografia	ANgina Instável		Sala 1	14:00						Confirmada
[redacted]	18591978	CHLO	Coronariografia	(vai aparecer		Sala 1	15:00	10:02	12:15	13:13		Domicílio: 2018-11-26 14:46:00	Recobro: Recobro Hemodinamic
[redacted]	11341084	Piso 5	Coronariografia		URG	Sala 1	16:00						Confirmada
[redacted]	16481442	Piso 5	Outros	de véspera 17H)		Sala 4	08:00	17:31	09:00	10:27	13:07	Internamento : Piso 5 - Cardiologia	Recobro: UCA-P5
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[redacted]	18592773	Centro Hospitalar Medio Tejo	Coronariografia e Angioplastia	NSTEMI Volta para o	URG	Sala 4	13:00	12:16	12:16	14:31		Internamento : Piso 5 - Cardiologia	Fim Procedimento
[redacted]	11346775	Consulta de Cardiologia	Coronariografia	Adiado de 23/11 pelo		Sala 4	14:00	11:59					Chegada Hemodinâmica
[redacted]	18590037	HSFX - UNICARD	Coronariografia	Angor instável	URG	Sala 4	14:00		14:30				Início Procedimento
[redacted]	18592795	Consulta de Cardiologia	Coronariografia	VE, CPM;av,i o doente		Sala 4	15:00	12:49					Chegada do Paciente
[redacted]	18592434	HSFX - UNICARD	Coronariografia	vem a troca com o primeiro	URG	Sala 4	16:00						Confirmada

CardioBase inforTUCANO SI

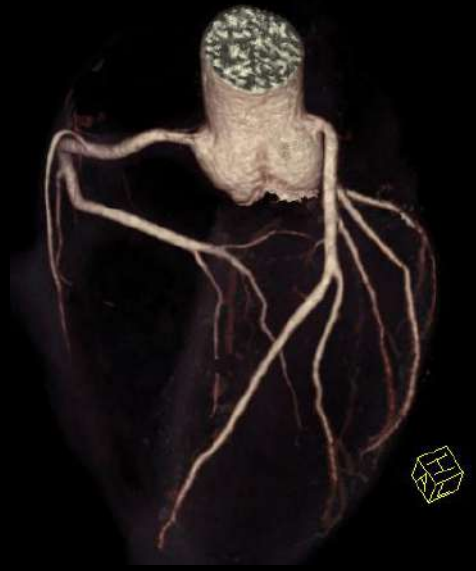
Artigos de Revisão

Angio TC cardíaca: o fim da coronariografia invasiva como modalidade diagnóstica? [67]

Pedro de Araújo Gonçalves, Hugo Marques

Hospital da Luz, Lisboa, Portugal

Rev Port Cardiol 2009; 28 (7-8): 825-842



Low probability of obstructive CAD

Routine coronary angiography before valvular/aortic surgery

Evaluation of possible CAD in Dilated CM and Hypertrophic CM

Low risk ACS?

European Heart Journal (2013) 34, 2949–3003
doi:10.1093/eurheartj/eht296

2013 ESC guidelines on the management of stable coronary artery disease

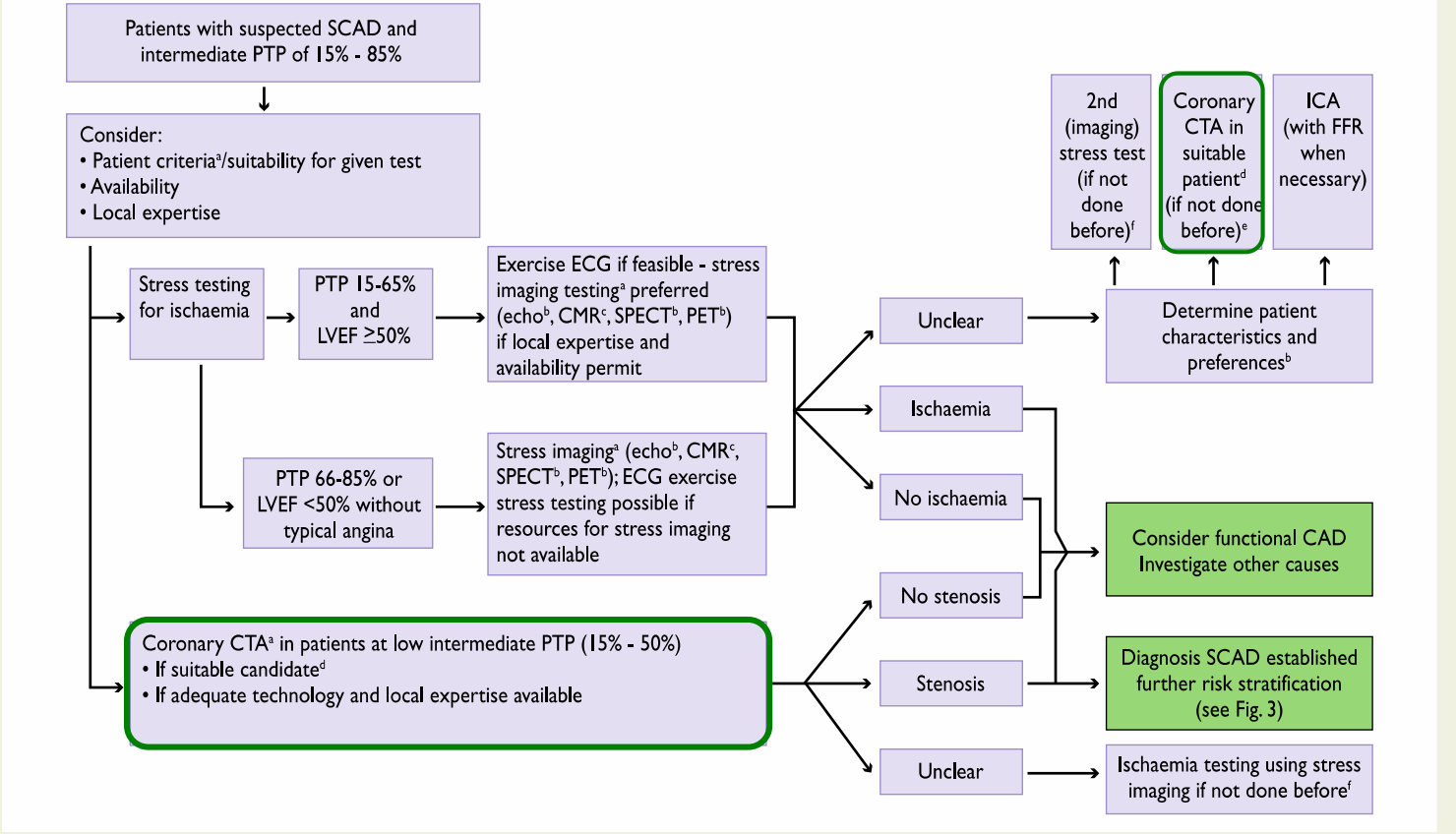
The Task Force on the management of stable coronary artery disease of the European Society of Cardiology

Cardiac CT as 1st line if:

-pre-test probability <50%

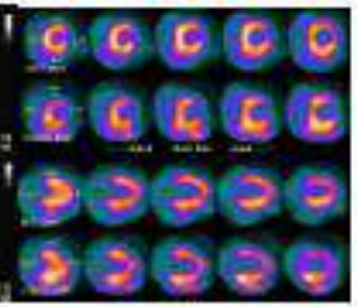
-good candidate (exclude arrhythmias, contrast allergy, renal failure)

-experienced centers



Cardiac CT

Stress tests



CAD probability

Low

Intermediate

High

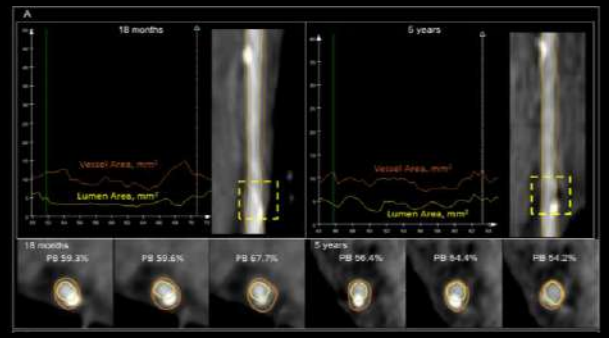
Stenosis >70%

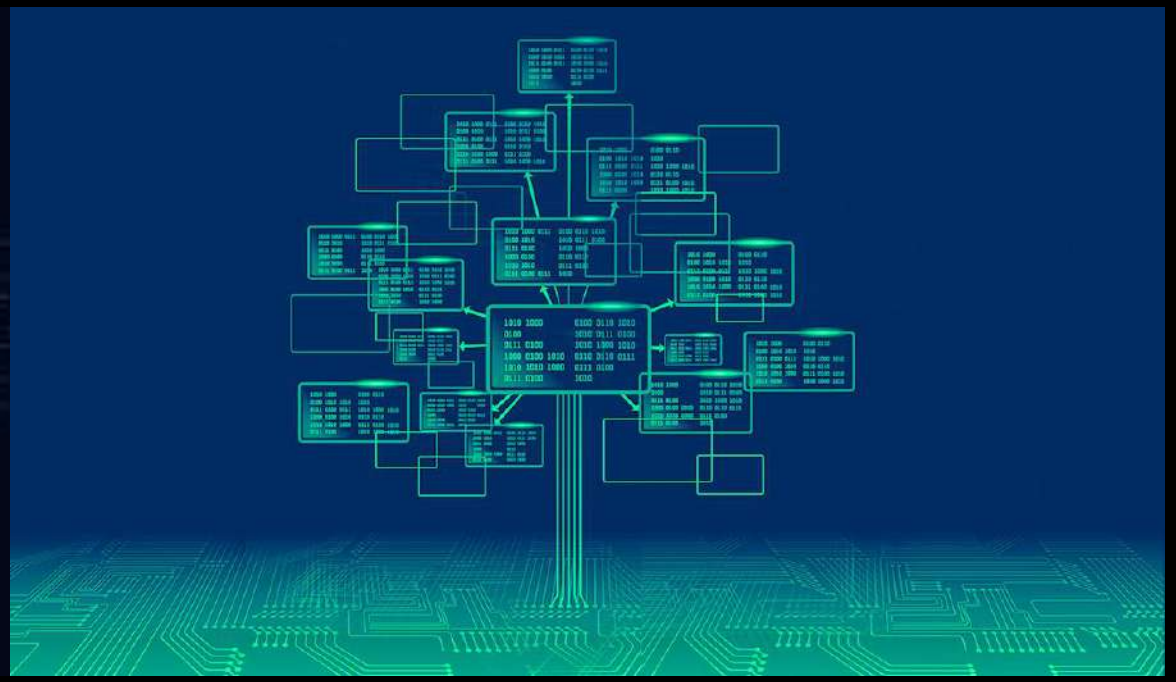
Plaque/vessel wall

Noncalcified plaque
Positive remodelling
Low attenuation plaque
Lesion length
Diameter of the distal vessel
...

But Cardiac CT can (should!) give information beyond stenosis severity

Machine Learning

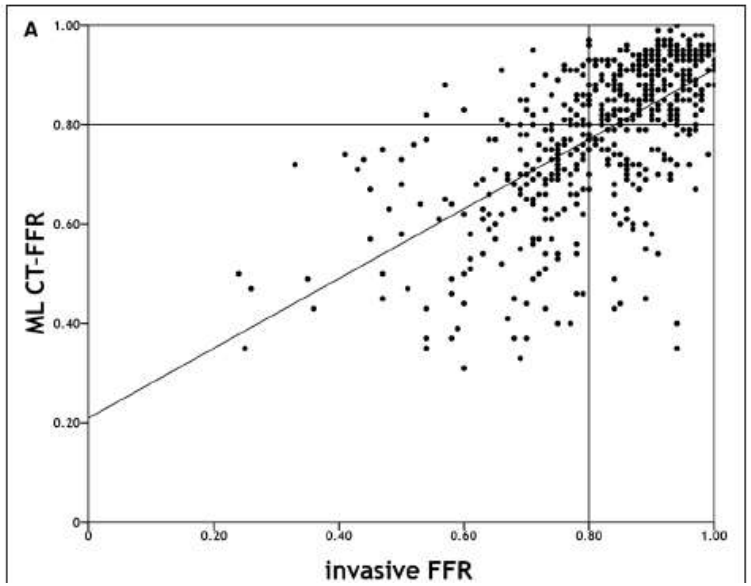


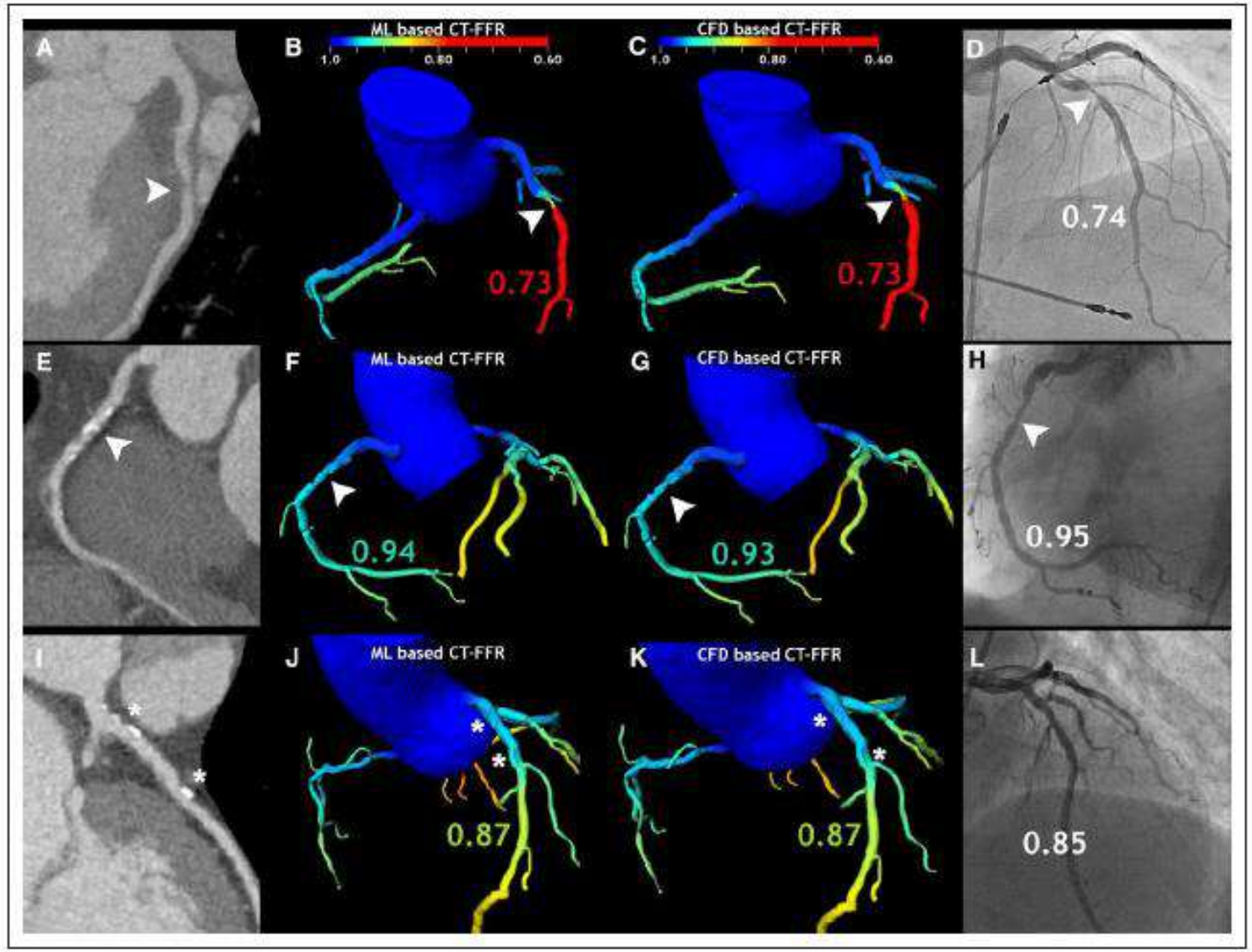


ORIGINAL ARTICLE

Diagnostic Accuracy of a Machine-Learning Approach to Coronary Computed Tomographic Angiography–Based Fractional Flow Reserve

Result From the MACHINE Consortium



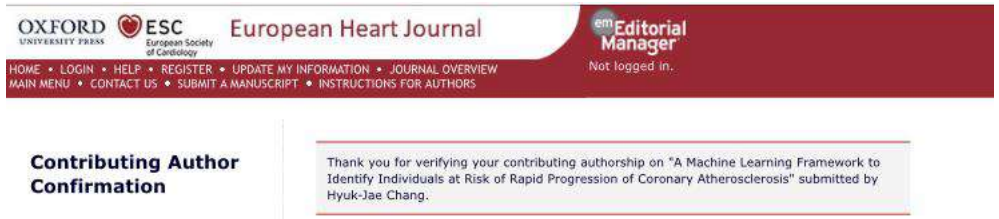


Circ Cardiovasc Imaging. 2018;11:e007217.

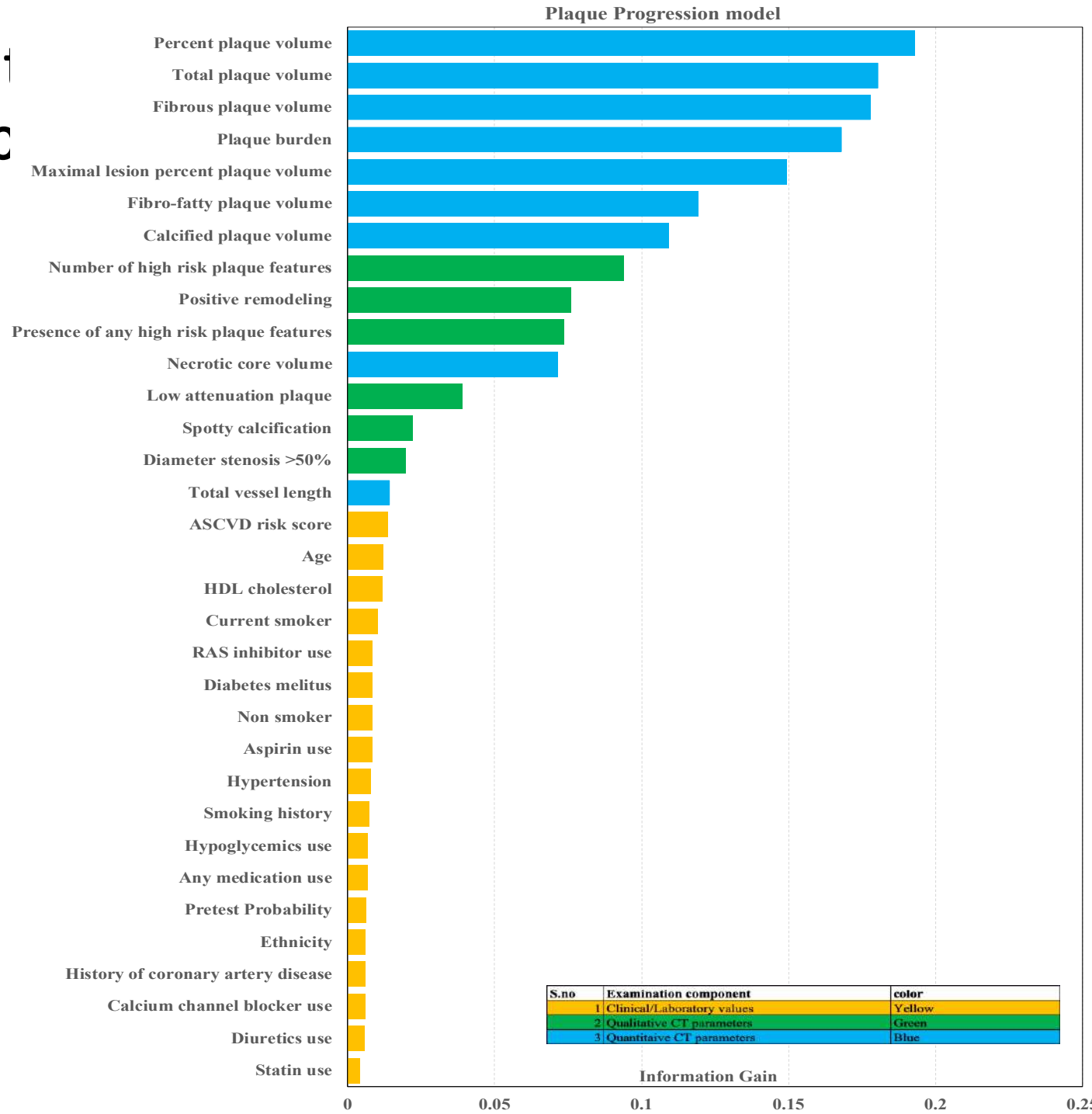
A Machine Learning Framework t Identify Individuals at Risk of Rap Progression of Coronary Atherosclerosis

Registo PARADIGM

N=2252 patients; 13 centers; 7 countries
Serial changes in CCTA

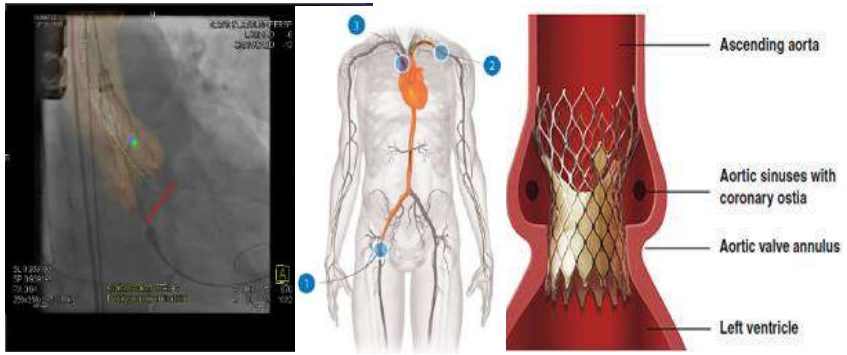


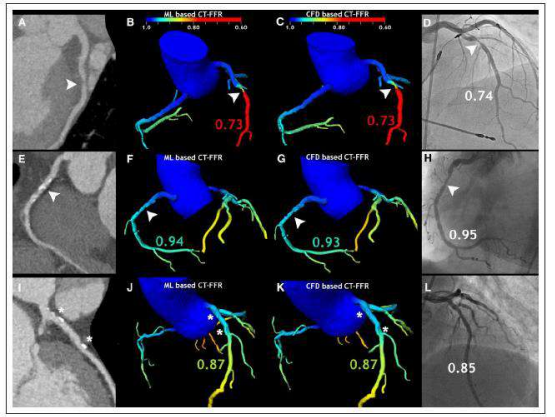
EHJ 2019, in press



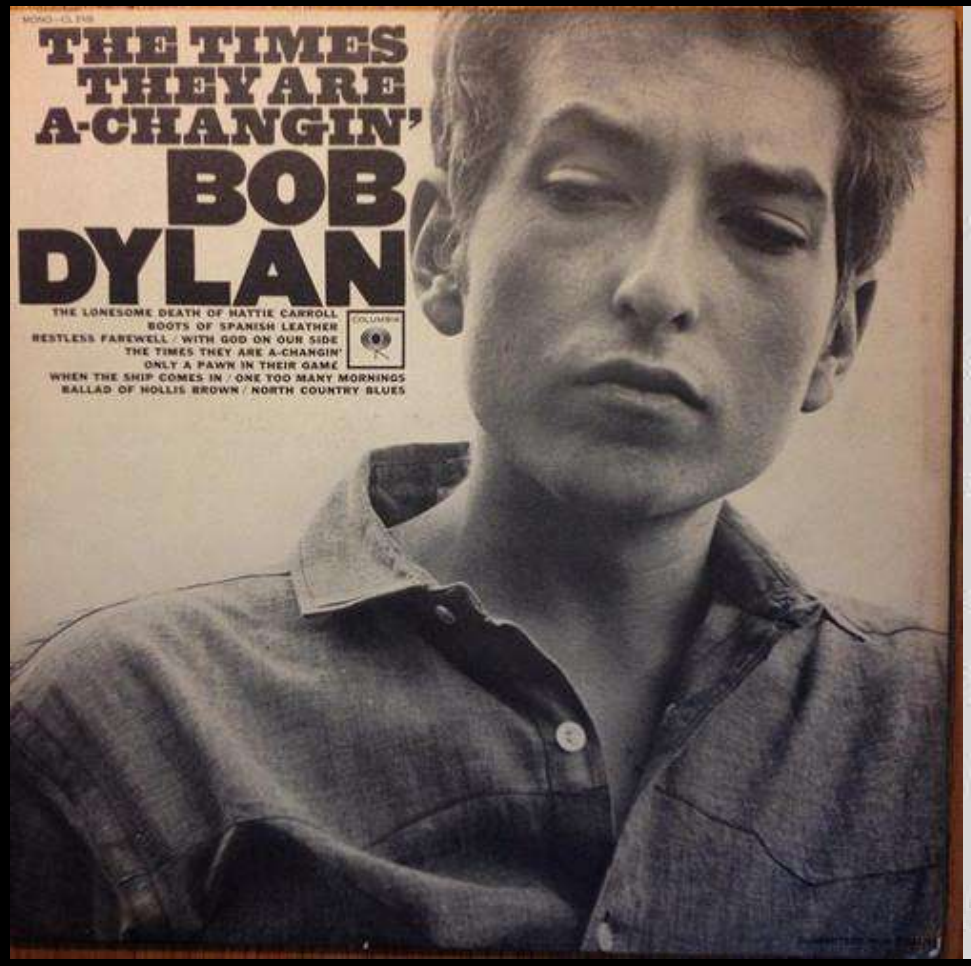
Future…!

- More structural heart interventions
- Less diagnostic cath vs PCI
- Cardiac CT with machine learning
- …





Protese aórtica
(2005)
ETE(transitório..!)
Mitraclip(2017)
CRT-D
(2013)
CABG (2012)



Come gather 'round people
Wherever you roam
And admit that the waters
Around you have grown
And accept it that soon
You'll be drenched to the bone.
If your time to you
Is worth savin'
Then you better start swimmin'
Or you'll sink like a stone

For the times they are a-changin'