GRCI 2017
France

6 AU 8 DÉCEMBRE 2017
Novotel Paris Tour Eiffel

Passion Communication Education

LES INCONTOURNABLES DE L'ANGIOPLASTIE CORONAIRE: LE TRONC COMMUN

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DÉCLARATION DE LIENS D'INTÉRÊT AVEC LA PRÉSENTATION

☑ Je n'ai pas de lien d'intérêt à déclarer

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- ***Comment bien évaluer une sténose du tronc?***
- Qui dilater d'une sténose du tronc?
- Comment « bien » dilater une sténose du tronc?

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UN PEU D'ANATOMIE…

- Naissance (habituelle!) du sinus antéro-gauche
- 3 segments: ostium, segment moyen, segment distal
- Bifurcation en IVA et Cx. Dans 30% des cas: trifurcation avec une bissectrice
- Pas de TC : 0,4%
- Longueur habituelle: 4 à 6 cm
- Chez l'homme: diamètre de 4.5 +/- 0.5 mm
- Chez la femme: 3.9 +/- 0.4 mm

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TABLE II Univariate comparison of left main coronary artery dimensions in men and women

Dimension	Men (n = 141)	Women (n = 116)	Significance (p value)
Lumen CSA (mm^2)	16.65 ± 4.04	14.0 ± 3.24	< 0.001
EEM CSA (mm^2)	20.58 ± 4.91	17.21 ± 3.97	< 0.001
MLD (mm^2)	4.26 ± 0.55	3.92 ± 0.45	< 0.001

Abbreviations: CSA = cross-sectional area, EEM = external elastic membrane, MLD = minimum lumen diameter.

Clin. Cardiol. 27, 291–294 (2004)

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OCT ou IVUS?

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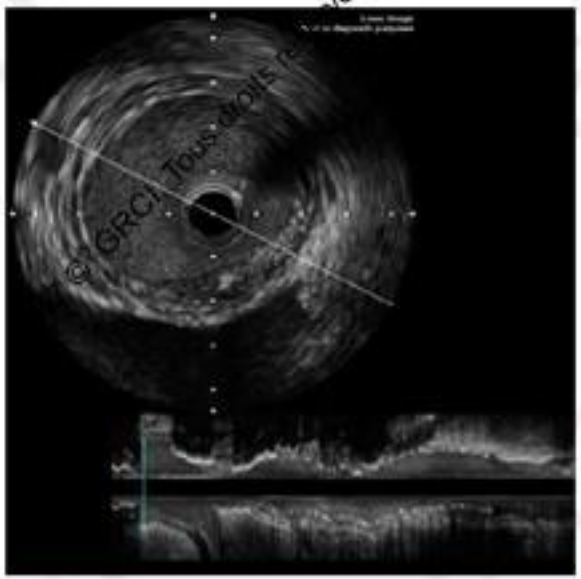
European Heart Journal – Cardiovascular Imaging (2012) 13, 370–386
doi:10.1093/ehjci/jes025

REVIEW

Optical coherence tomography: from research to practice

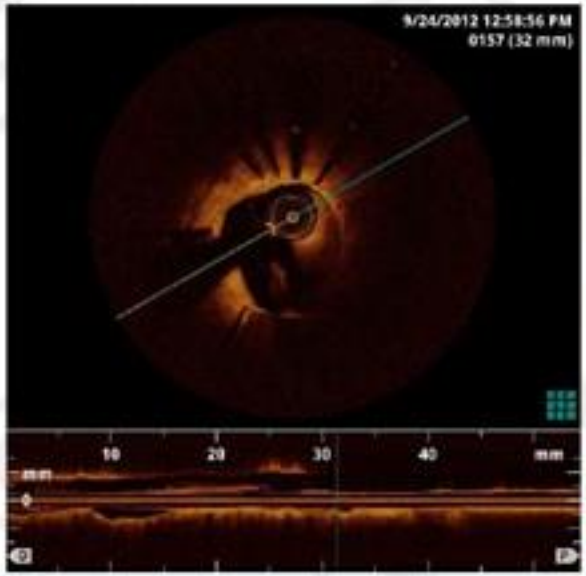
Juan Luis Gutiérrez-Chico[1], Eduardo Alegría-Barrero[2], Rodrigo Teijeiro-Mestre[2], Pak Hei Chan[2], Hiroto Tsujioka[2], Ranil de Silva[2], Nicola Viceconte[2], Alistair Lindsay[2], Tiffany Patterson[2], Nicolas Foin[4], Takashi Akasaka[3], and Carlo di Mario[2,4]*

IVUS



RA : 90 microns
RL : 30 images/mm
Pénétration tissulaire : > 40 mm
Longueur d'exploration : 150 mm
Pas de produit de produit de contraste

OCT



RA : 13 microns
RL : 5 images/mm
Pénétration tissulaire : < 1 mm
Longueur d'exploration : 60 mm
Lavage artériel au produit de contraste

Kubo et al. J Am Coll Cardiol

Table I Comparative technical summary of the three main imaging modalities used in interventional cardiology for diagnostic and for interventional purposes

	Angiography	IVUS	OCT
Radiation type	X-radiation	Ultrasound	NIR light
Frequency	3×10^3–3×10^7THz	20–45 MHz	192 THz
Wavelength (μm)	10^{-5}–10^{-2}	35–80	1.3
Axial resolution (μm)	59–137	100–200	10–20
Lateral resolution (μm)	NA	200–300	20–90
Rotation speed (Hz)	NA	30	16–160
Pull-back speed (mm/s)	NA	0.5–1	1–20
Tissue penetration (mm)	200–450	10	1–3
Scan diameter—field of view (mm)	NA	15	7–11
Usefulness for			
Plaque/tissue characterization	+	++	+++
Expansion/sizing	+	+++	+++
Apposition	–	++	+++
Vascular injury	+	++	+++
Intervention guidance	++	+	+
Assessment of restenosis/NIH	+++	+++	++
Assessment of coverage	–	–	+++

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Clinical Impact of Intravascular Ultrasound Guidance in Drug-Eluting Stent Implantation for Unprotected Left Main Coronary Disease

Pooled Analysis at the Patient-Level of 4 Registries

Table 3. Incidence of Major Adverse Events

	IVUS	No IVUS	p Value
Overall, n	505	505	
Death	7.4	13.0	0.01
Cardiac death	3.3	6.0	0.07
MI	4.5	6.5	0.4
TLR	7.7	6.3	0.7
Death + MI + TLR	14.4	22.2	0.006
Cardiac death + MI + TLR	11.7	16.0	0.04
Definite or probable stent thrombosis	0.6	2.2	0.04
Subgroup with distal lesions, n	221	226	
Cardiac death + MI + TLR	11.0	19.0	0.03
Subgroup with distal lesions-2 stents, n	63	62	
Cardiac death + MI + TLR	16.7	41.0	0.02

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Long-Term Clinical Outcome After Fractional Flow Reserve–Guided Treatment in Patients With Angiographically Equivocal Left Main Coronary Artery Stenosis

Michalis Hamilos, MD, PhD*; Olivier Muller, MD, PhD*; Thomas Cuisset, MD; Argyrios Ntalianis, MD, PhD; Gregory Chlouverakis, PhD; Giovanna Sarno, MD; Olivier Nelis, RN; Jozef Bartunek, MD, PhD; Marc Vanderheyden, MD; Eric Wyffels, MD; Emanuele Barbato, MD, PhD; Guy R. Heyndrickx, MD, PhD; William Wijns, MD, PhD; Bernard De Bruyne, MD, PhD

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Table 2. Angiographic Characteristics and Pressure Data

	Nonsurgical Group, FFR ≥0.80 (n=138)	Surgical Group, FFR <0.80 (n=75)	P
No. of diseased vessels, n (%)			
0*	52 (38)	19 (25)	0.07
1*	45 (32)	26 (35)	0.76
2*	30 (22)	18 (24)	0.73
3*	11 (8)	12 (16)	0.1
LAD, n (%)	55 (40)	38 (51)	0.15
LCx, n (%)	43 (31)	29 (39)	0.29
RCA, n (%)	42 (30)	33 (44)	0.052
Ostial type, n (%)	49 (35)	31 (41)	0.46
Mid type, n (%)	19 (14)	6 (8)	0.27
Distal type, n (%)	72 (52)	38 (51)	0.89
Stenosis, %	34.7±12	44.2±12.6	<0.0001
MLD, mm	2.6±0.66	2.01±0.49	<0.0001
Ref D, mm	4.04±1.03	3.8±0.8	0.17
FFR	0.88±0.05	0.73±0.06	<0.0001
P_a, mm Hg	94±17	94±17	0.97
P_d, mm Hg	83±15	69±13	<0.0001

RCA indicates right coronary artery; MLD, minimal lumen diameter; Ref D, reference diameter; P_a, mean aortic pressure; and P_d, mean pressure distal to the lesion.

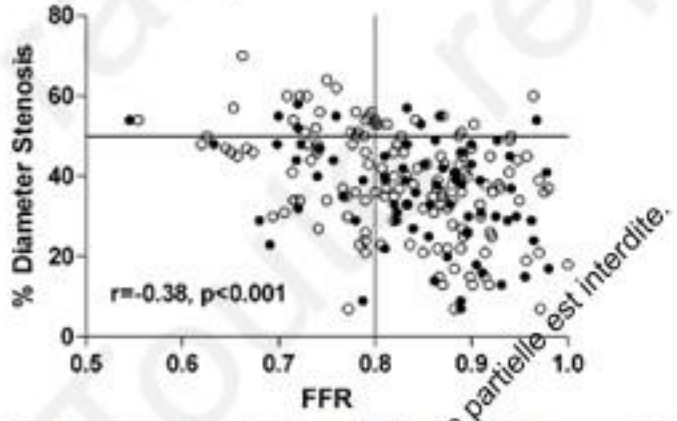
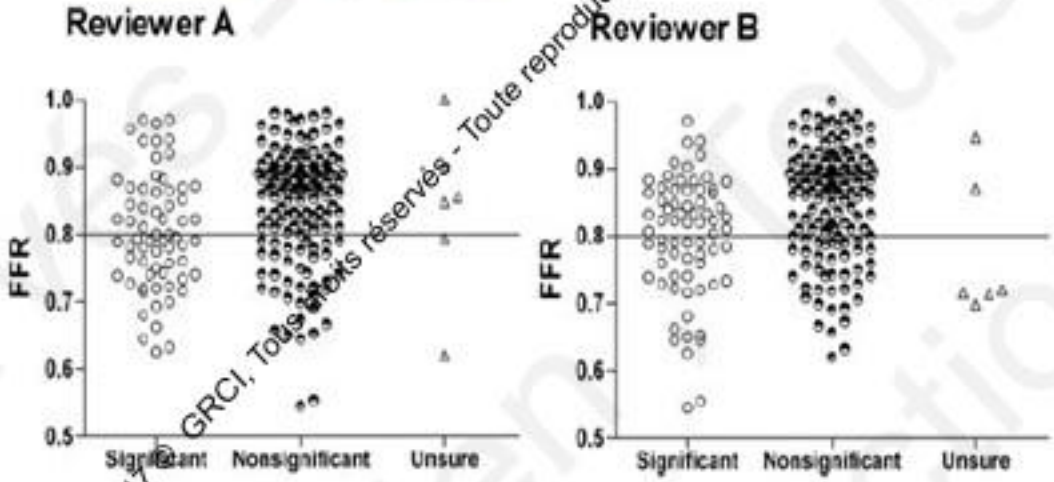


Figure 2. Scatterplots showing the distribution of percent DS and the corresponding FFR values. The dots represent patients with isolated LMCA stenosis.



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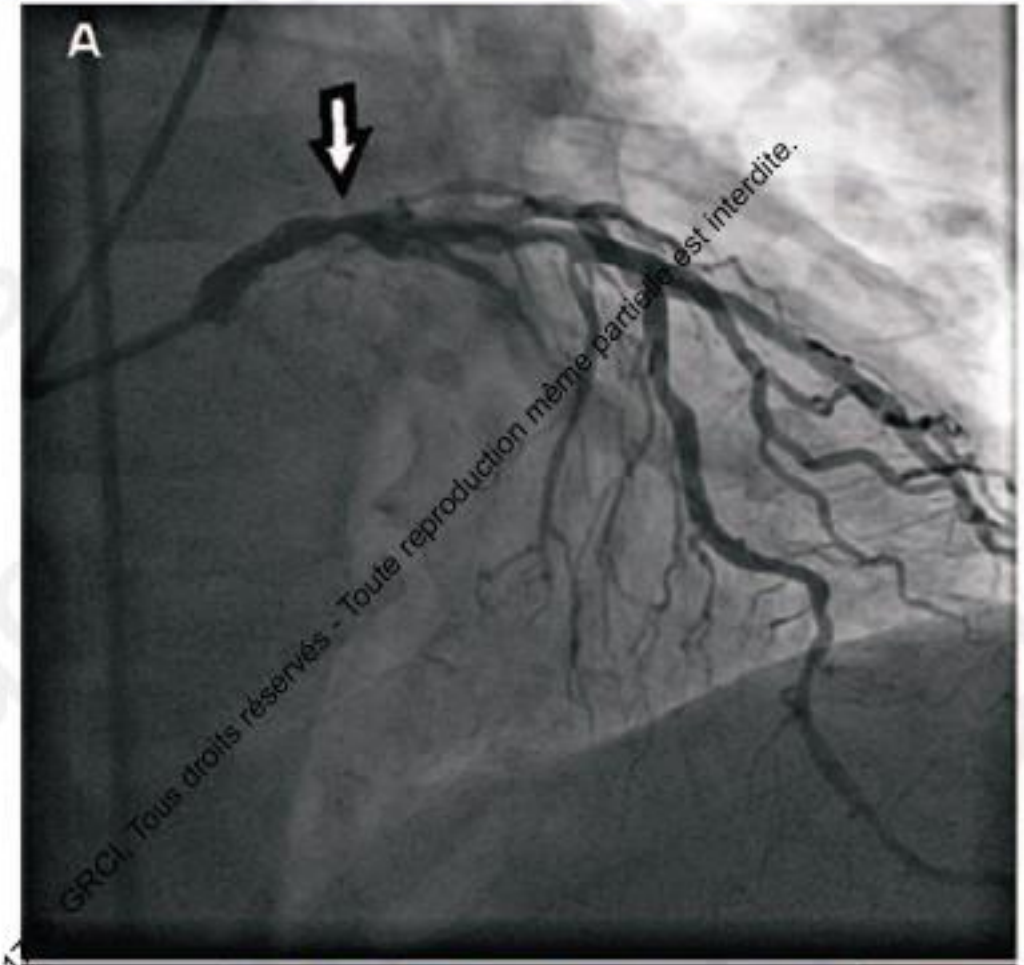
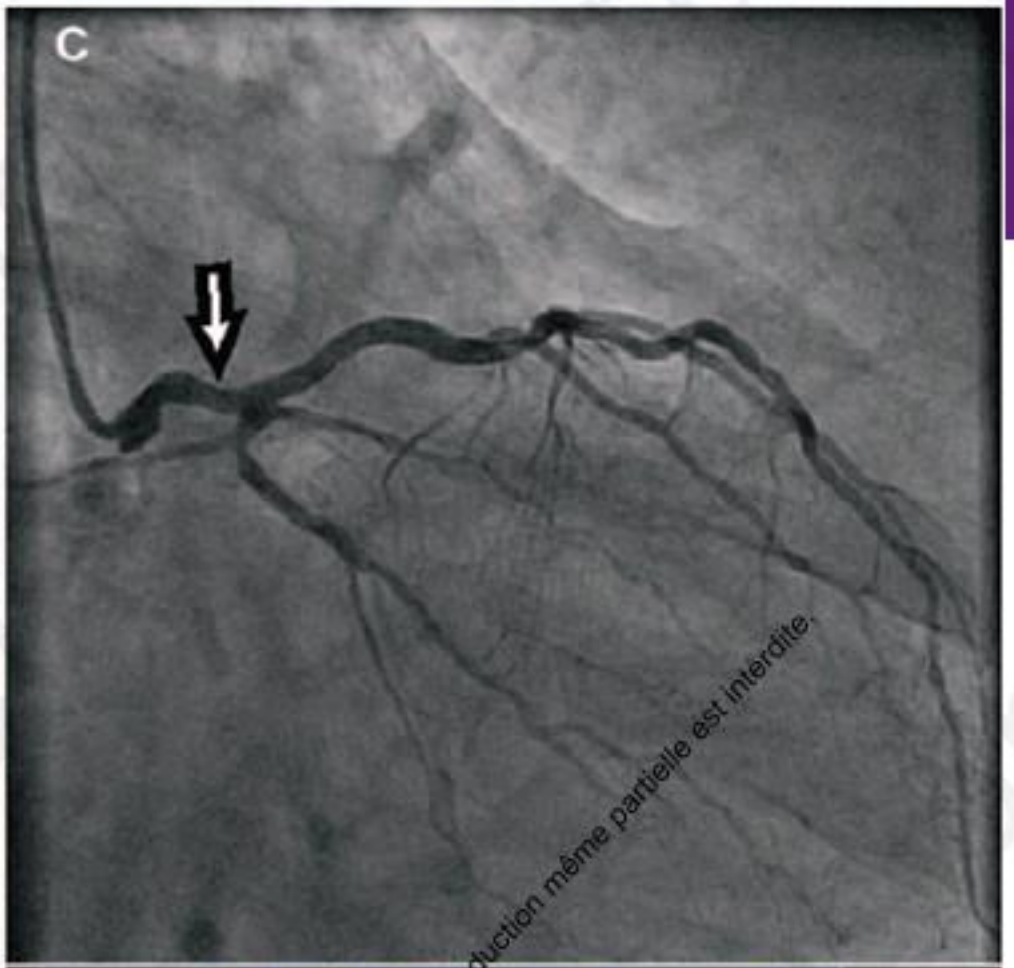
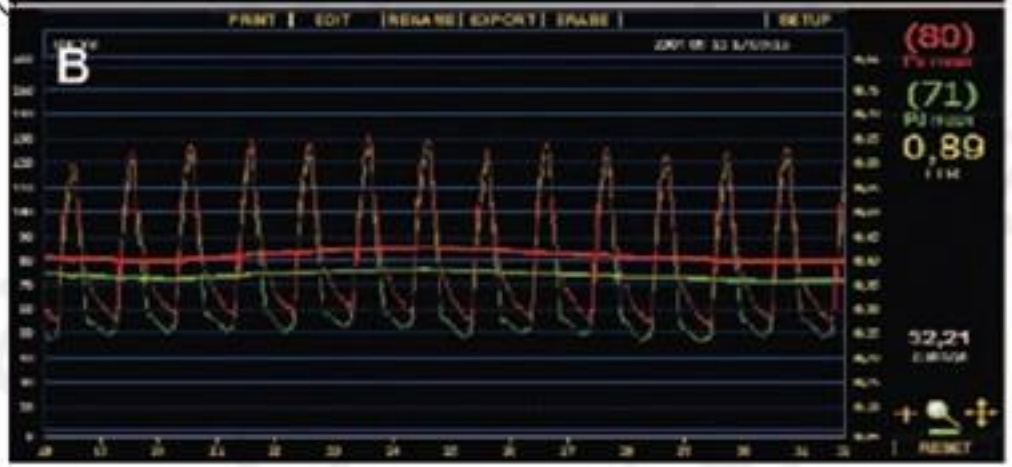
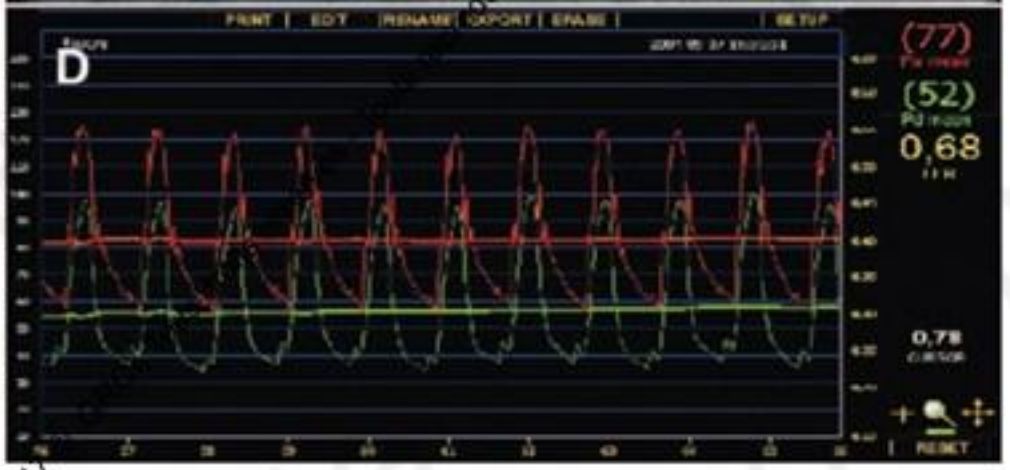
Circulation. 2009;120:1505-1512









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Recommendations for the clinical value of intracoronary diagnostic techniques

Recommendations	Class[a]	Level[b]	Ref.[c]
FFR to identify haemodynamically relevant coronary lesion(s) in stable patients when evidence of ischaemia is not available.	I	A	50,51,713
FFR-guided PCI in patients with multivessel disease.	IIa	B	54
IVUS in selected patients to optimize stent implantation.	IIa	B	702,703,706
IVUS to assess severity and optimize treatment of unprotected left main lesions.	IIa	B	705
IVUS or OCT to assess mechanisms of stent failure.	IIa	C	
OCT in selected patients to optimize stent implantation.	IIb	C	

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European Heart Journal (2014) 35, 2541–2619

- Comment bien évaluer une sténose du tronc?
- ***Qui dilater d'une sténose du tronc?***
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2014 ESC/EACTS Guidelines on myocardial revascularization

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

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

Indications for revascularization in patients with stable angina or silent ischaemia

Extent of CAD (anatomical and/or functional)		Class[a]	Level[c]
For prognosis	Left main disease with stenosis >50%[a]	I	A
	Any proximal LAD stenosis >50%[a]	I	A
	Two-vessel or three-vessel disease with stenosis > 50%[a] with impaired LV function (LVEF<40%)[a]	I	A
	Large area of ischaemia (>10% LV)	I	B
	Single remaining patent coronary artery with stenosis >50%[a]	I	C
For symptoms	Any coronary stenosis >50%[a] in the presence of limiting angina or angina equivalent, unresponsive to medical therapy	I	A

CAD = coronary artery disease; FFR = fractional flow reserve; LAD = left anterior descending coronary artery; LV = left ventricular.
[a]With documented ischaemia or FFR ≤ 0.80 for diameter stenosis <90%.

European Heart Journal (2014) 35, 2541–2619

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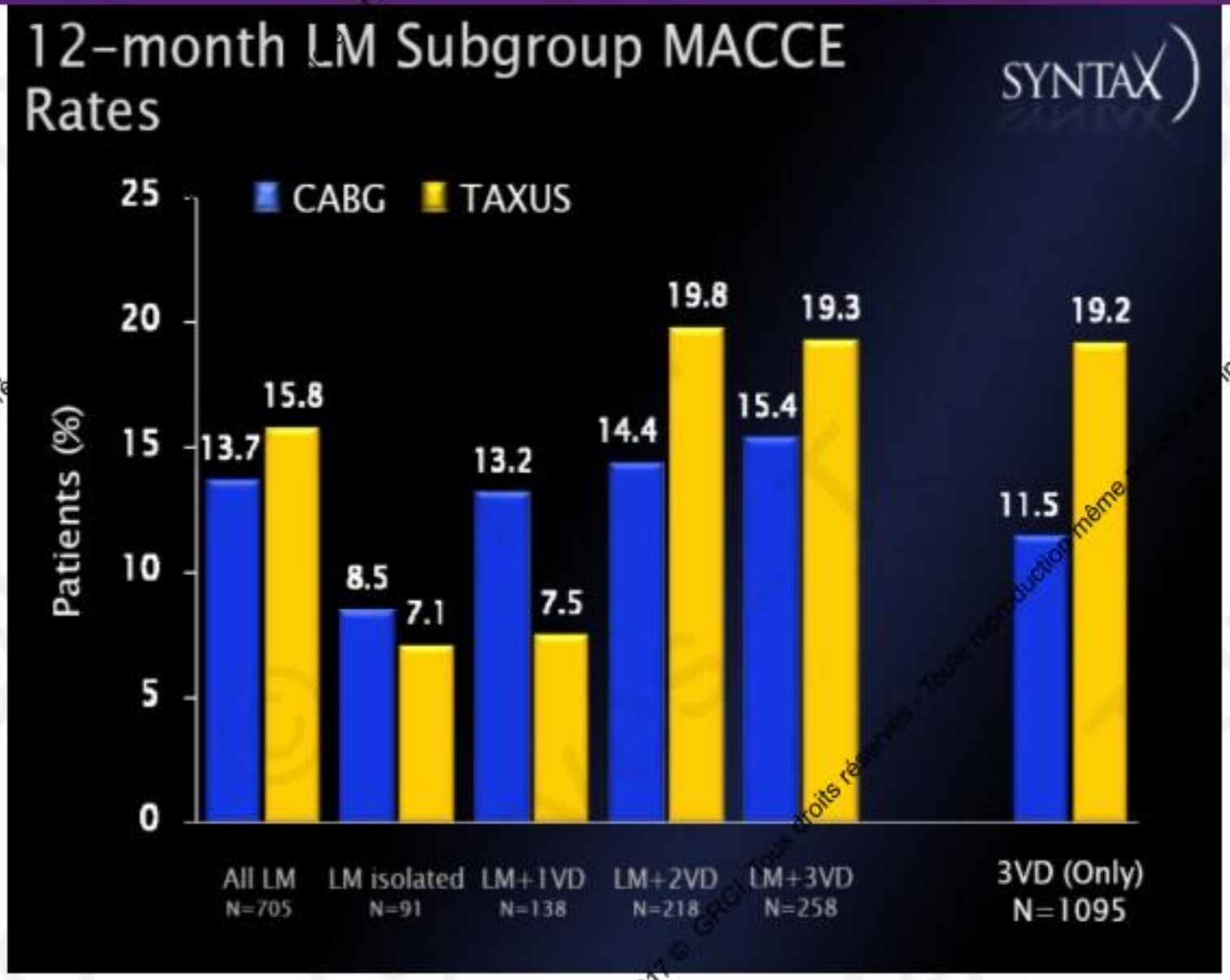

N Engl J Med 2009;360:961-720

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Five-Year Outcomes in Patients with Left Main Disease Treated with Either Percutaneous Coronary Intervention or Coronary Artery Bypass Grafting in the SYNTAX Trial

Marie-Claude Morice, Patrick W. Serruys, A. Pieter Kappetein, Ted E. Feldman, Elisabeth Ståhle, Antonio Colombo, Michael J. Mack, David R. Holmes, James W. Choi, Witold Ruzyllo, Grzegorz Rehga, Jian Huang, Kristine Roy, Keith D. Dawkins and Friedrich Mohr

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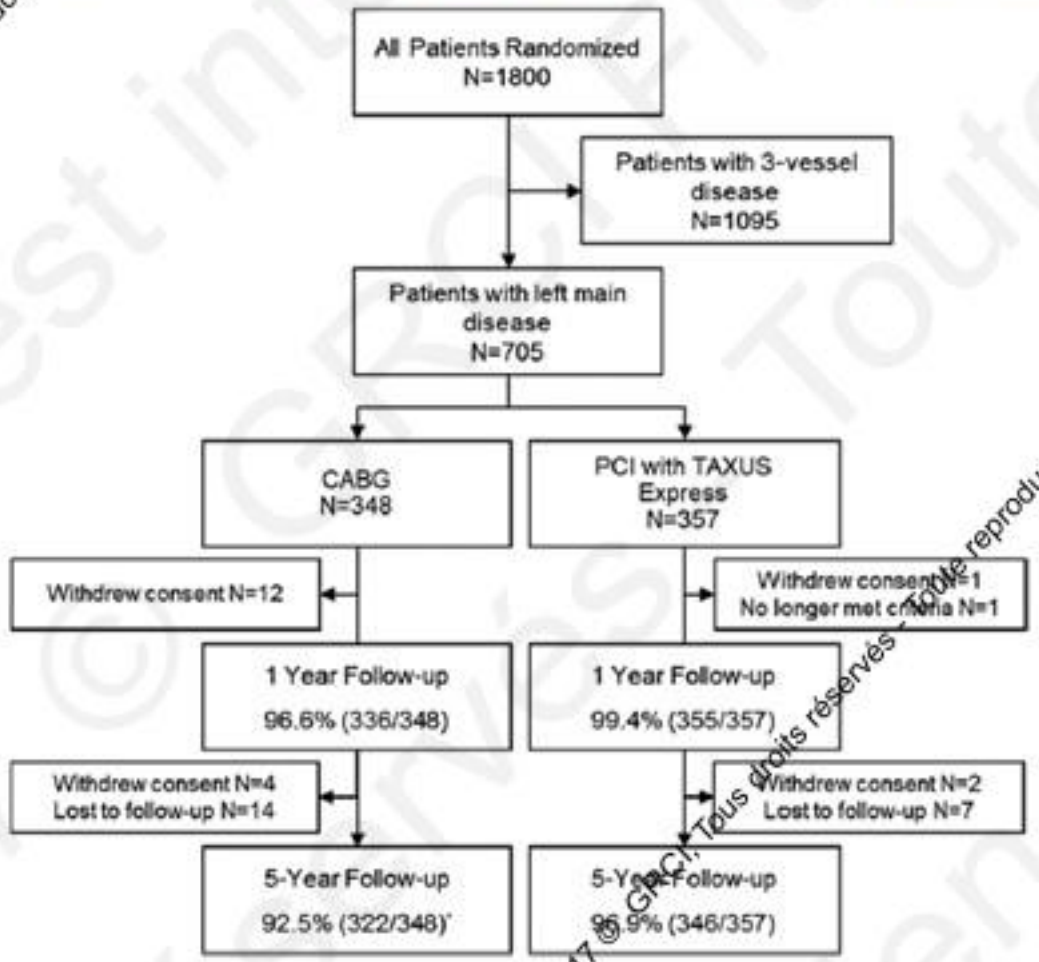

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Circulation 2014;129:2388-2394

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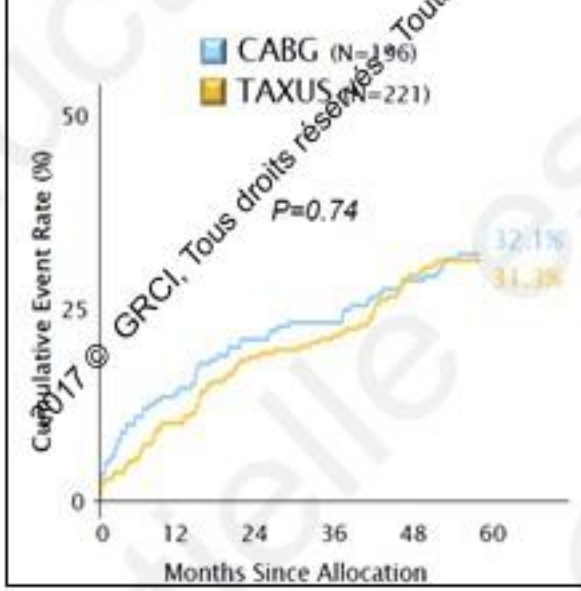
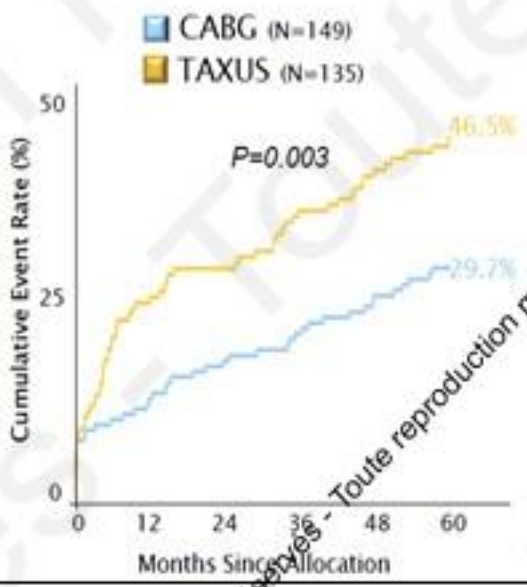
LM Subset-Low to Intermediate Scores (0-32)



	CABG	PCI	*P* value
Death	15.1%	7.9%	0.02
CVA	3.9%	1.4%	0.11
MI	3.8%	6.1%	0.33
Death, CVA or MI	19.8%	14.8%	0.16
Revasc.	18.6%	22.6%	0.36

LM Subset- High Scores (≥33)



	CABG	PCI	*P* value
Death	14.1%	20.9%	0.11
CVA	4.9%	1.6%	0.13
MI	6.1%	11.7%	0.13
Death, CVA or MI	22.1%	26.1%	0.40
Revasc.	11.6%	34.1%	<0.001

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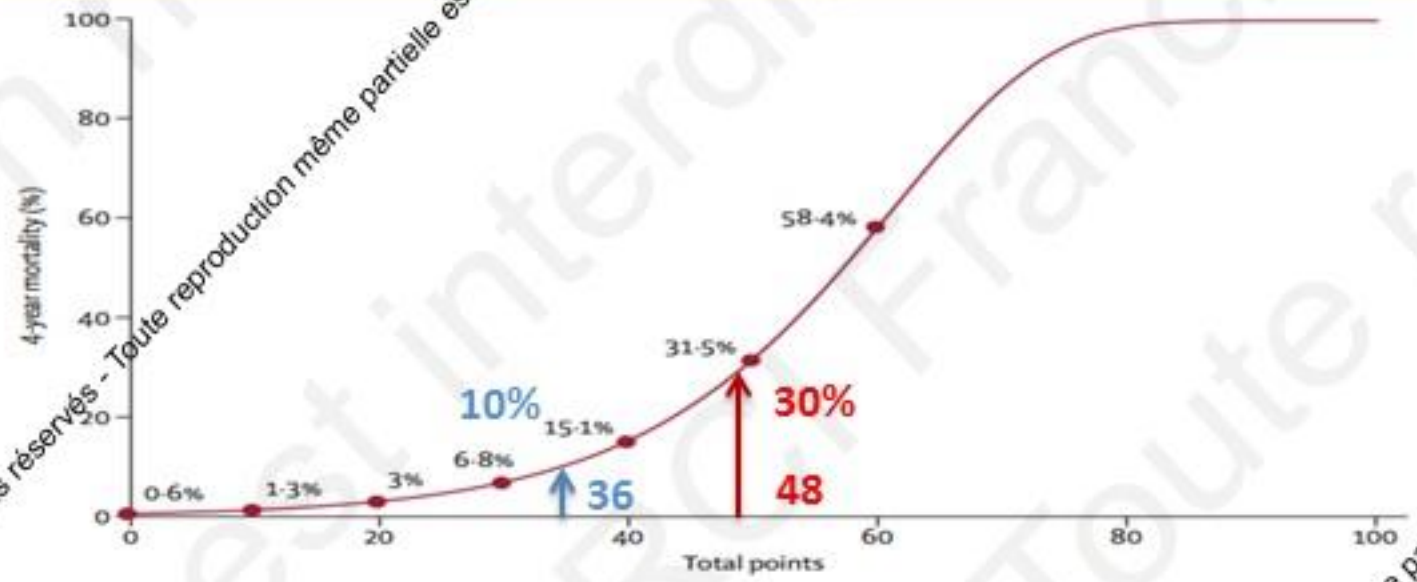
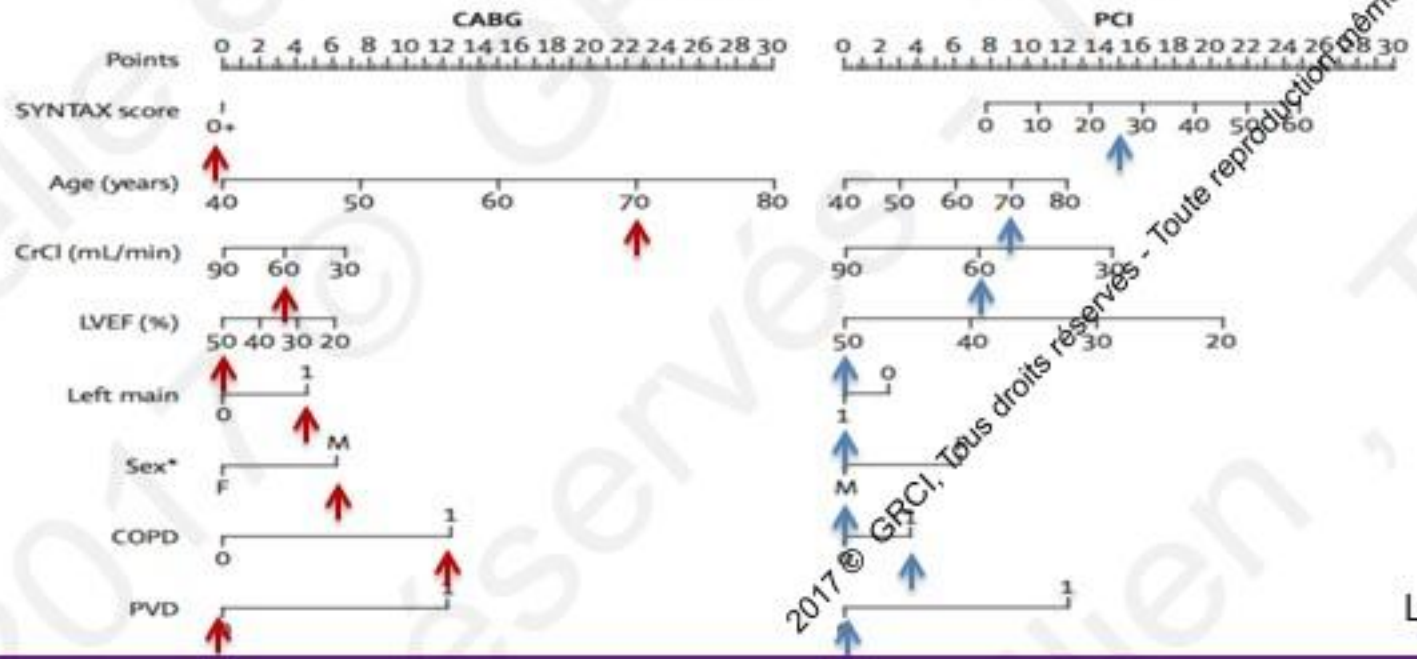
Circulation 2014;129:2388-2394

SYNTAX SCORE II





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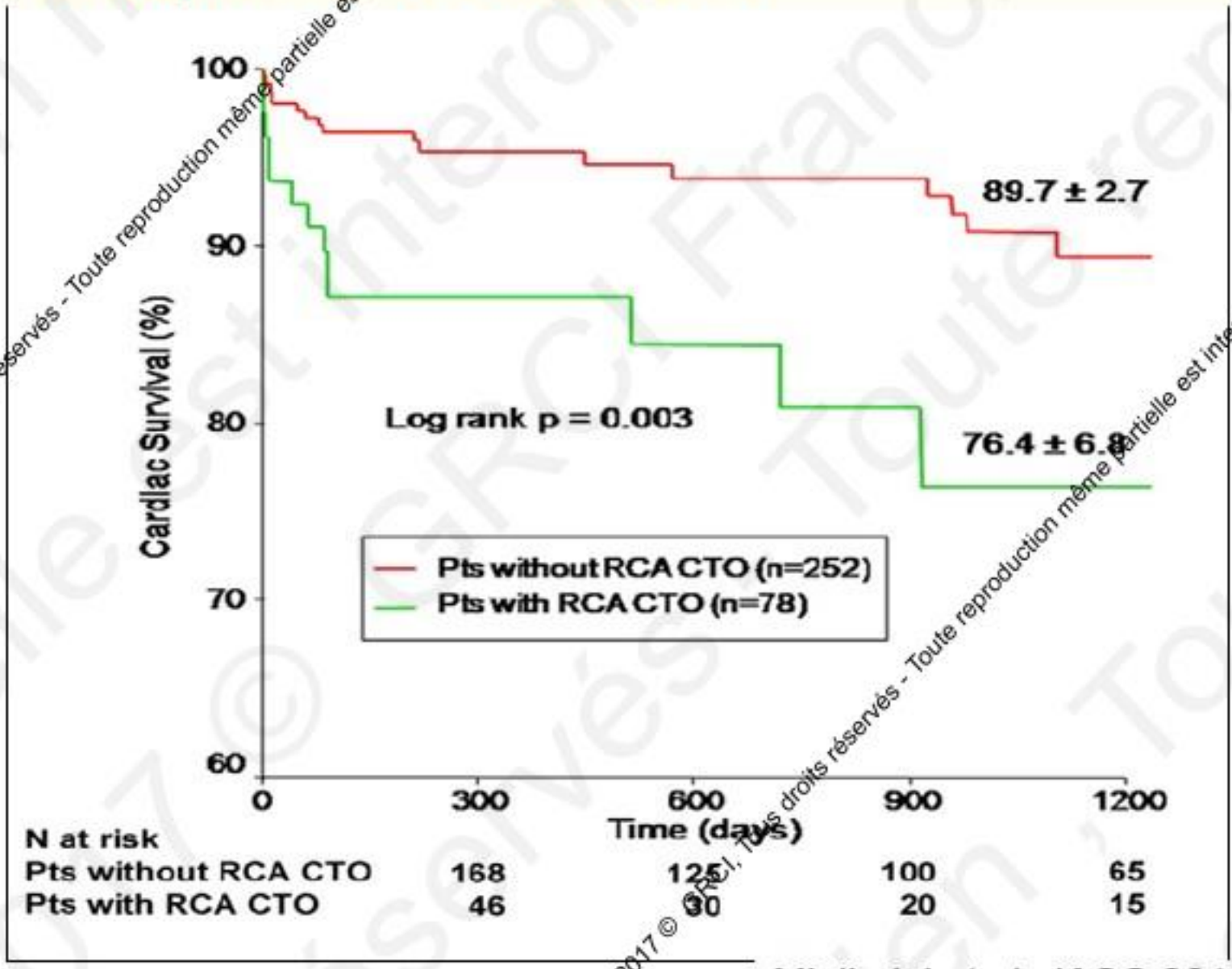
Lancet 2013, vol 381

The Impact of Right Coronary Artery Chronic Total Occlusion on Clinical Outcome of Patients Undergoing Percutaneous Coronary Intervention for Unprotected Left Main Disease



Migliorini et al. JACC 2011;58:125–30

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The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 DECEMBER 8, 2016 VOL. 375 NO. 23

Everolimus-Eluting Stents or Bypass Surgery for Left Main Coronary Artery Disease

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EXCEL

2900 pts with unprotected left main disease

↓

SYNTAX score ≤32

Consensus agreement of eligibility and equipoise by heart team

→ No (N=1000) → Enrollment registry

↓ Yes (N=1900)

Stratified by diabetes, SYNTAX score and center → R

↓

PCI (Xience EES) (N=950)

CABG (N=950)

Follow-up: 1 month, 6 months, 1 year, annually through 5 years

Primary endpoint: Measured at a median 3-yr FU, minimum 2-yr FU

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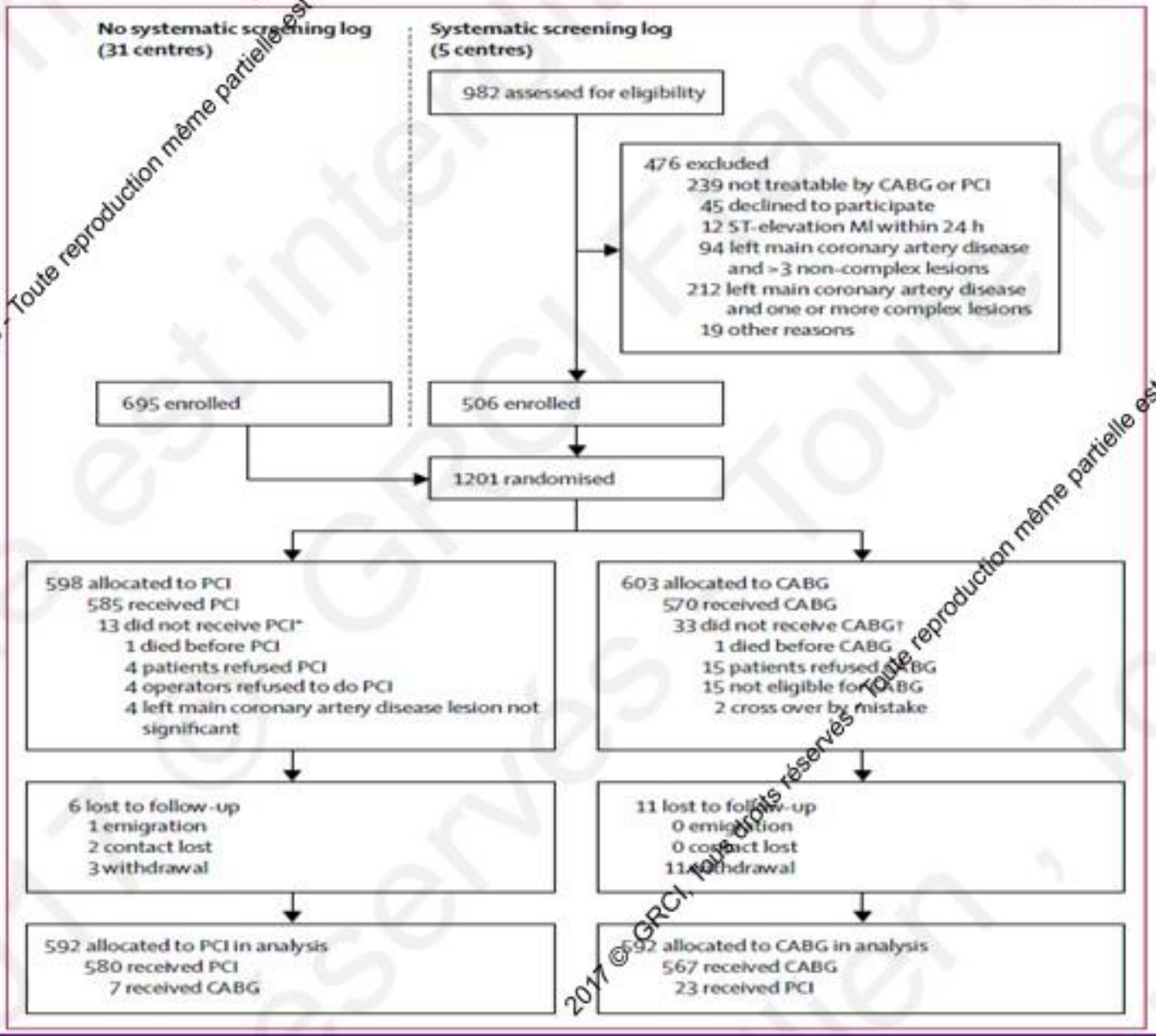
Percutaneous coronary angioplasty versus coronary artery bypass grafting in treatment of unprotected left main stenosis (NOBLE): a prospective, randomised, open-label, non-inferiority trial

Lancet 2016; 388: 2743–52



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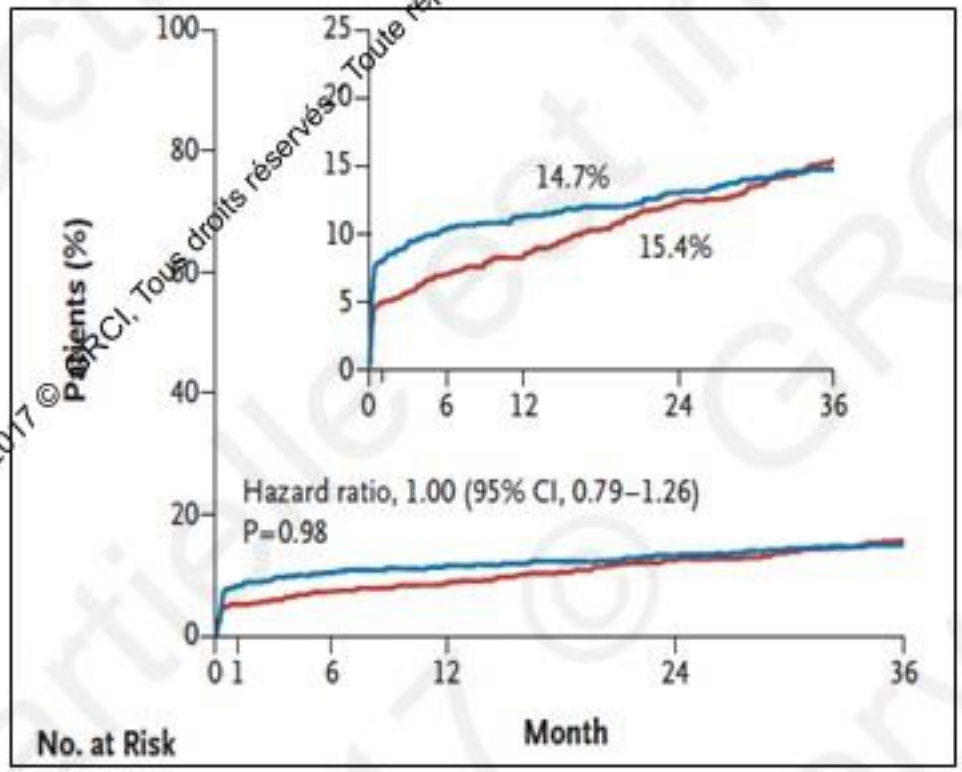
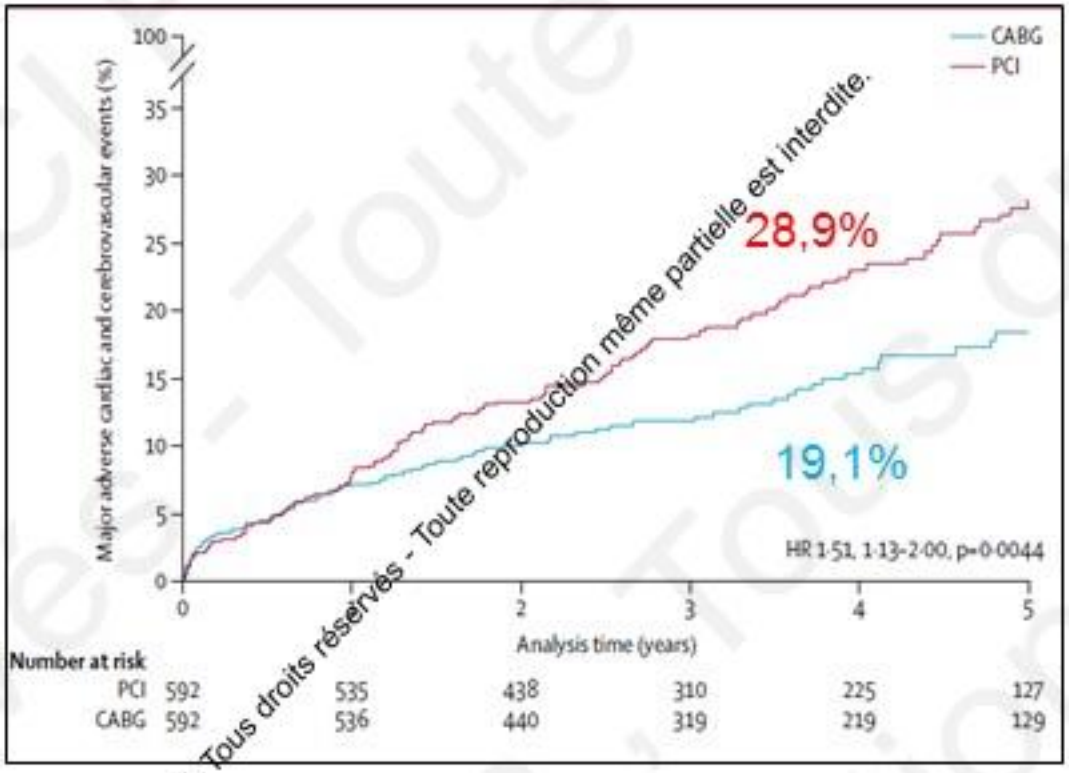
EXCEL

Primary Endpoint
Death, Stroke or MI at 3 Years



NOBLE

Primary Endpoint
Death, Stroke, MI, New revascularisation at 5 Years



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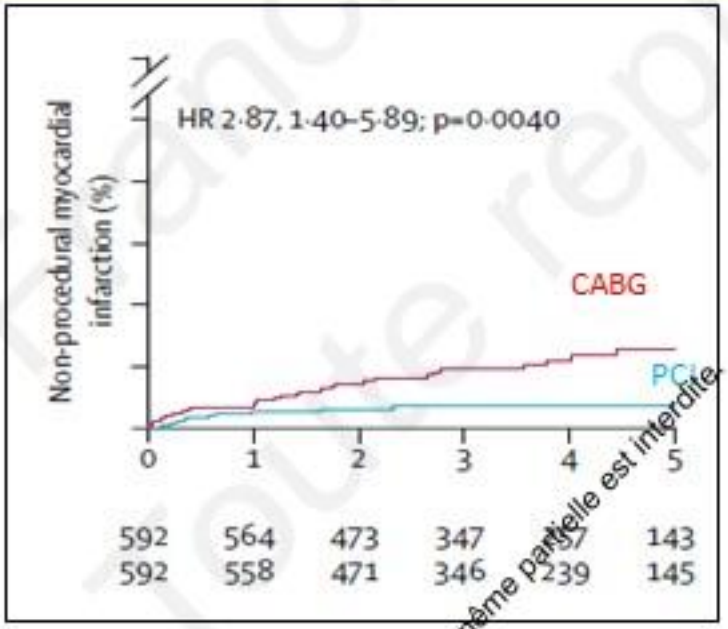
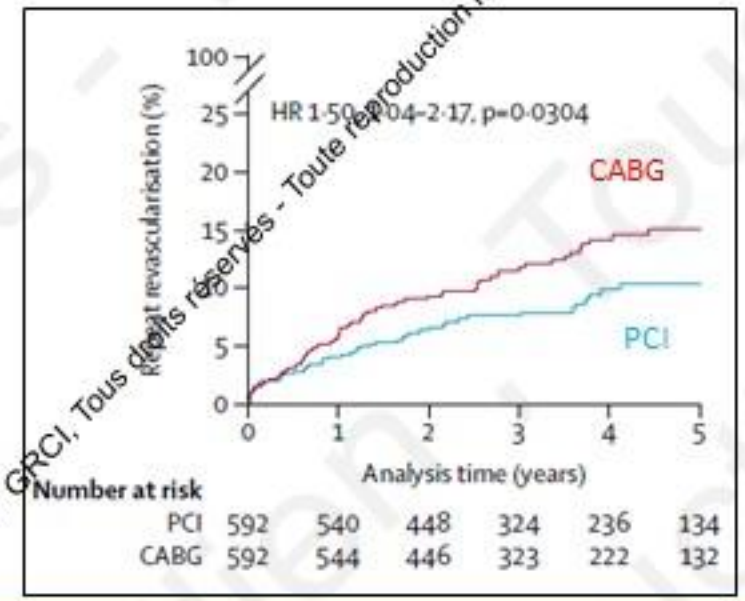
	PCI (n=592)	CABG (n=592)	p value
Age (years)	66·2 (9·9)	66·1 (9·4)	0·91
Women	116 (20%)	140 (24%)	0·09
Body-mass index (kg/m²)	27·9 (4·5)	28·1 (4·4)	0·53
Diabetes type 1 or type 2	86 (15%)	90 (15%)	0·94
Family history of ischaemic heart disease	321 (58%)	307 (56%)	0·45
Statin treatment	482 (82%)	464 (78%)	0·17
Hypertension	386 (66%)	389 (66%)	0·91
Active smoking	109 (19%)	127 (22%)	0·18
Previous PCI	116 (20%)	118 (20%)	0·90
Previous CABG	4 (1%)	2 (<1%)	0·41
Ejection fraction	60% (IQR 55–65)	60 (IQR 52–64)	0·27
NYHA class			
I	244 (53%)	195 (43%)	..
II	135 (29·6%)	150 (33%)	..
III	57 (13%)	77 (17%)	..
	23 (5%)	33 (7%)	0·0120
EUROSCORE	2 (IQR 2–4)	2 (IQR 2–4)	0·18
SYNTAX score	22·5 (7·5)	22·4 (8·0)	0·74
Indication			
Stable angina pectoris	486 (82%)	491 (83%)	0·66
Acute coronary syndrome	106 (18%)	100 (17%)	0·66
Lesions to be treated (n [IQR])	2 (1–3)	2 (2–3)	<0·0001
Distal LMCA lesion	477 (81%)	482 (81%)	0·77

Data are n (%), mean (SD), or median (IQR). NYHA class=New York Heart Association class. LMCA=left main coronary artery.

Table 1: **Baseline characteristics by treatment group**





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Recommendation for the type of revascularization (CABG or PCI) in patients with SCAD with suitable coronary anatomy for both procedures and low predicted surgical mortality

Recommendations according to extent of CAD	CABG		PCI		
	Class[a]	Level[b]	Class[a]	Level[b]	Ref[c]
One or two-vessel disease without proximal LAD stenosis.	IIb	C	I	C	
One-vessel disease with proximal LAD stenosis.	I	A	I	A	107,108,160, 161,178,179
Two-vessel disease with proximal LAD stenosis.	I	B	I	C	108,135,137
Left main disease with a SYNTAX score ≤ 22.	I	B	I	B	17,134,170
Left main disease with a SYNTAX score 23–32.	I	B	IIa	B	17
Left main disease with a SYNTAX score >32.	I	B	III	B	17
Three-vessel disease with a SYNTAX score ≤ 22.	I	A	I	B	17,157,175,176
Three-vessel disease with a SYNTAX score 23–32.	I	A	IIa	B	17,157,175,176
Three-vessel disease with a SYNTAX score >32.	I	A	III	B	17,157,175,176

CABG = coronary artery bypass grafting; LAD = left anterior descending coronary artery; PCI = percutaneous coronary intervention; SCAD = stable coronary artery disease.

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European Heart Journal (2014) 35, 2541–2619

CAS CLINIQUE 1

- Homme de 78 ans
- Tabagisme sevré
- SCA juin 2016 : lésions tritronculaires: recanalisation CD III avec stent actif et 3 mois plus tard stenting actif IVA moyenne avec angioplastie au ballon seul ostium deuxième diagonale
- Fonction rénale normale
- Asymptomatique
- Ischémie silencieuse: scintigraphie myocardique: 89% FMT. Négatif cliniquement-positif électriquement
- FEVG 60%
- Séquelle d'infarctus inféro-latéral. Ischémie péri-nécrotique antéro-latérale: 1-2 segments sur 17. Ischémie myocardique antéro-apicale: 1 segment sur 17 dans le territoire de l'IVA

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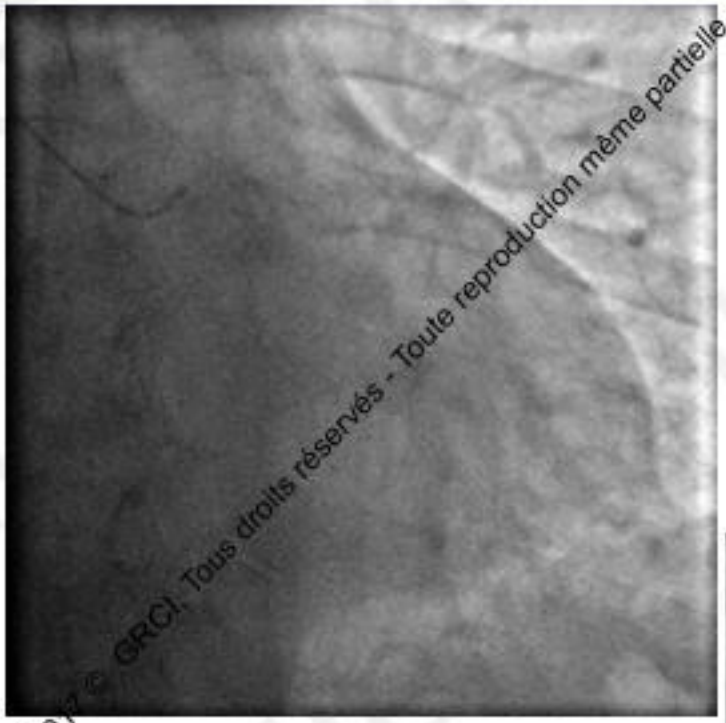

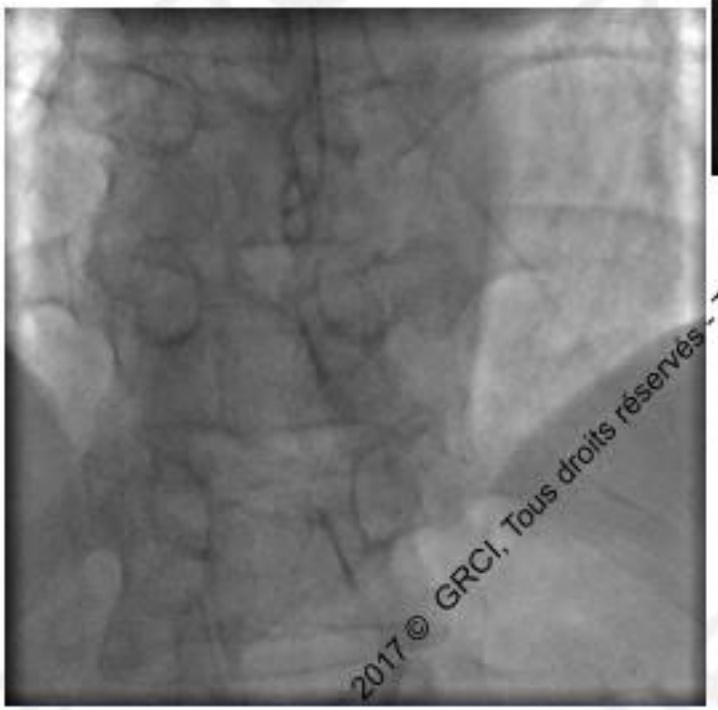

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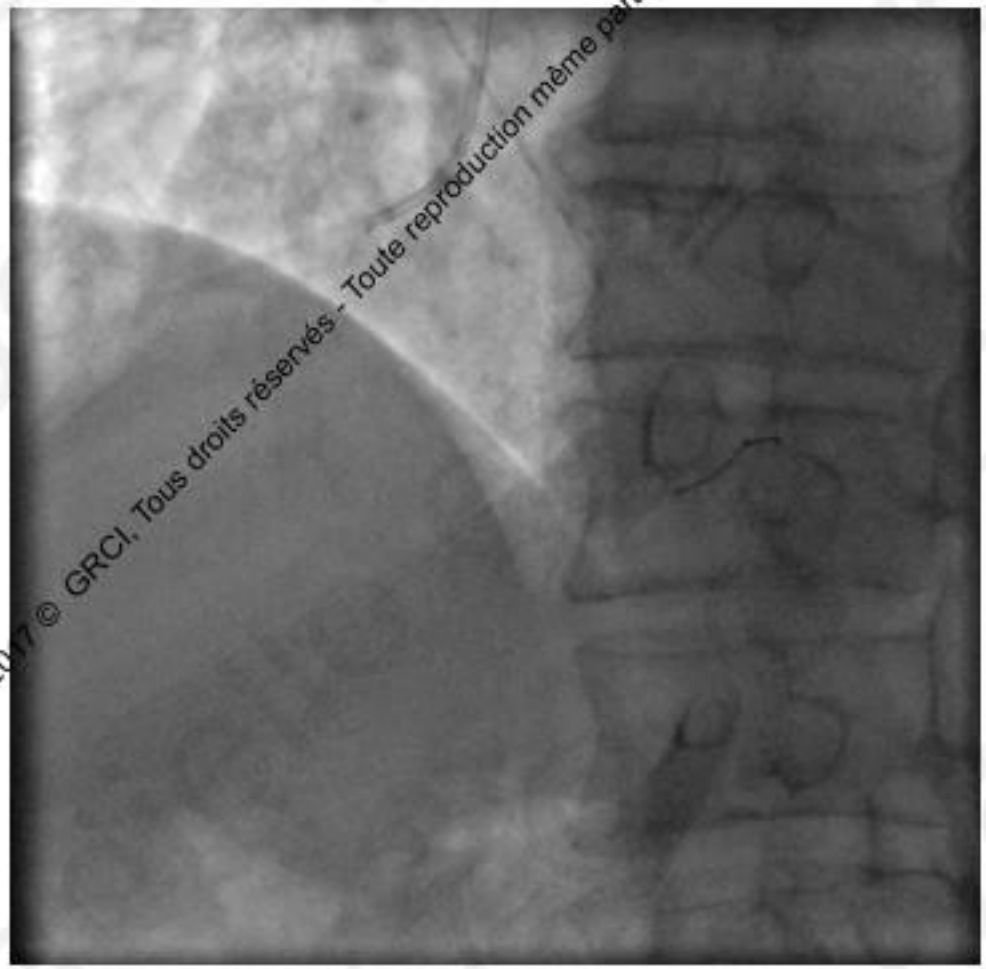

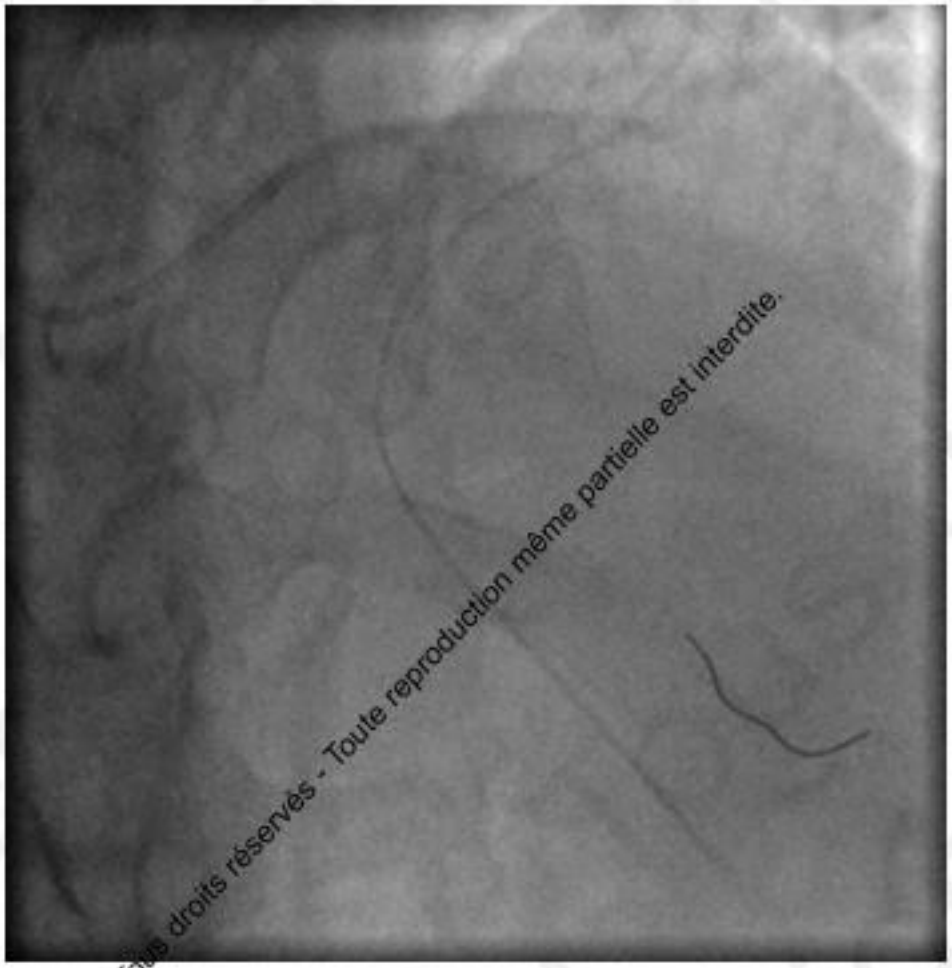

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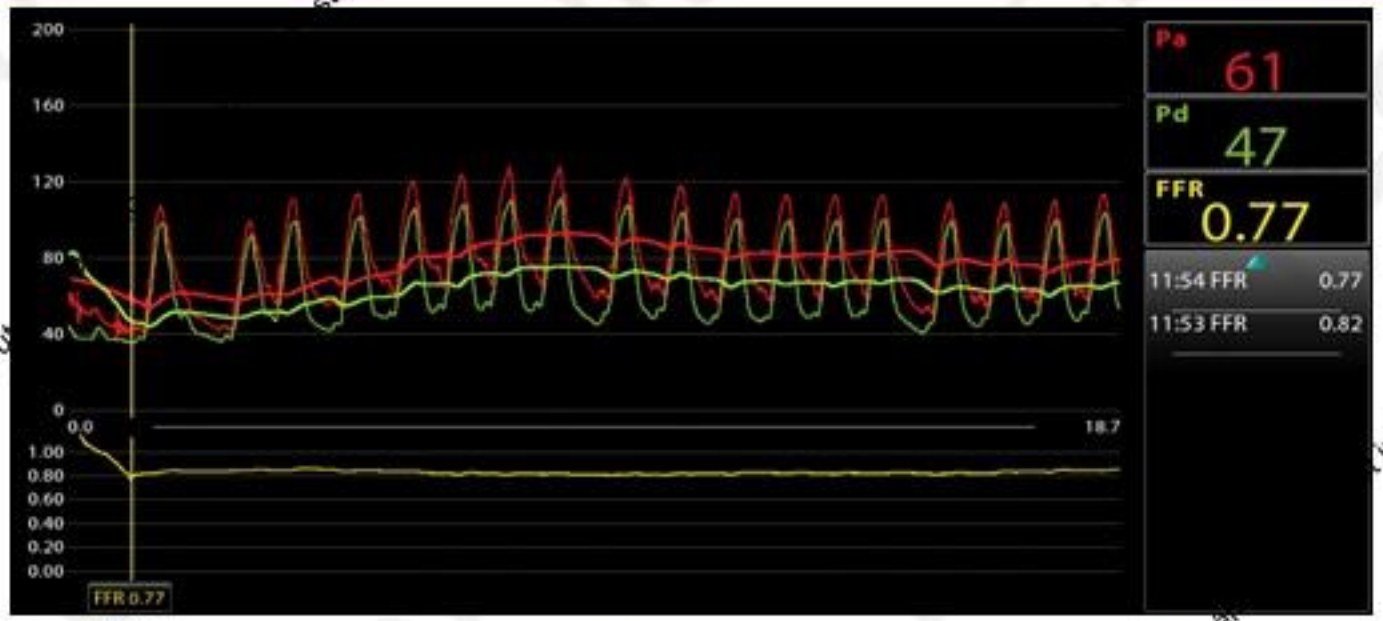
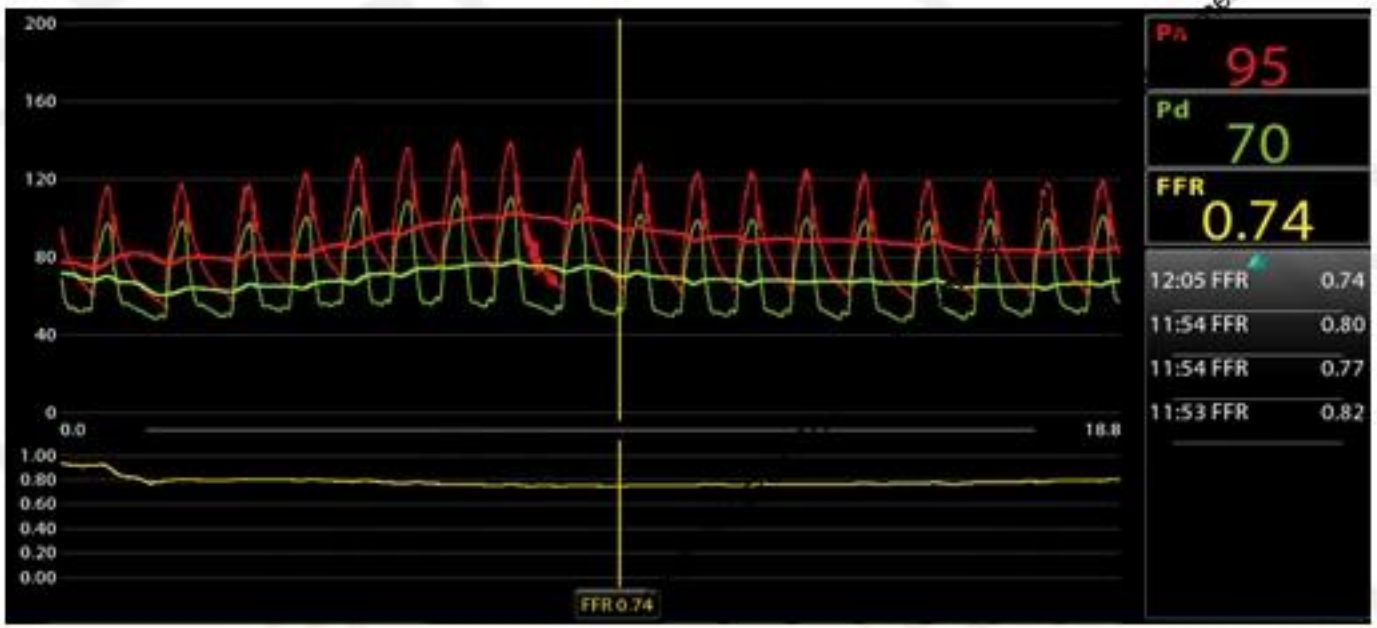
CD



TC



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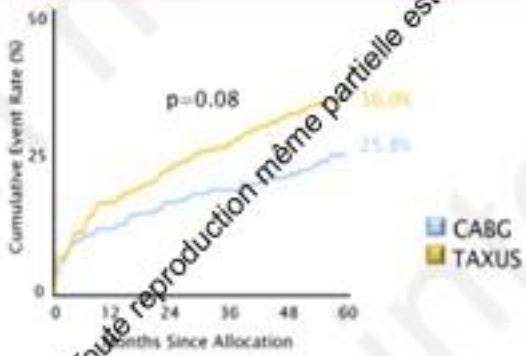

The cumulative MACCE rate is displayed for the SYNTAX Trial group this score corresponds

SYNTAX Score I

Lesion 1

segment number(s)	
(segment 2): 1x2=	2
(segment 4): 1x2=	2
(segment 5): 5x2=	10
(segment 9a): 1x2=	2
(segment 11): 1.5x2=	3
(segment 12b): 1x5=	5
Age T.O. is yes	1
+ Blunt stump	1
Sub total lesion 1	*26*

Diffuse disease/Small vessels

Segment 2	1
Segment 11	1
Sub total diffuse disease/small vessels	*2*

TOTAL: **28**

SYNTAX Score II

SYNTAX II

Decision making -between CABG and PCI- guided by the SYNTAX Score II to be endorsed by the Heart Team.

PCI

SYNTAX Score II:	31.6
PCI 4 Year Mortality:	7.7 %

CABG

SYNTAX Score II:	40.0
CABG 4 Year Mortality:	15.1 %

Treatment recommendation ⓘ*:* *PCI*

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The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 DECEMBER 20, 2012 VOL. 367 NO. 25

Strategies for Multivessel Revascularization in Patients with Diabetes

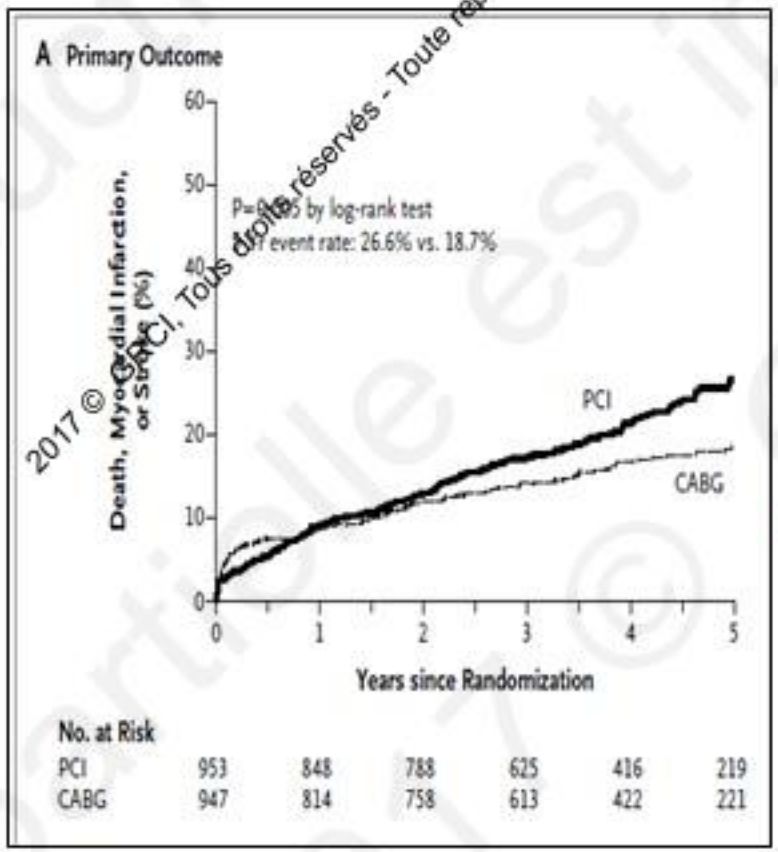

Table 2. Kaplan–Meier Estimates of Key Outcomes at 2 Years and 5 Years after Randomization.

Outcome	2 Years after Randomization		5 Years after Randomization		Patients with Event		P Value*
	PCI	CABG	PCI	CABG	PCI	CABG	
	number (percent)				*number*		
Primary composite†	121 (13.0)	108 (11.9)	200 (26.6)	146 (18.7)	205	147	0.005‡
Death from any cause	62 (6.7)	57 (6.3)	114 (16.3)	83 (10.9)	118	86	0.049
Myocardial infarction	62 (6.7)	42 (4.7)	98 (13.8)	48 (6.0)	99	48	<0.001
Stroke	14 (1.5)	24 (2.7)	20 (2.4)	37 (5.2)	22	37	0.03§
Cardiovascular death	9 (0.9)	12 (1.3)	73 (10.9)	52 (6.8)	75	55	0.12

* P values were calculated with the use of the log-rank test on the basis of all available follow-up data (i.e., more than 5 years).
† The primary composite outcome was the rate of death from any cause, myocardial infarction, or stroke.
‡ P=0.006 in the as-treated (non–intention-to-treat) analysis.
§ P=0.16 by the Wald test of the Cox regression estimate for study-group assignment in 1712 patients after adjustment for the average glucose level after the procedure.

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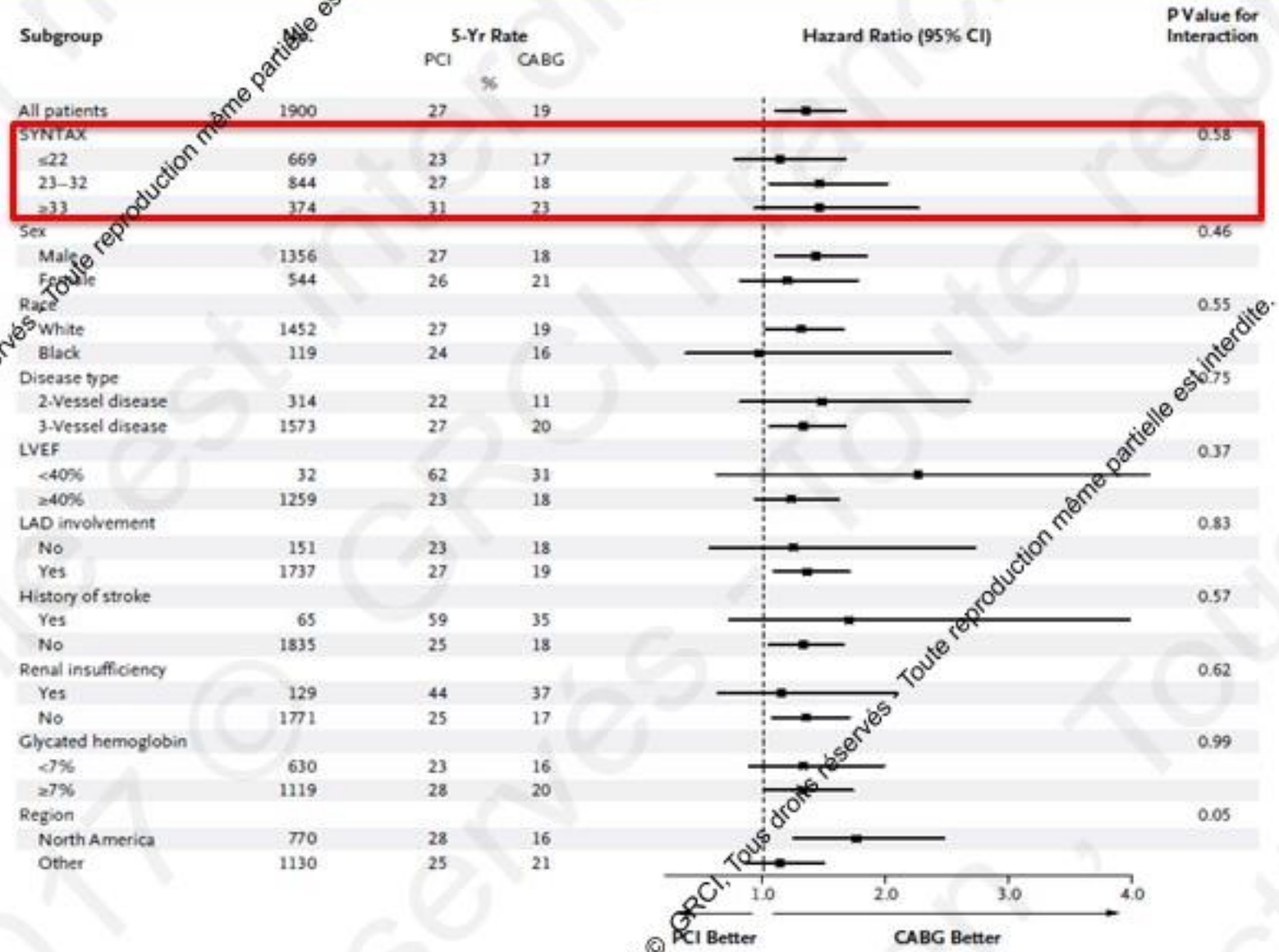
the FREEDOM Trial.N Engl J Med 2012;367:2375-84



Subgroup	No.	5-Yr Rate PCI %	5-Yr Rate CABG %	P Value for Interaction
All patients	1900	27	19	
SYNTAX				0.58
≤22	669	23	17	
23–32	844	27	18	
≥33	374	31	23	
Sex				0.46
Male	1356	27	18	
Female	544	26	21	
Race				0.55
White	1452	27	19	
Black	119	24	16	
Disease type				0.75
2-Vessel disease	314	22	11	
3-Vessel disease	1573	27	20	
LVEF				0.37
<40%	32	62	31	
≥40%	1259	23	18	
LAD involvement				0.83
No	151	23	18	
Yes	1737	27	19	
History of stroke				0.57
Yes	65	59	35	
No	1835	25	18	
Renal insufficiency				0.62
Yes	129	44	37	
No	1771	25	17	
Glycated hemoglobin				0.99
<7%	630	23	16	
≥7%	1119	28	20	
Region				0.05
North America	770	28	16	
Other	1130	25	21	

the FREEDOM Trial. N Engl J Med 2012;367:2375-84

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Specific recommendations for revascularization in patients with diabetes

Recommendations	Class[a]	Level[b]	Ref[c]
In patients presenting with STEMI, primary PCI is recommended over fibrinolysis if it can be performed within recommended time limits.	I	A	363
In patients with NSTE-ACS, an early invasive strategy is recommended over non-invasive management.	I	A	180,338, 364–366
In stable patients with multivessel CAD and/or evidence of ischaemia, revascularization is indicated in order to reduce cardiac adverse events.	I	B	93,367
In patients with stable multivessel CAD and an acceptable surgical risk, CABG is recommended over PCI.	I	A	106,175,349
In patients with stable multivessel CAD and SYNTAX score ≤22, PCI should be considered as alternative to CABG.	IIa	B	346,350
New-generation DES are recommended over BMS.	I	A	351,352
Bilateral mammary artery grafting should be considered.	IIa	B	368
In patients on metformin, renal function should be carefully monitored for 2 to 3 days after coronary angiography/PCI.	I	C	

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- Comment bien évaluer une sténose du tronc?
- Qui dilater d'une sténose du tronc?
- ***Comment « bien » dilater une sténose du tronc?***

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Fractal geometry of arterial coronary bifurcations: a quantitative coronary angiography and intravascular ultrasound analysis

Gérard Finet*, MD PhD; Martine Gilard, MD; Béatrice Perrenot, PhD; Gérard Rioufol, MD PhD; Pascal Motreff, MD; Laurence Gavit, PhD; Rémy Prost, PhD

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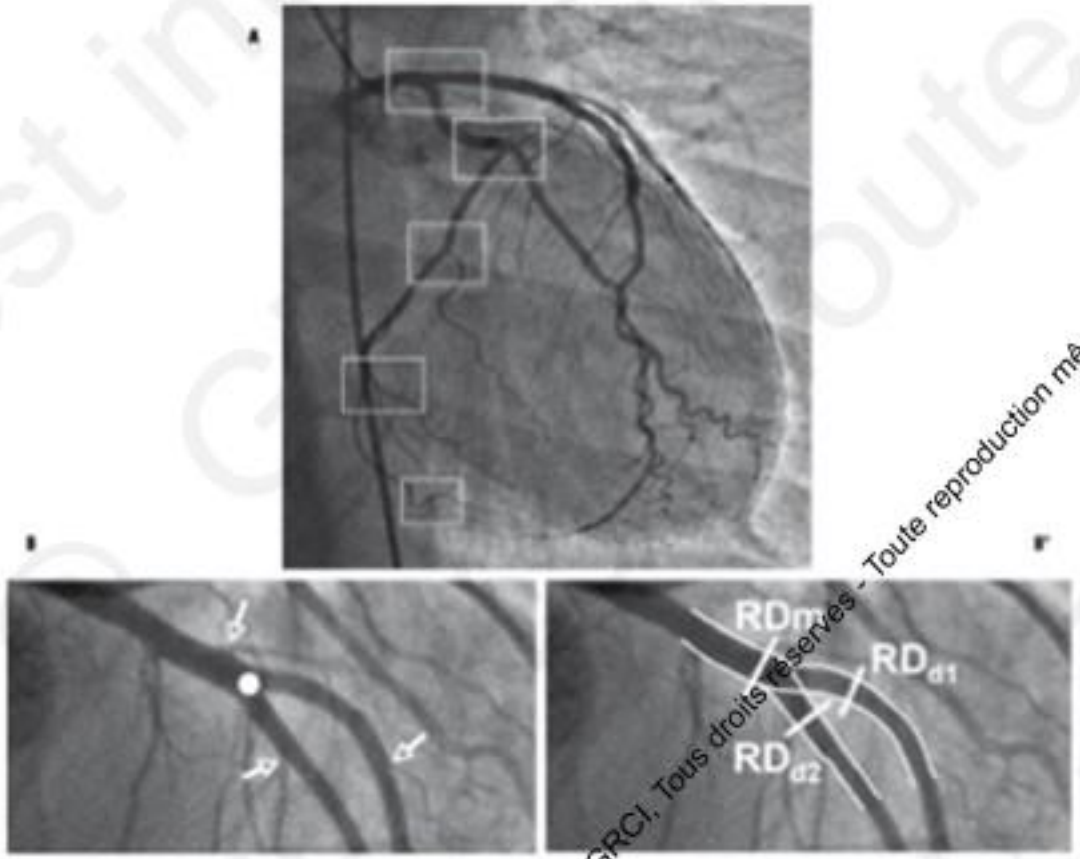

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EuroIntervention 2007;3:490-498 - DOI10.4244/EIJV3I4A87

Table 1. Multi-scale analysis. Quantification of coronary artery bifurcations according to mother-vessel diameter.
Values obtained on quantitative coronary bifurcation angiography.

	For all	$4.5 \leq D_m$	$4 \leq D_m \leq 4.5$	$3.5 \leq D_m \leq 4$	$3 \leq D_m \leq 3.5$	$2.5 \leq D_m \leq 3$	$D_m \leq 2.5$
# of bifurcation	173	21	24	18	43	33	35
D_m (mean±DS)	3.339±0.948	5.195±0.561	4.202±0.143	3.726±0.132	3.192±0.146	2.748±0.119	2.224±0.186
$D_{d\text{-larger}}$ (mean±DS)	2.708±0.774	4.159±0.529	3.334±0.3	3.046±0.338	2.559±0.258	2.312±0.273	1.831±0.226
$D_{d\text{-smaller}}$ (mean±DS)	2.236±0.689	3.476±0.548	2.828±0.333	2.476±0.501	2.027±0.337	1.889±0.241	1.583±0.209
Reduction in mm (mean±DS)	0.631±0.365	1.036±0.538	0.868±0.333	0.681±0.321	0.633±0.246	0.436±0.245	0.394±0.154
% reduction	18.9	19.93	20.64	18.26	19.84	15.86	17.72
Mean ratio	0.678	0.6846	0.6865	0.685	0.7019	0.6595	0.656
±DS	0.0665	0.0632	0.0655	0.0827	0.066	0.058	0.059

$$D_{Vx\ principal} = 0.67 * (D_{br\ mère} + D_{br\ fille})$$

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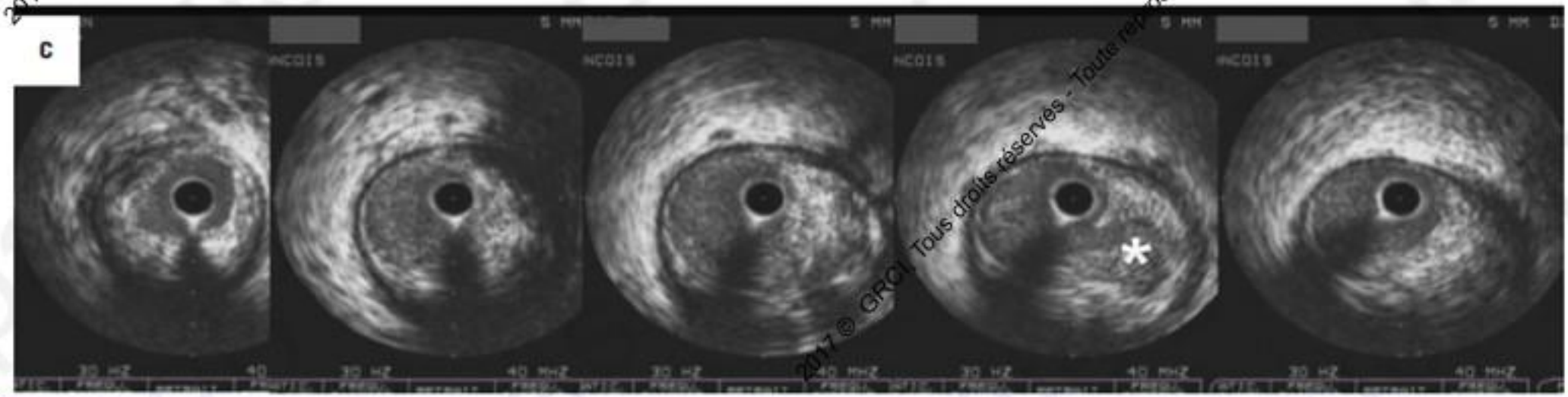
D_{mother} measured	2.2 mm
$D_{daughter1}$ measured	3.1 mm
$D_{daughter2}$ measured	3.2 mm
Expected D_{mother} (fractal ratio)	4.2 mm
Expected %D stenosis	50%



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Provisional T-strategy

Unprotected Left Main Stenting in the Real World
Two-Year Outcomes of the French Left Main Taxus Registry

Beatriz Vaquerizo, MD; Thierry Lefèvre, MD; Olivier Darremont, MD; Marc Silvestri, MD; Yves Louvard, MD; Jean Louis Leymarie, MD; Philippe Garot, MD; Helen Routledge, MD; Federico de Marco, MD; Thierry Unterseeh, MD; Marcel Zwahlen, PhD; Marie-Claude Morice, MD

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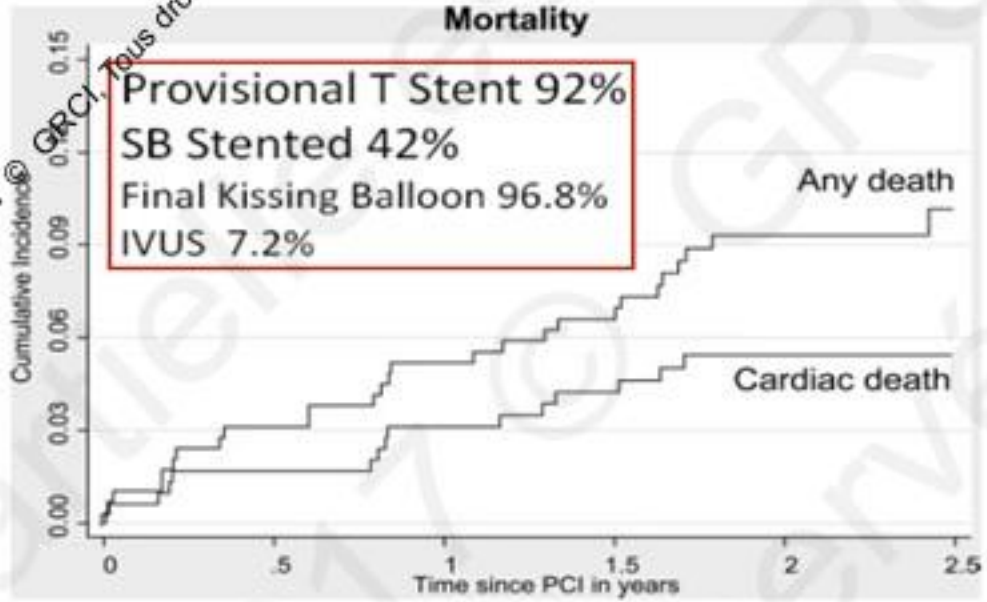

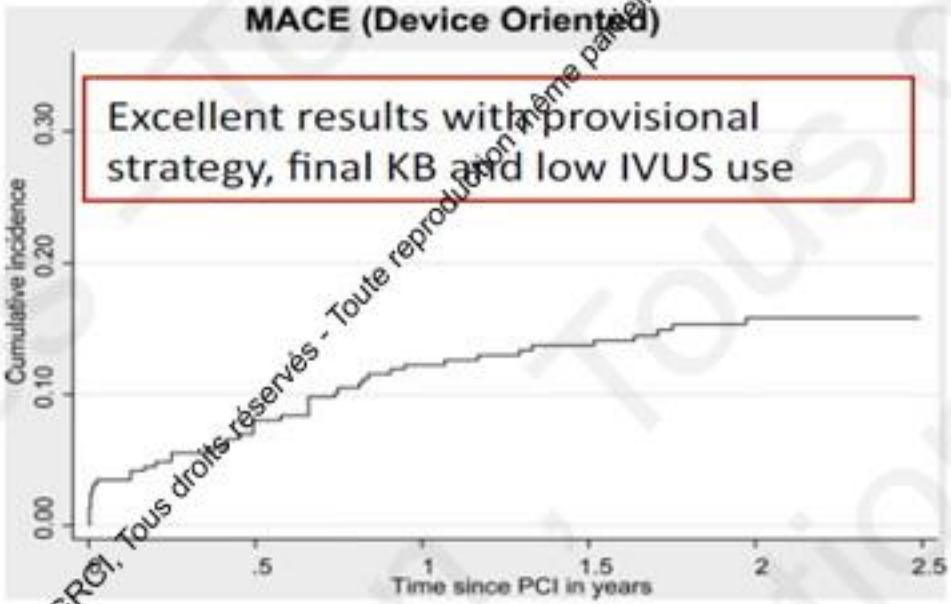

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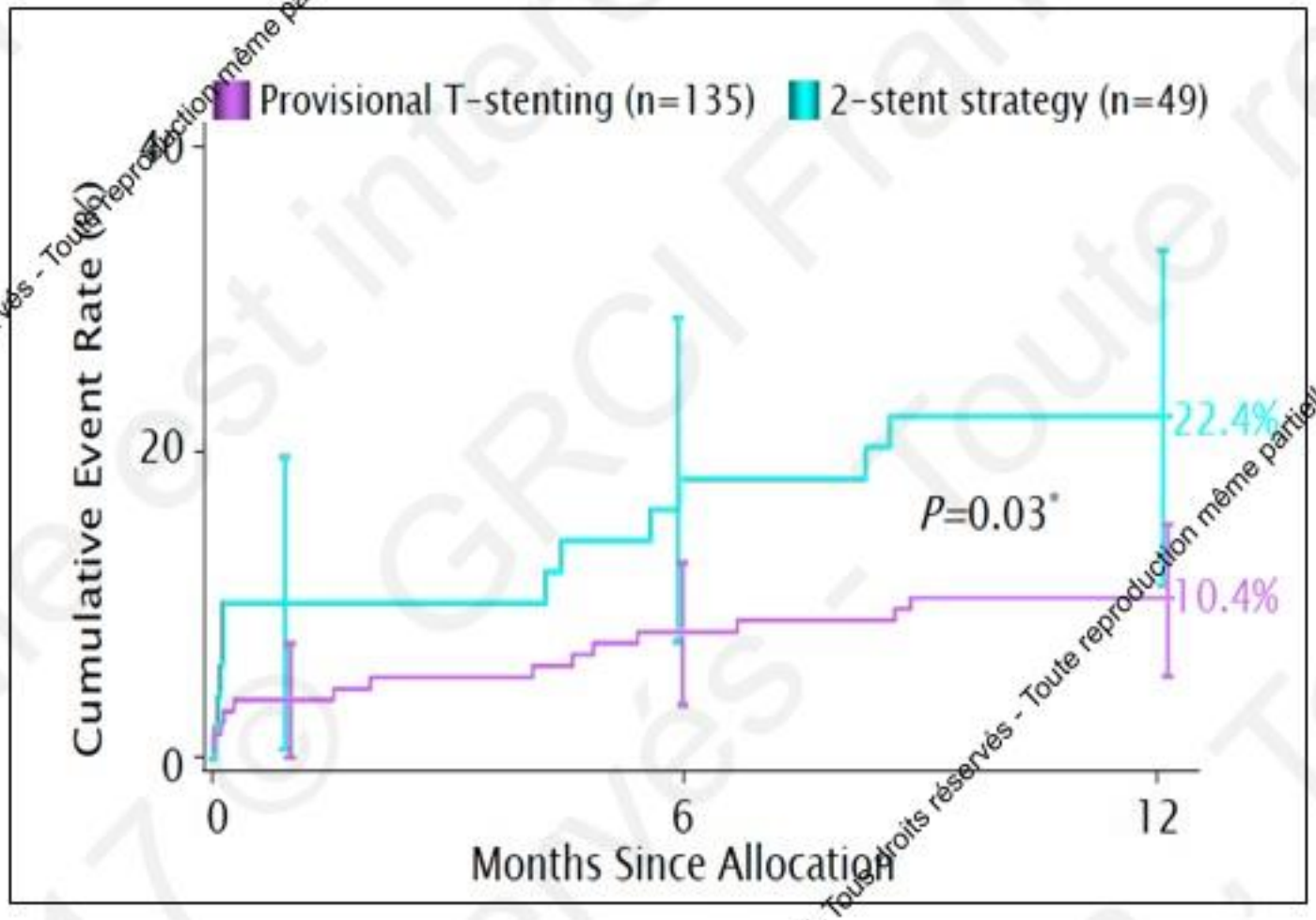
Circulation. 2009;119:2349-2356



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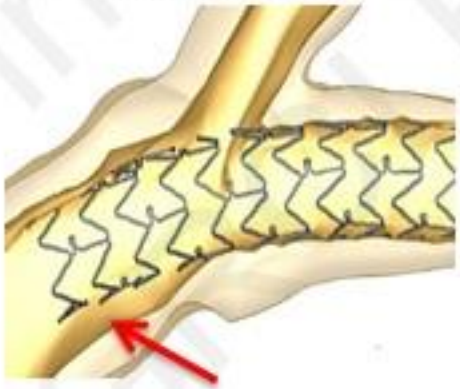
N Engl J Med 2009;360:961-720

POURQUOI FAIRE UN POT (Proximal Optimisation Technique)?

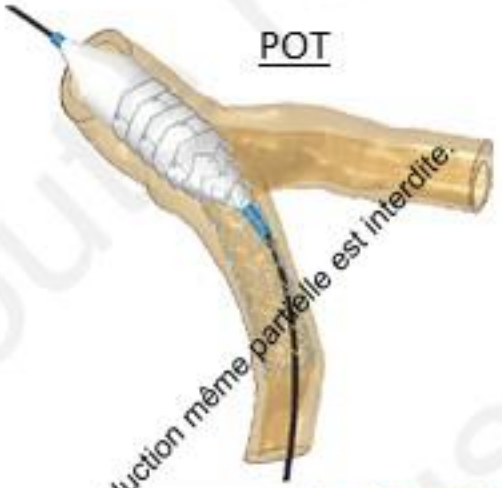
-Meilleure apposition proximale: on adapte le stent à l'anatomie
-Eviter de refranchir sous le stent
-Faciliter le refranchissement distal

Déploiement du stent

Après stenting



POT



Kissing final

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CAS CLINIQUE 2

- Homme 71 ans
- Clairance créatinine 62
- AAA 33 mm (2016)
  Tabac 10 PA sevré
  Diabète 2 modéré
  HTA
- Stent iliaque gauche
- Coronarographie pour échographie de stress positive en inférieur en pré-opératoire de chirurgie vasculaire
- FEVG normale

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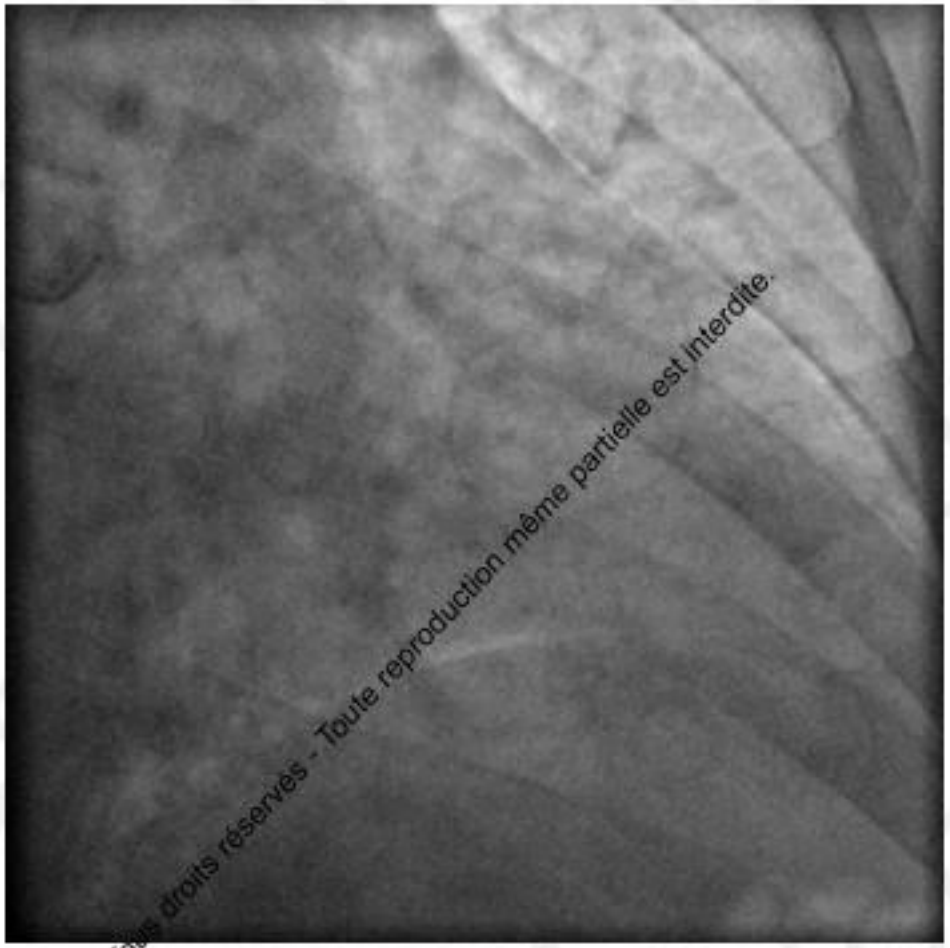

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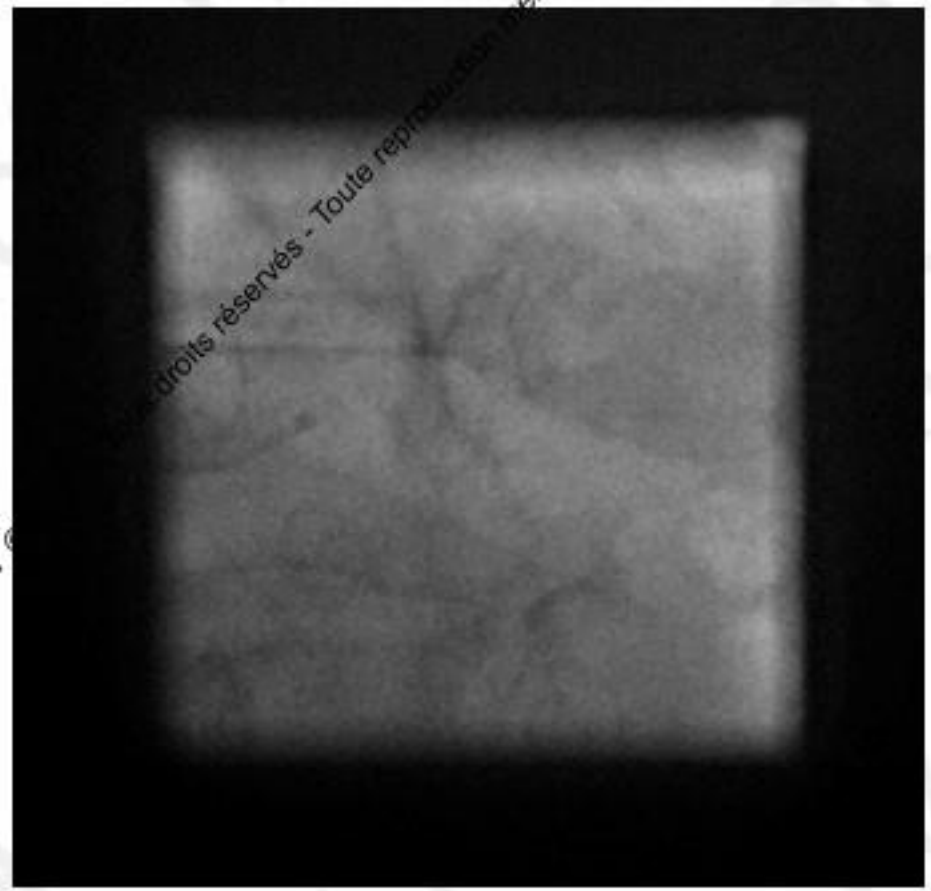

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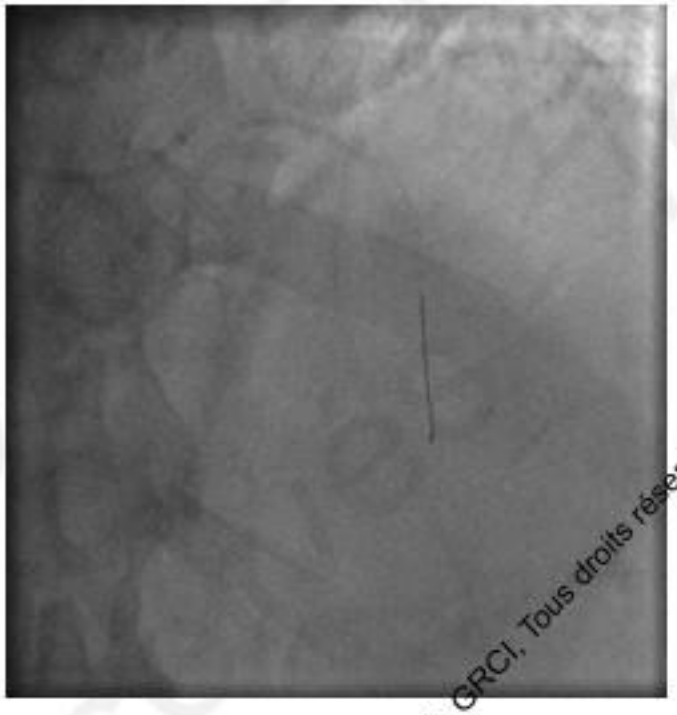

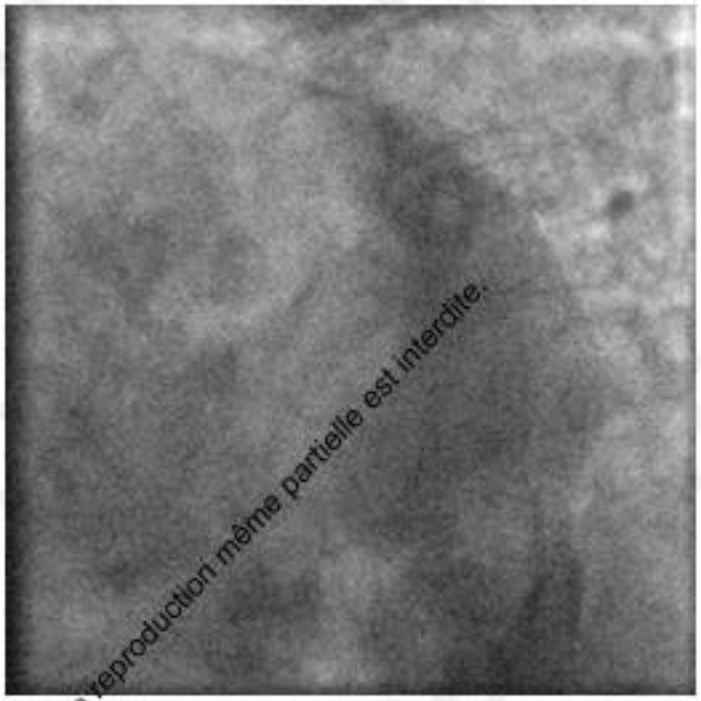

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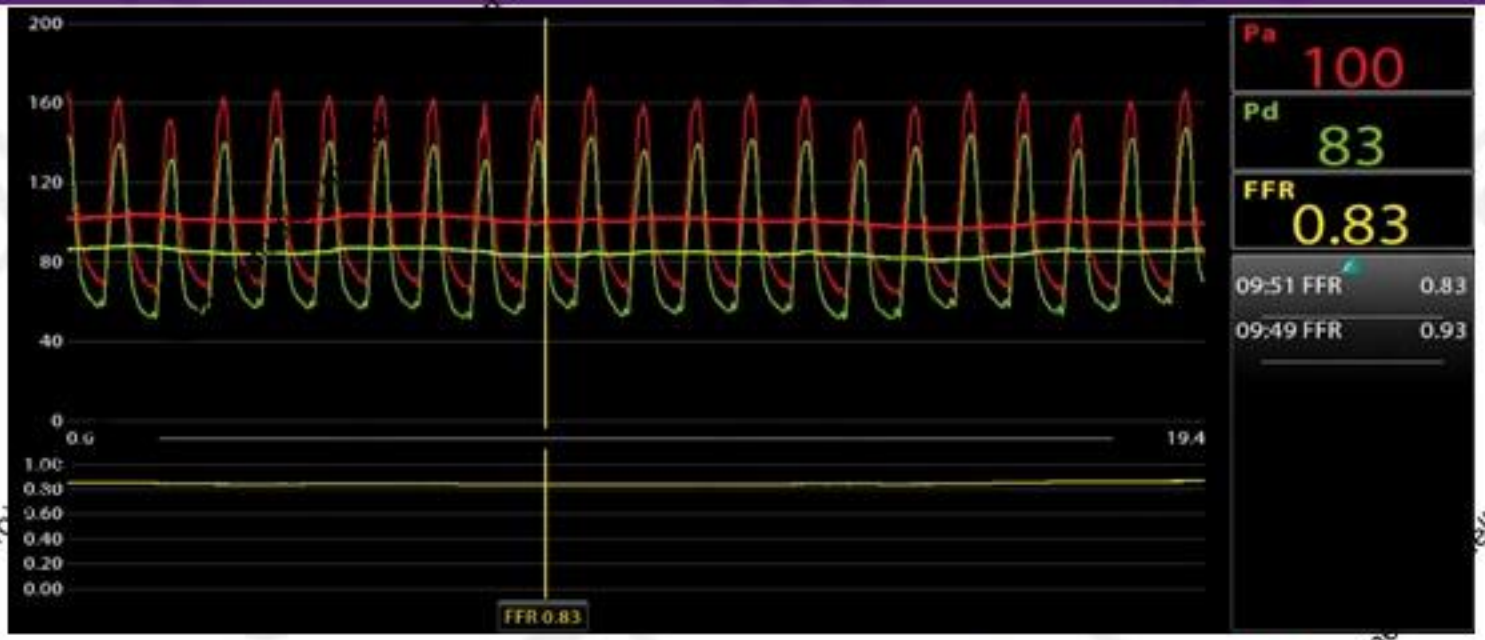
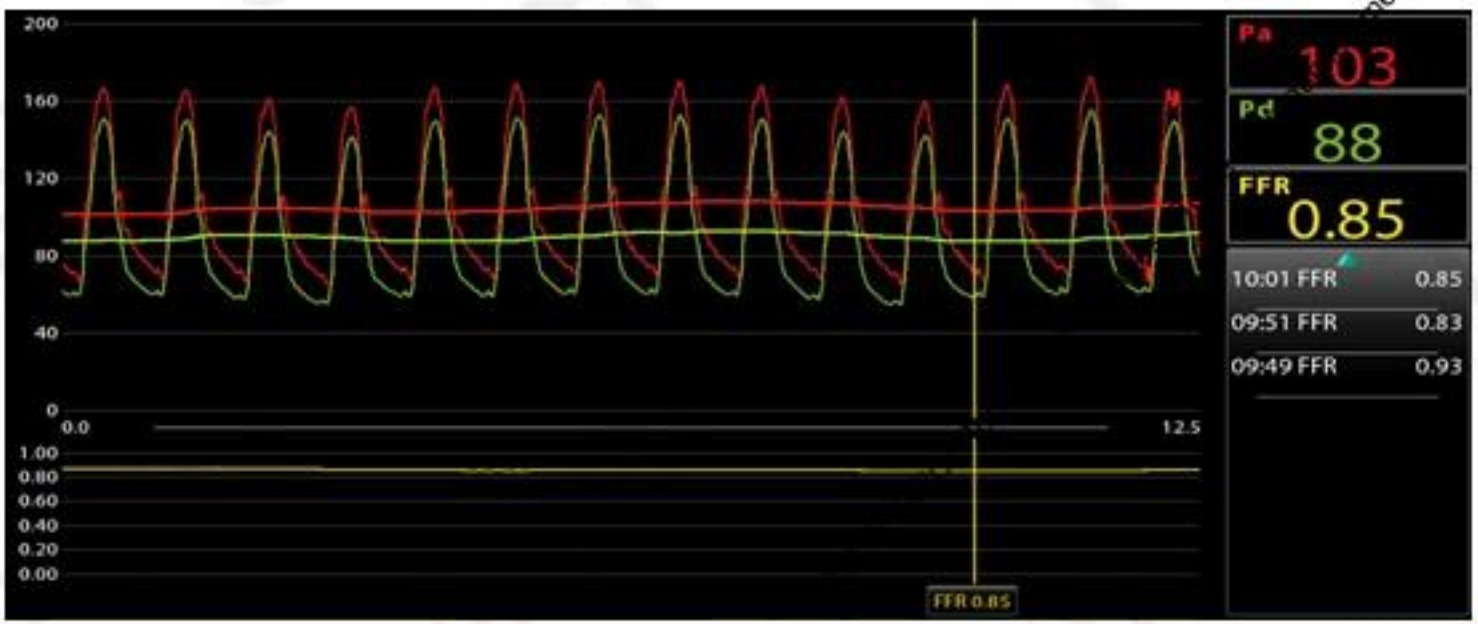
Cx



IVA



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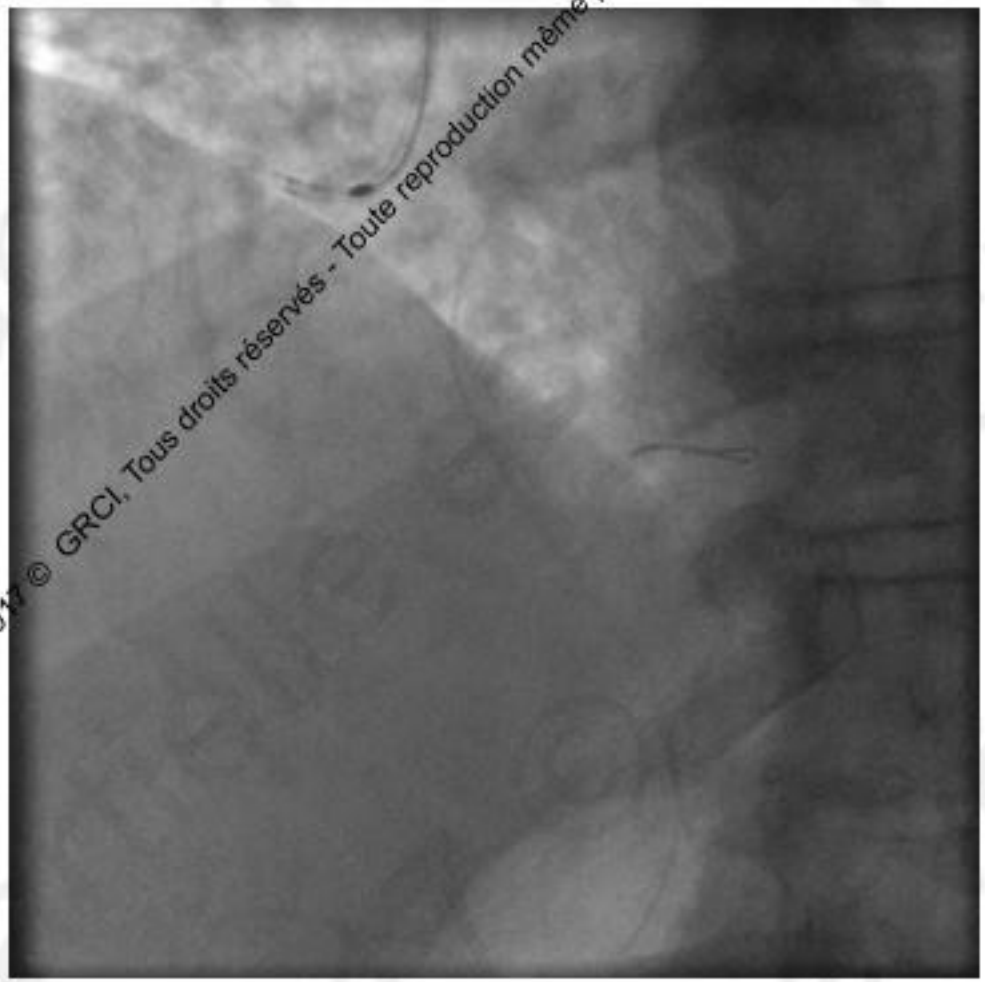

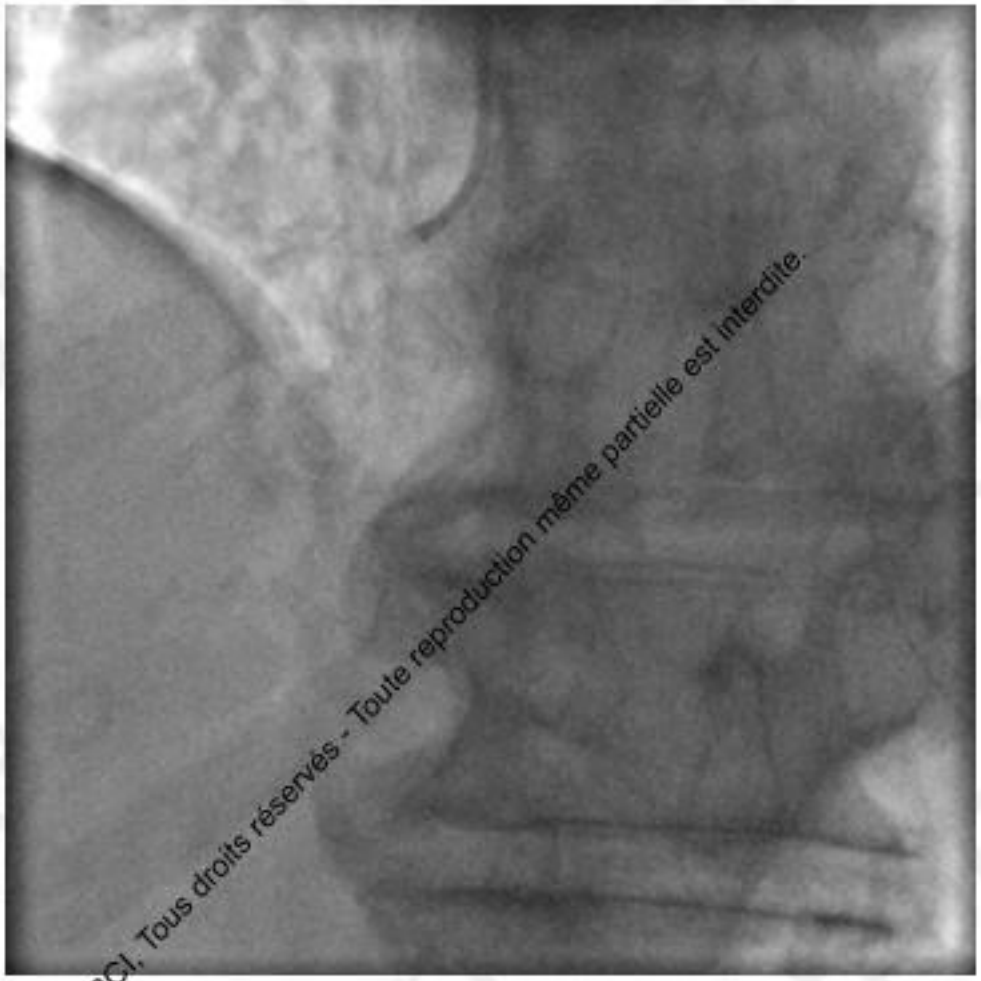

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TAKE HOME MESSAGE

- Problèmes et limites de l'évaluation angiographique *seule* du TC
- Pas d'angioplastie du TC sans évaluation IVUS et/ou FFR
- Diamètre Branche mère=0.67x (Diamètre fille 1+Diamètre fille 2)
- Angioplastie possible avec Syntax score ≤ 22. Intérêt Syntax score II?
- Technique de Provisional T stenting avec POT
- Stenting actif si pas de CI pour bithérapie AP prolongée
- Discussion en « Heart Team »
- Pas d'angioplastie Ad Hoc!!! (Hors contexte de SCA…)

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