LE TRONC COMMUN DANS TOUS SES ETATS

QUELLES TECHNIQUES AVEC QUELS OUTILS ?

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CHU TOULOUSE-RANGUEIL

APPAC 06 Juin 2013

Université Paul Sabatier TOULOUSE III

Hôpitaux de Toulouse

Pôle Cardiovasculaire et Métabolique

Aucun conflit d’intérêt

Hôpitaux de Toulouse

Pôle Cardiovasculaire et Métabolique

Localization of the LM Lesion

Ostial-proximal 28 %

Mid-segment 18 %

Distal 69 %

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Pôle Cardiovasculaire et Métabolique

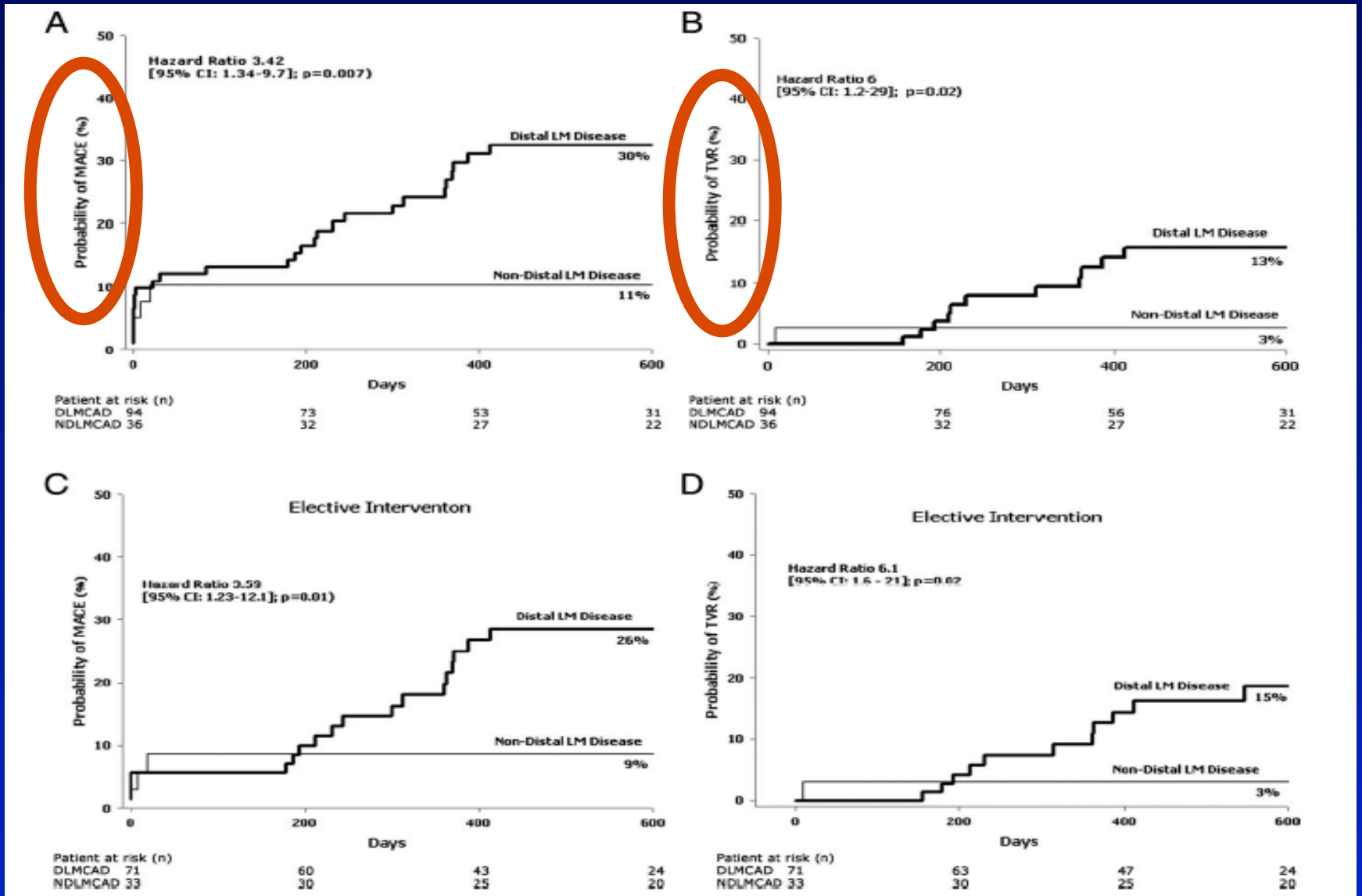

Figure 1. Adverse events in patients treated for distal left main coronary artery (LMCA) disease (DLMD) as compared with patients treated for nondistal LMCA disease (NDLMD). Cumulative risk of major adverse cardiac events (MACE) (A) and target vessel revascularization (TVR) (B) in the whole population, and cumulative risk of MACE (C) and TVR (D) in the elective population.

Valgimigli Jacc 2006

RESTENOSE OSTIALE TCG

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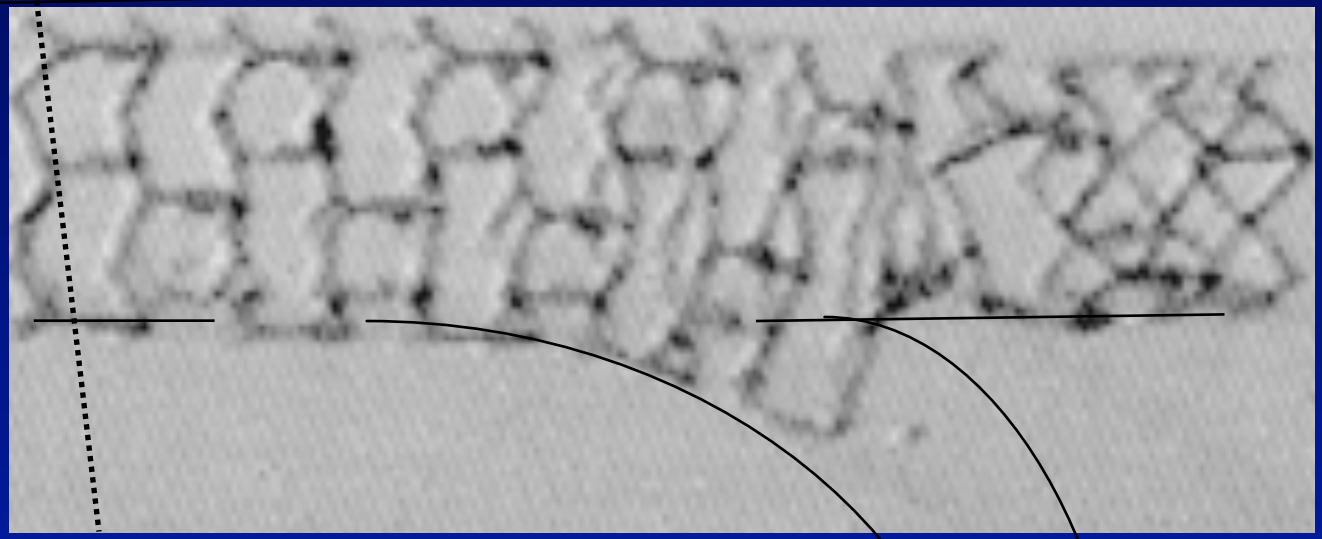
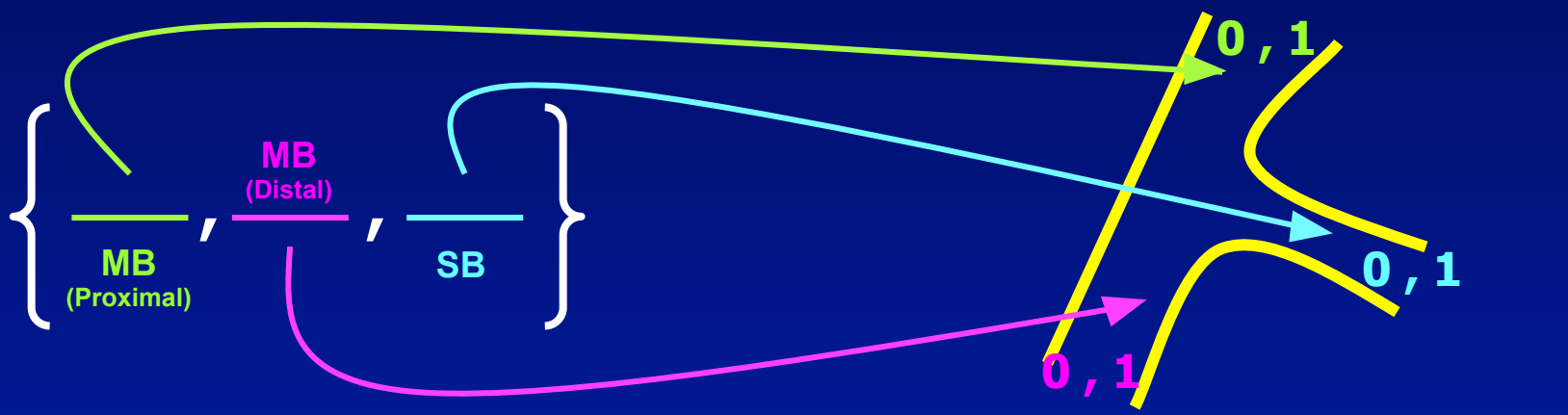
Pôle Cardiovasculaire et Métabolique

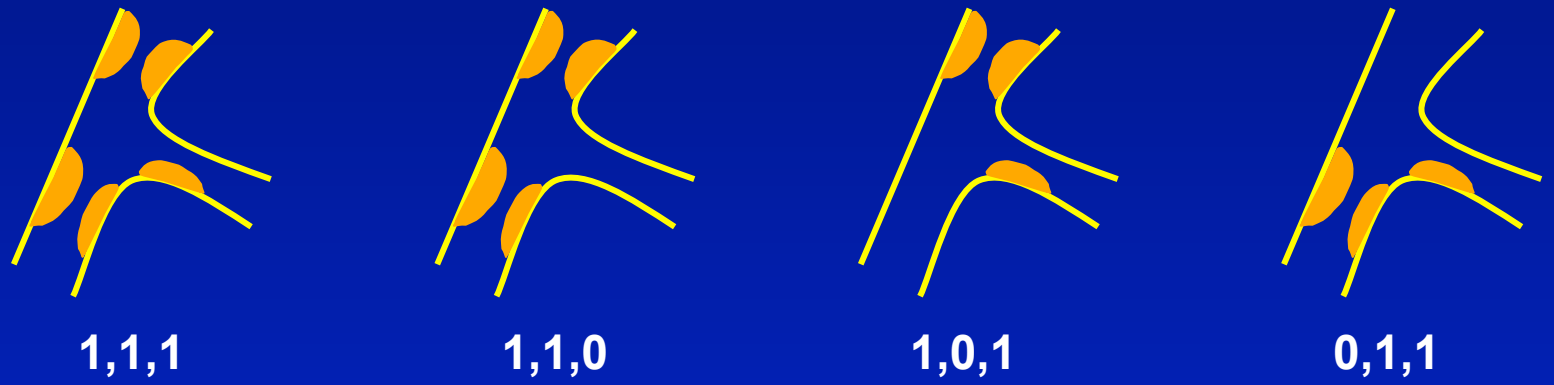
STENTING DU TRONC OSTIAL



Bien dérouler le tronc, Incidence craniale
10 à 20% stent dans l'aorte thoracique
Resténose ostiale +++

Classification de Medina





1,1,1 1,1,0 1,0,1 0,1,1

1,0,0 0,1,0 0,0,1

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Pôle Cardiovasculaire et Métabolique

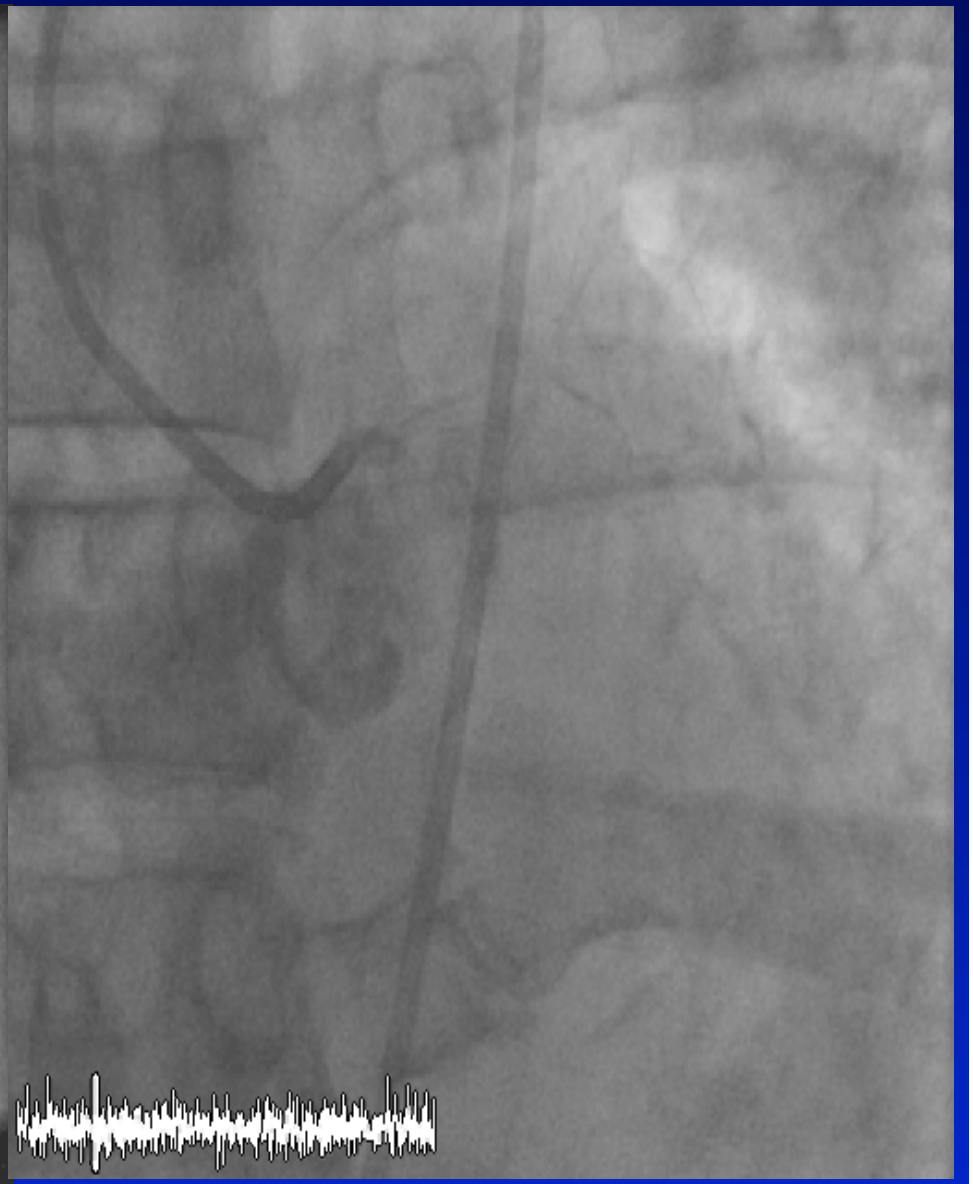
Quelles techniques ?

- ✓ Comment je traite : 1 ou 2 stents?... Simple vs Complexe?
- ✓ Kissing final systématique?
- ✓ Quelle technique si je dois mettre 2 stents?

Mr D. 64 ans

- Détresse respiratoire aigue (polypnée à 40, saturation à 94% sous 15L d'O2 nasal), tachycarde et état de choc (TA systolique < à 75 mmHg)
- Sus décalage ST antérieur étendu
- ETT : akinésie antéro médiane et hypokinésie apicale, FEVG 30% sans complication mécanique.
- Transfert en salle de cathétérisme cardiaque pour coronarographie en urgence.

CD infiltrée sans lésion significative



Occlusion thrombotique du Tronc Commun Gauche
TIMI 0

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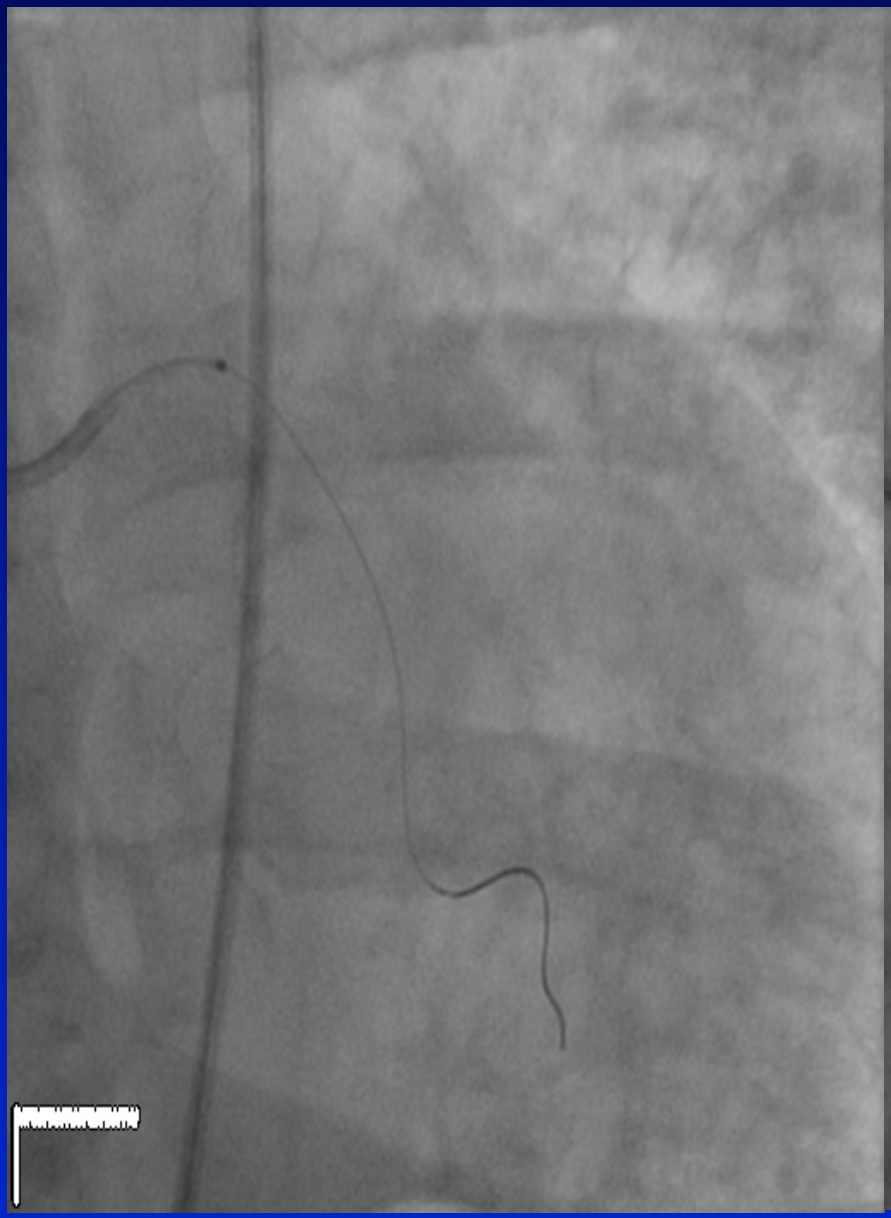
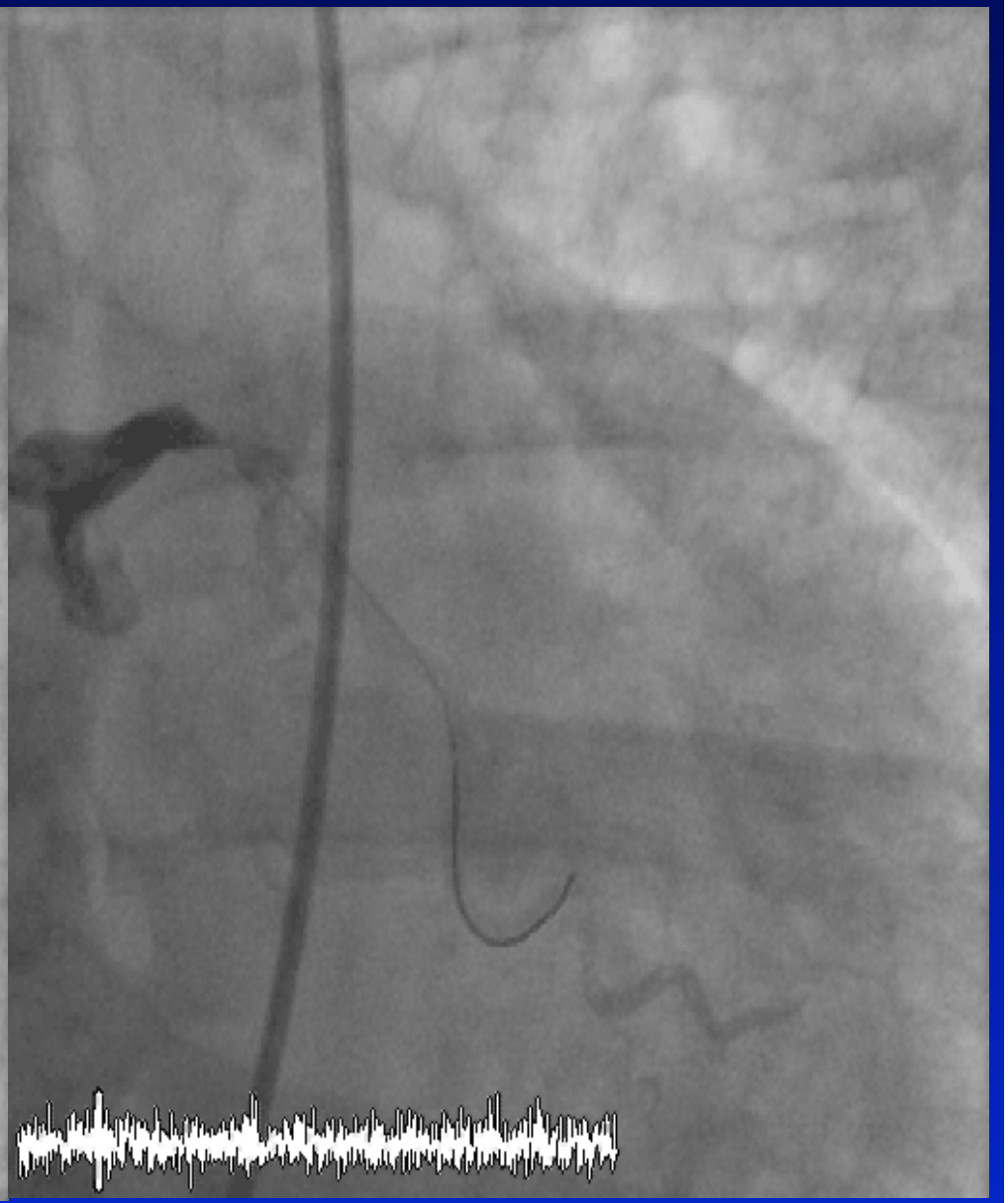
Pôle Cardiovasculaire et Métabolique



Thromboaspiration ver la CX



TIMI 3 dans la CX post thromboaspiration

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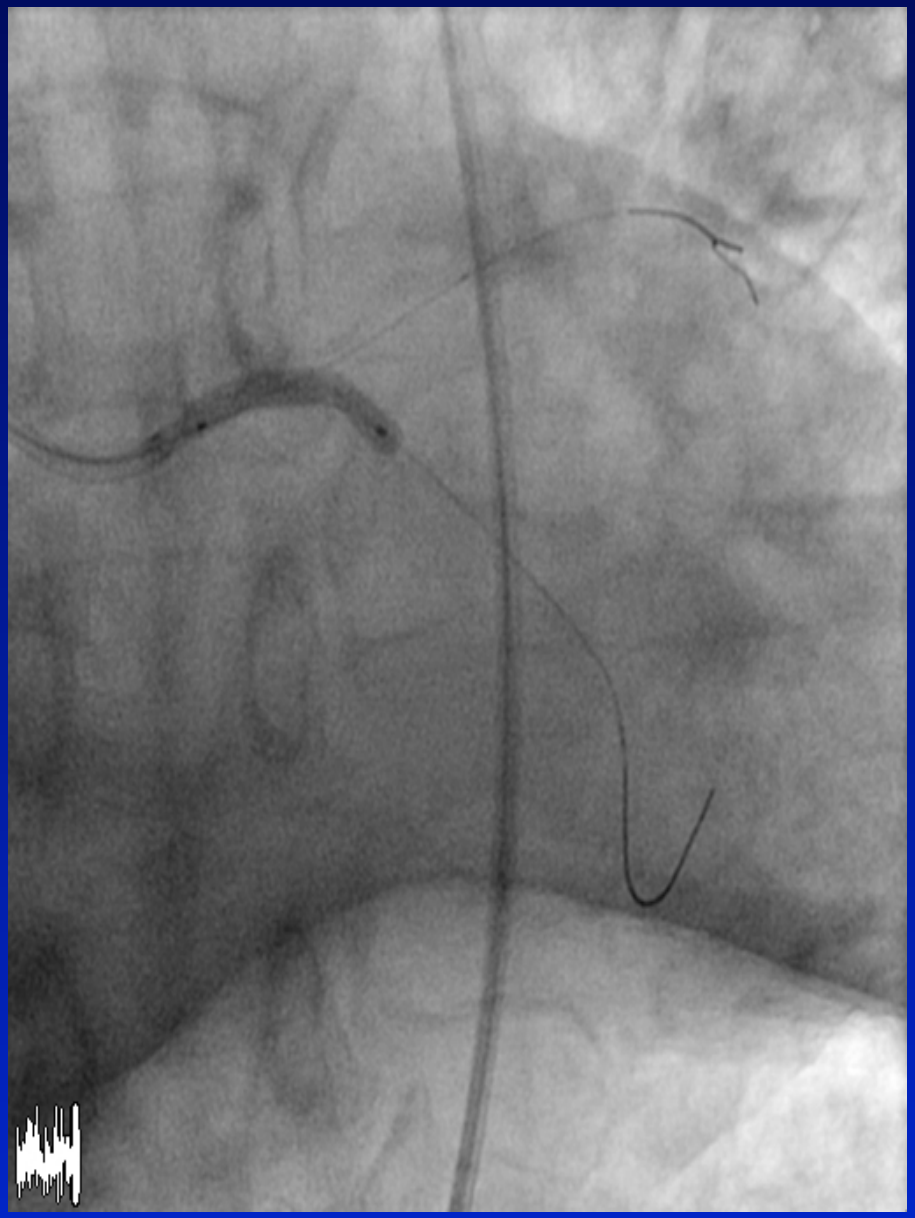
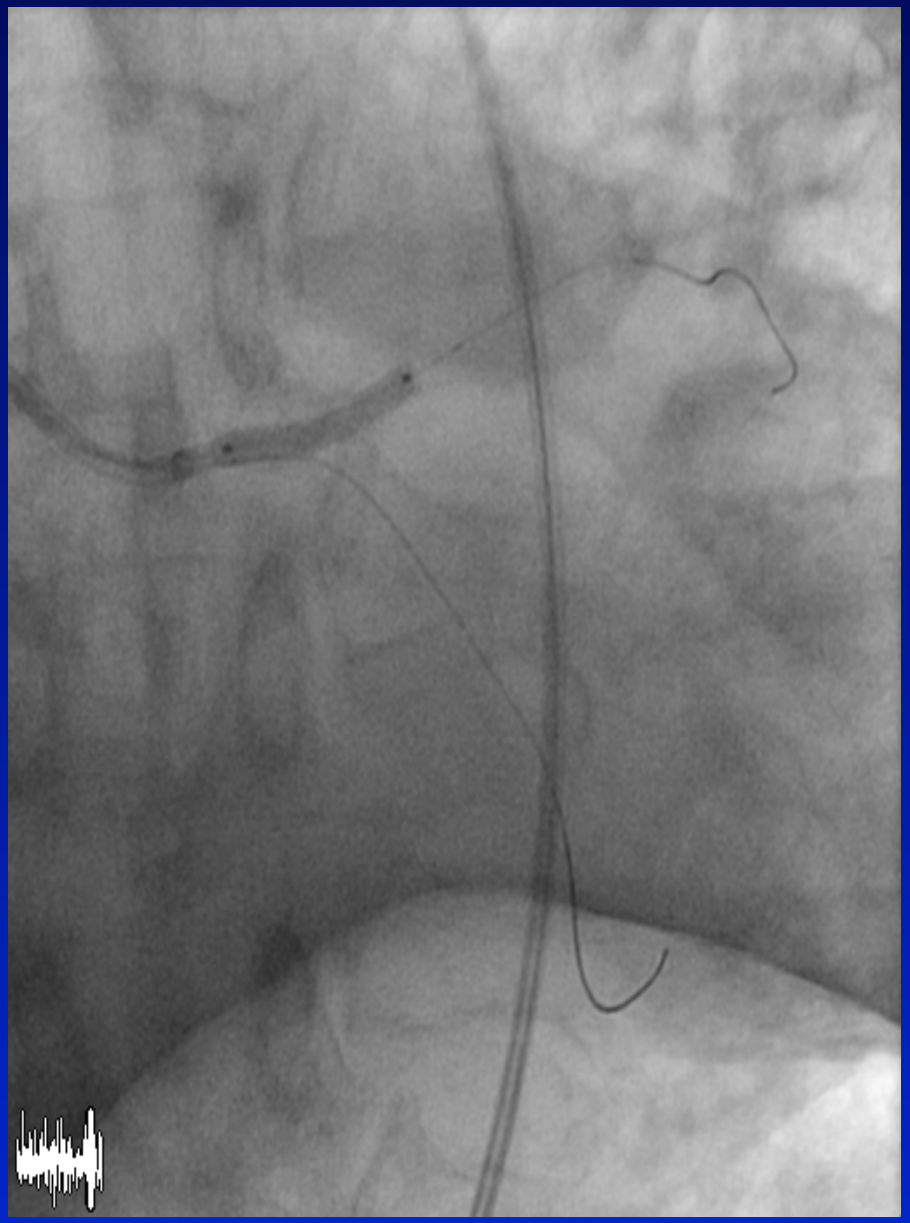
Pôle Cardiovasculaire et Métabolique

La technique des 2 guides
Augmente les Chances de Succès

- ✓ Modifie favorablement l'angle entre les 2 Branches
- ✓ Maintien la branche ouverte
- ✓ Est un bon marqueur en cas d'occlusion
- ✓ Favorise le stenting « provisionnel»



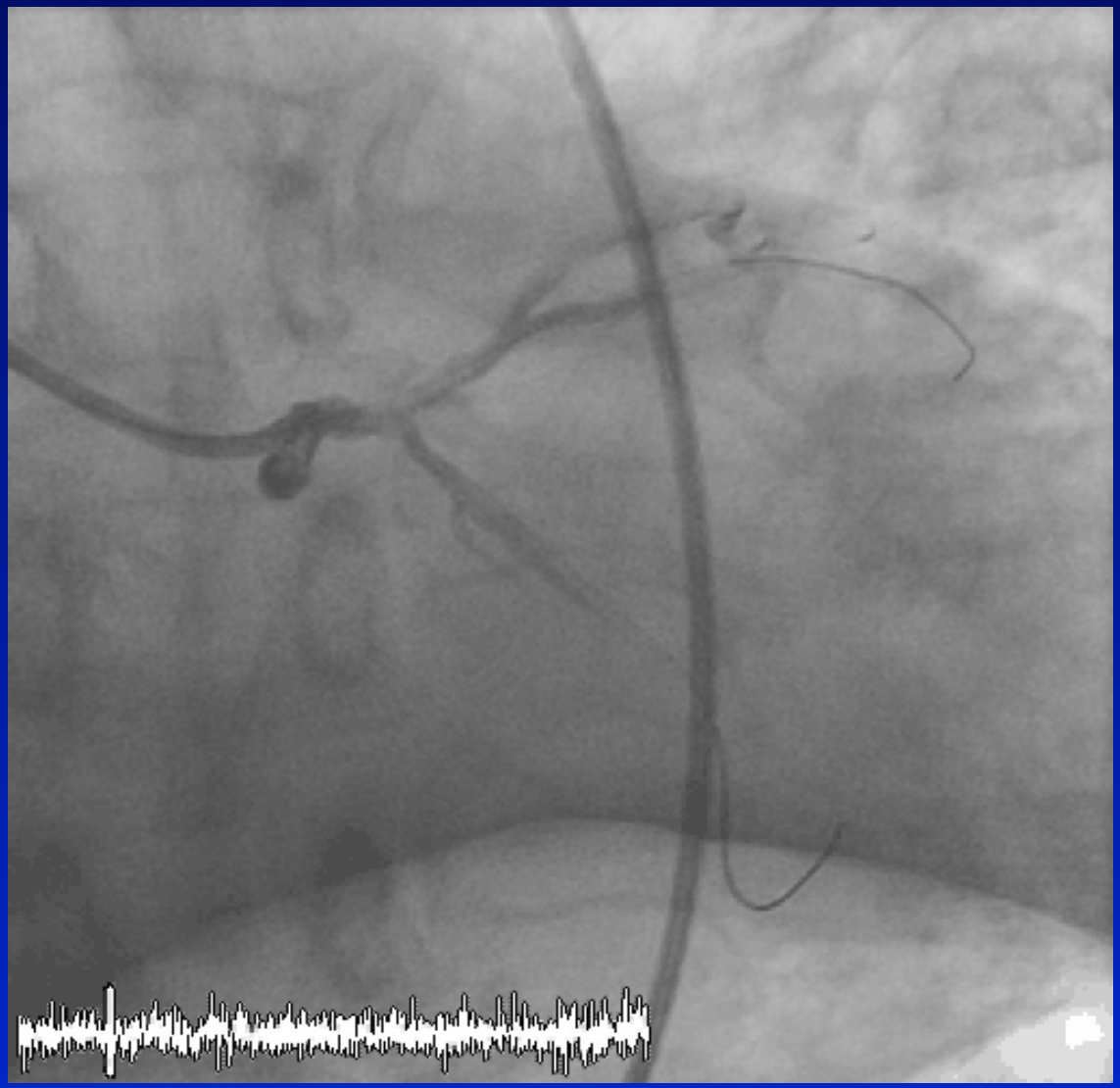
Prédilatation au ballon TCG-CX



Prédilatation au ballon TCG-IVA

Hôpitaux de Toulouse

Pôle Cardiovasculaire et Métabolique



Contrôle post prédilatation

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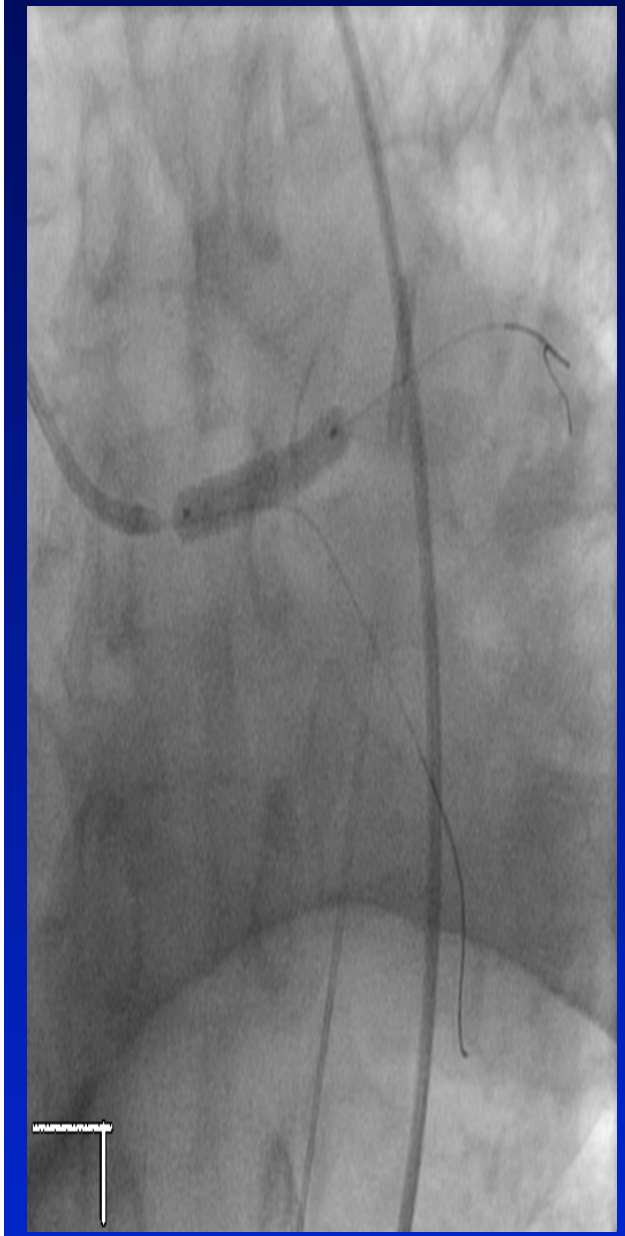
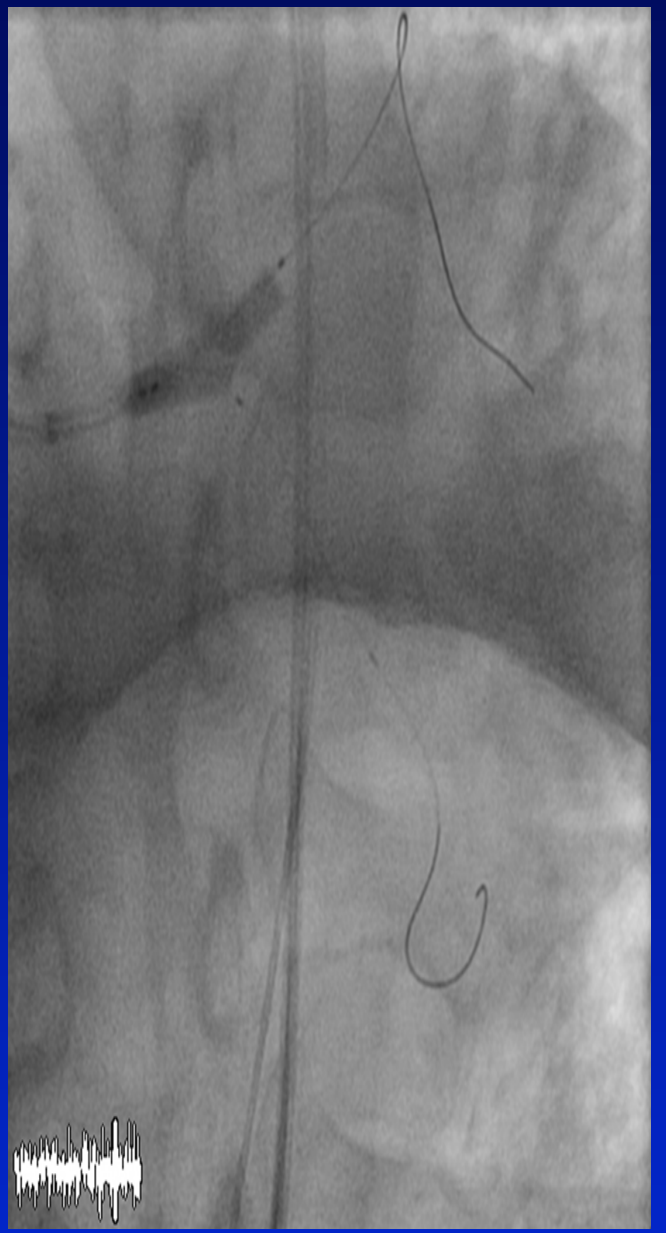
Pôle Cardiovasculaire et Métabolique



Provisional technique stenting
de TCG-IVA par un DES

POT: Proximal Optimisation
Traitement par un ballon NC



Kissing par 2 ballons NC

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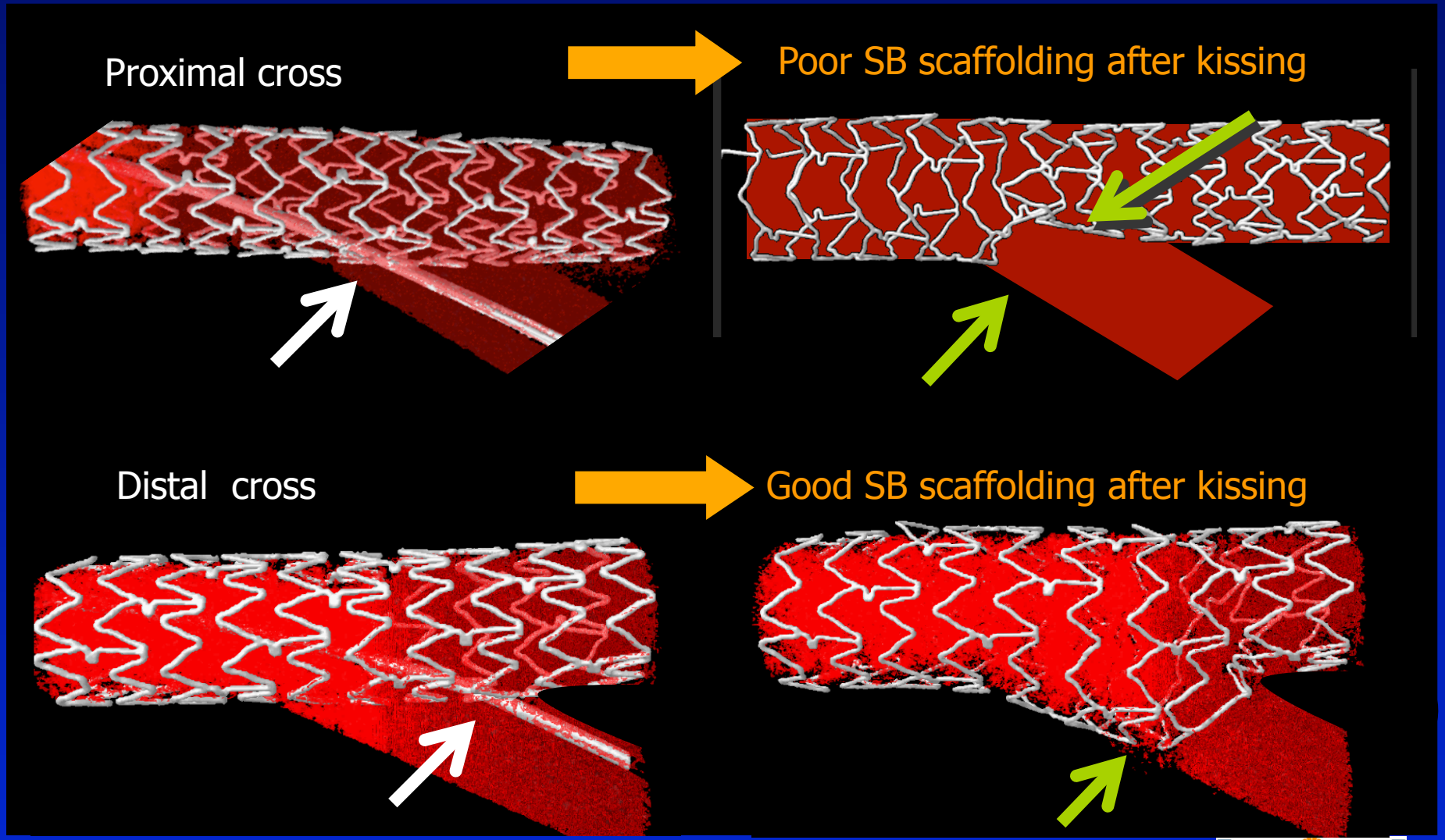
Pôle Cardiovasculaire et Métabolique

Proximal vs. Distal cross & "Kissing b."



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Pôle Cardiovasculaire et Métabolique

Contrôle final

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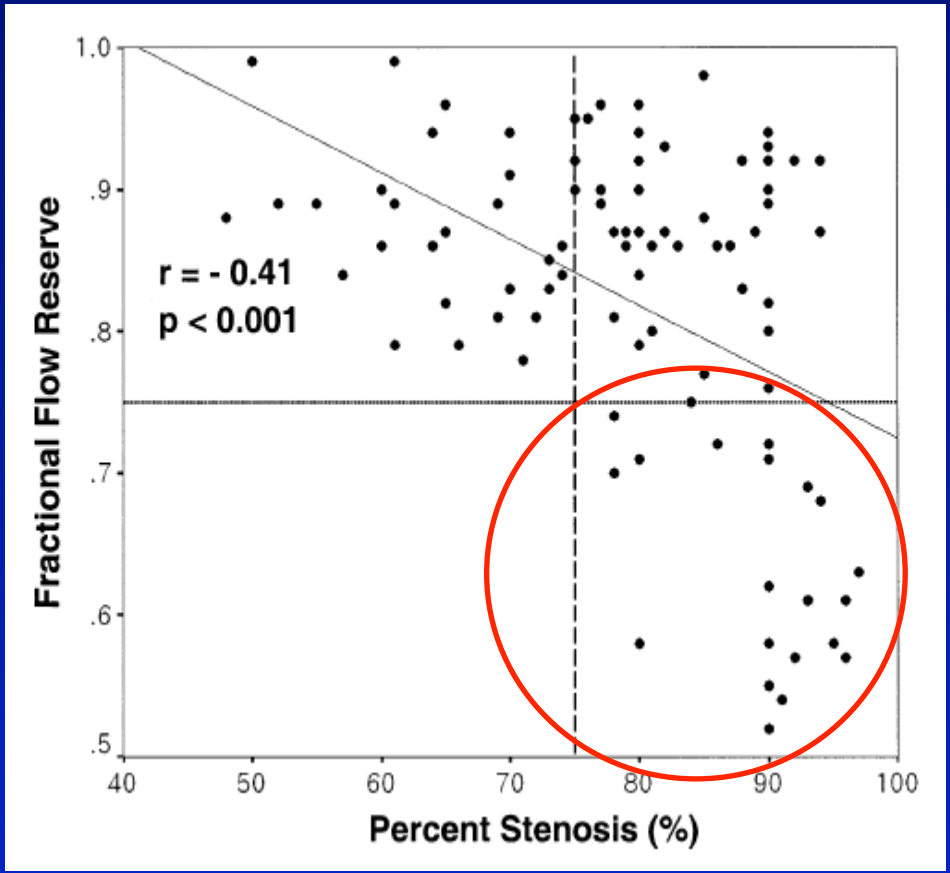
Pôle Cardiovasculaire et Métabolique

Physiologic Assessment of Jailed Side Branch Lesions Using Fractional Flow Reserve



38% of lesions
> 75% stenosis

Bon-Kwon Koo et al JACC 2005; 46: 633-7

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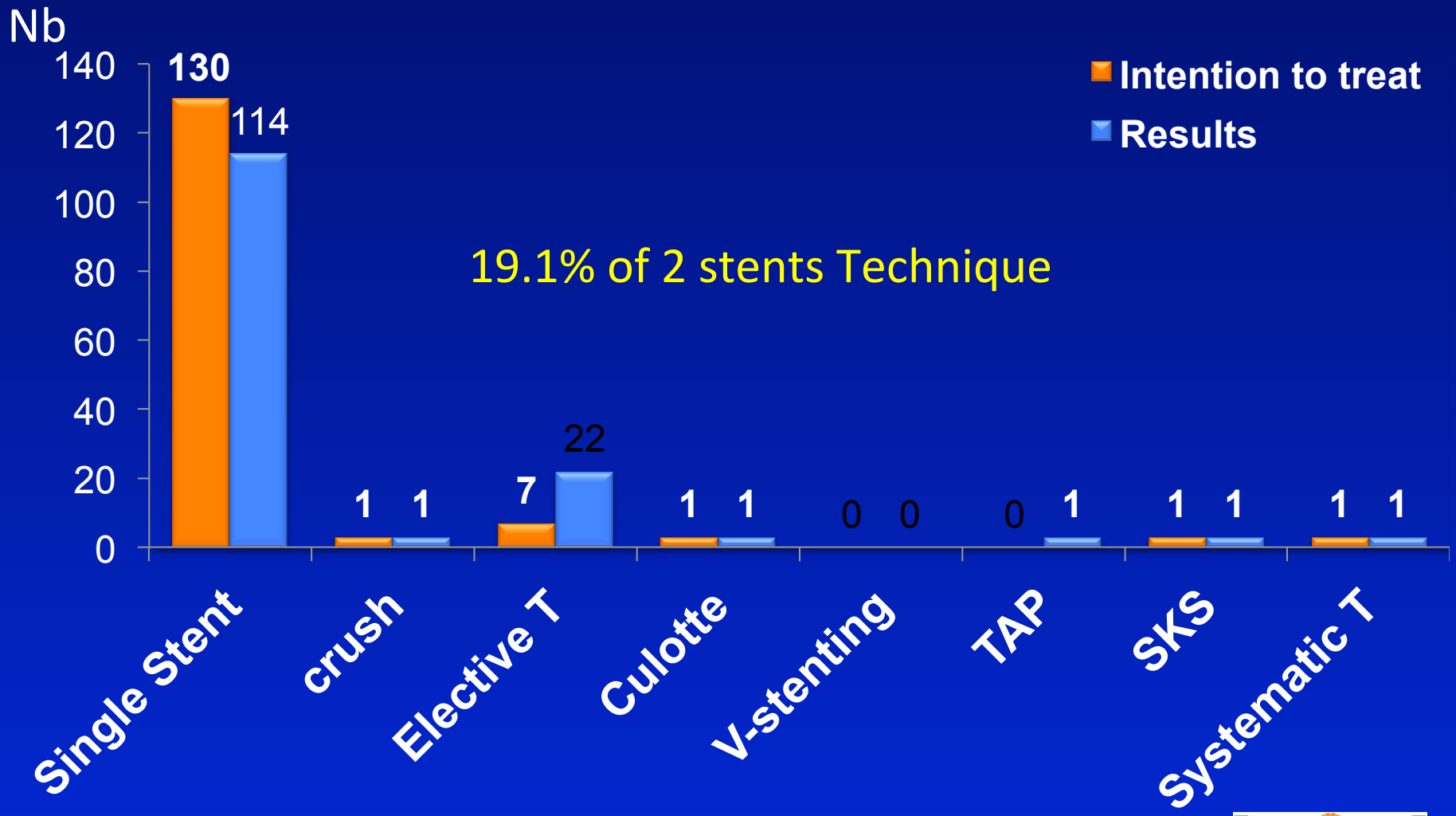
Pôle Cardiovasculaire et Métabolique

Stenting Technique

N=141 distal Left Main



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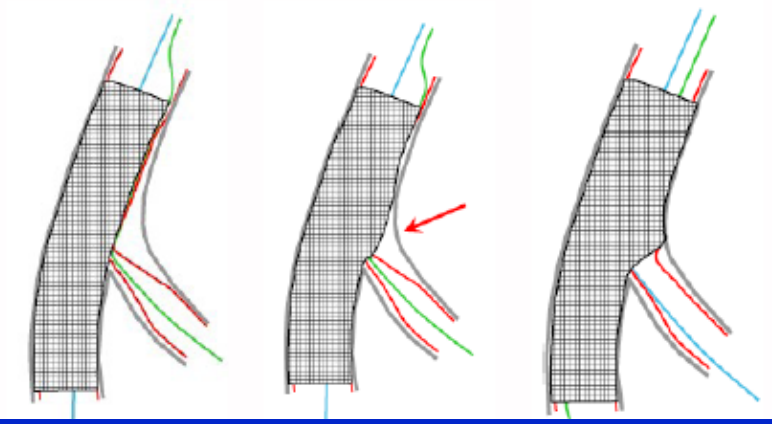
Pôle Cardiovasculaire et Métabolique

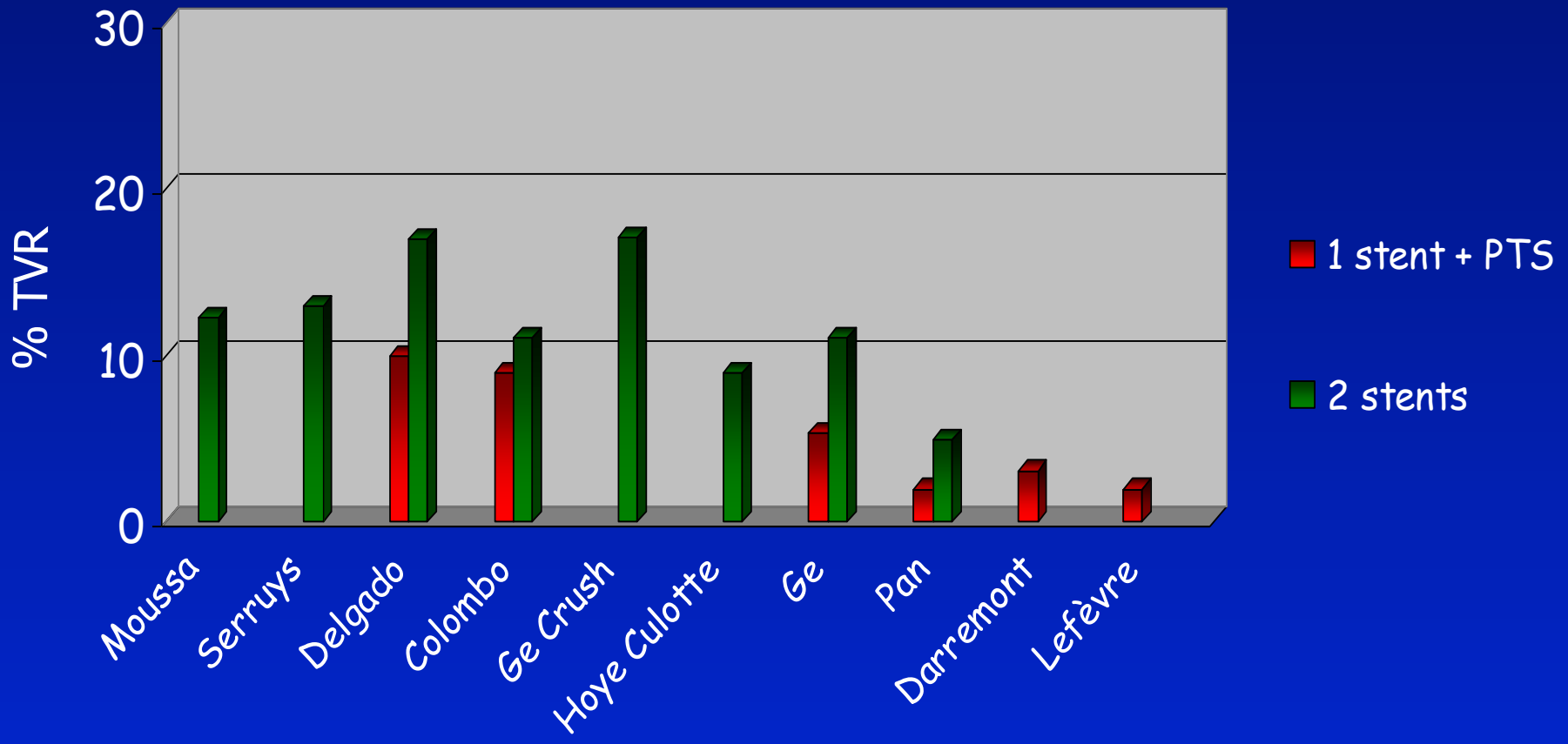
Provisional-T

Rules of engagement

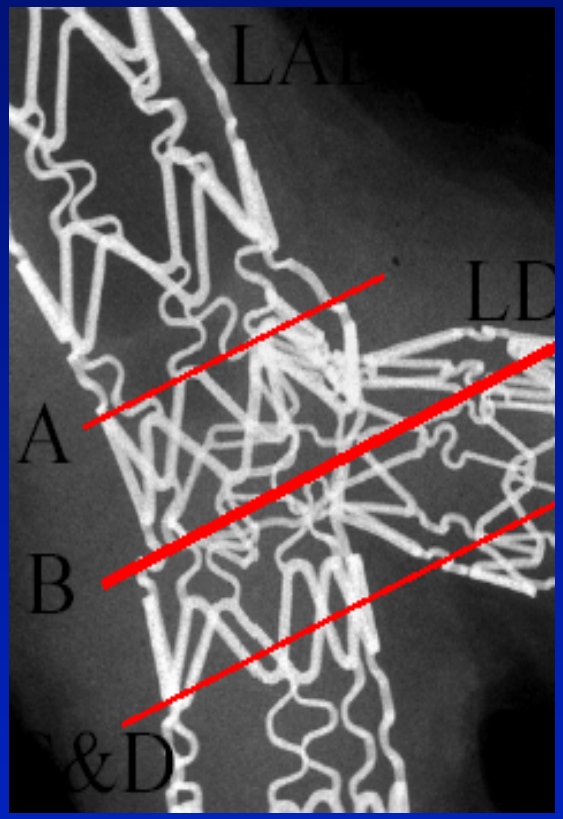
- No side branch predilatation
- Stent according to distal vessel diameter
- Jail wire
- Proximal optimisation
- Cross distally
- Kissing inflations
- Proximal final balloon

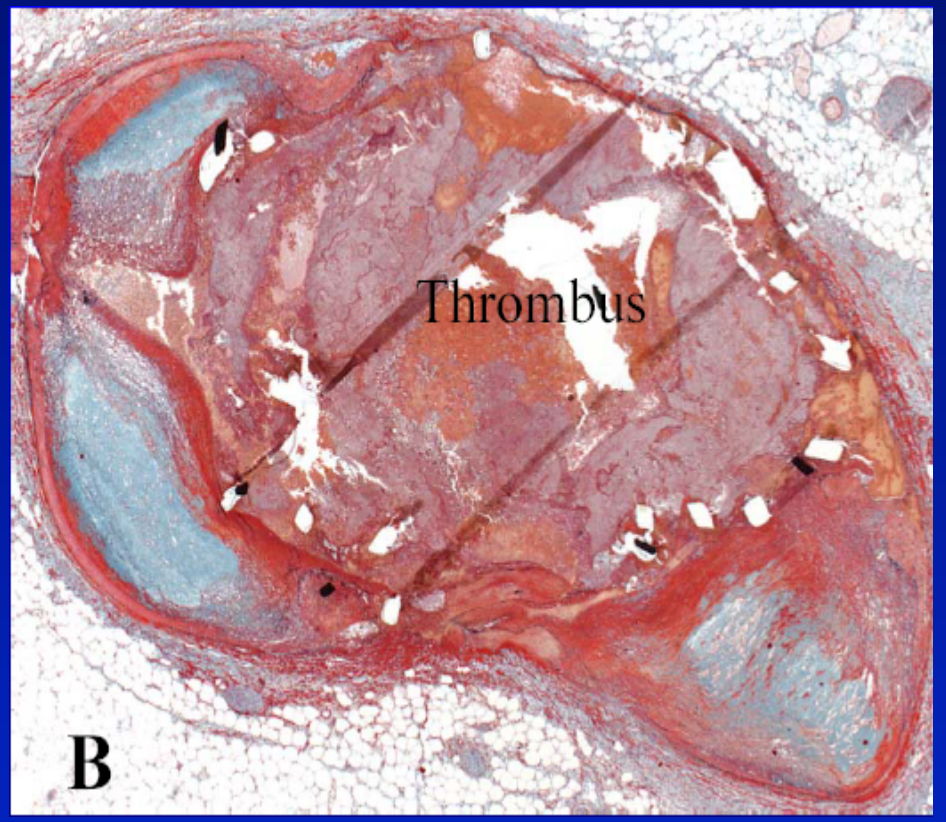


Deux DES Pas Meilleur que Un



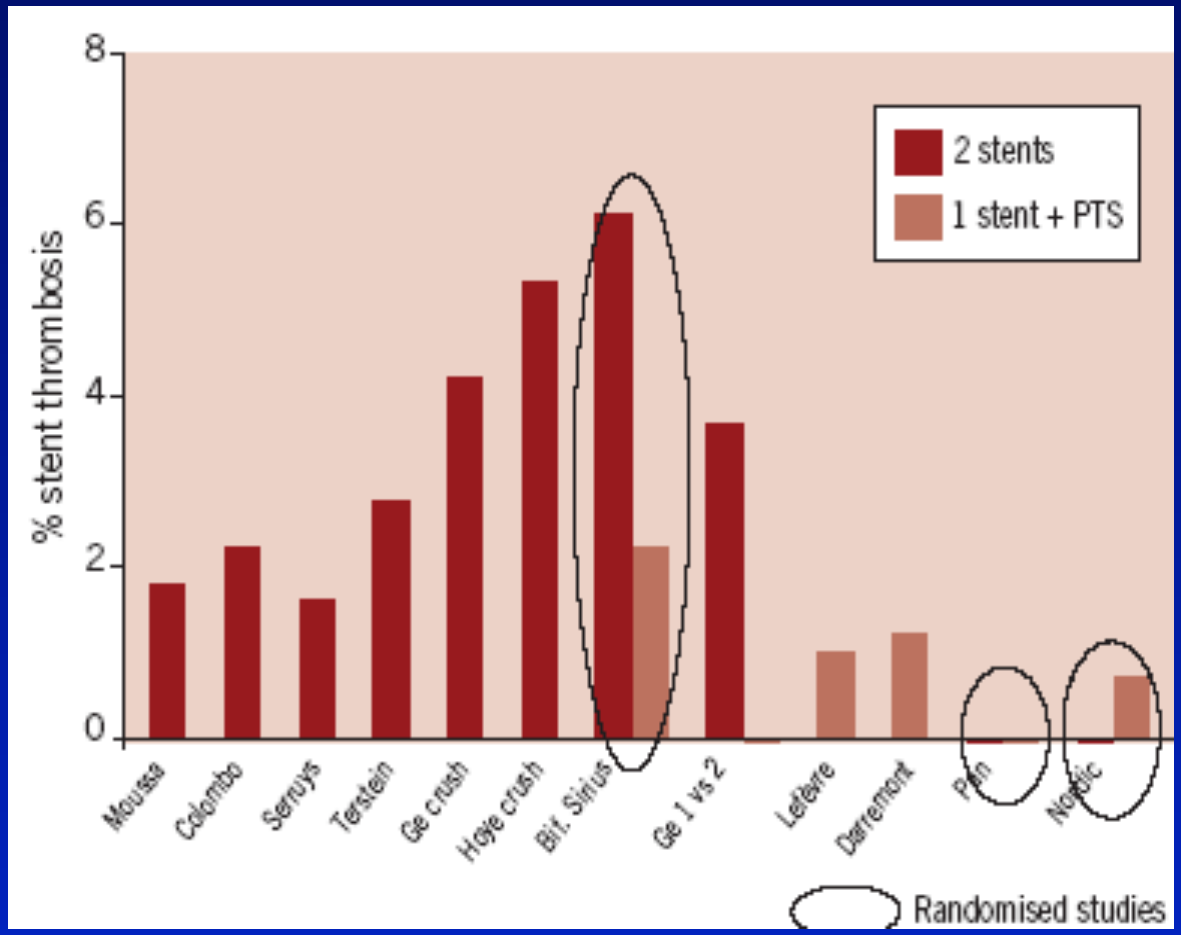
Risque Accru avec Deux DES





« … cause of stent thrombosis stent underexpension, crush technique … »

Renu Virmani et al, TCT 2004



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Pôle Cardiovasculaire et Métabolique

Etudes Simple vs Complexe

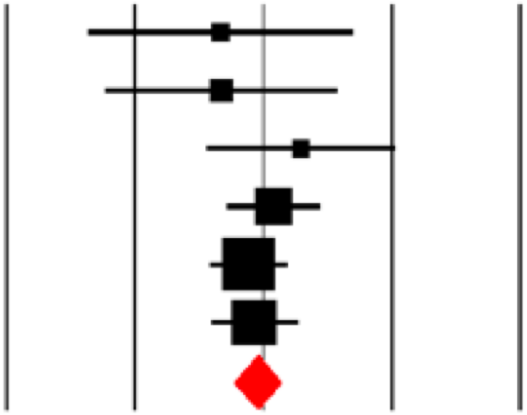
Study	Year	Pts on simple strategy	Pts on complex strategy	Specific strategy
Colombo et al	2004	22	63	Crush
NORDIC 1	2004	207	206	T/crush
Pan et al	2004	47	44	T
BBK	2007	101	101	T
CACTUS	2008	173	177	Crush
BBC1	2008	249	248	Crush/culotte

Bifurcation stenting with DES : a Meta-analysis

C.

TLR

Study	Year	Events / Total		MH risk ratio and 95% CI	Statistics for each study		
		Provisional	Two stents		MH risk ratio	Lower limit	Upper limit
Pan et al.	2004	1 / 47	2 / 44		0.47	0.04	4.98
Colombo et al.	2004	1 / 22	6 / 63		0.48	0.06	3.75
NORDIC	2006	4 / 207	2 / 206		1.99	0.37	10.75
Ferenc et al.	2008	11 / 101	9 / 101		1.22	0.53	2.82
BBC ONE	2008	14 / 250	18 / 250		0.78	0.40	1.53
CACTUS	2009	11 / 173	13 / 177		0.87	0.40	1.88
Overall		42 / 800	50 / 841		0.91	0.61	1.35



Test for heterogeneity: Q=2.2, df=5, P=0.82 I^2=0%
Test for overall effect: Z= -0.49, P=0.63

Fixed Effects Model

S Brar et al, EuroIntervention, 2009, Sep; 5(4): 475-84

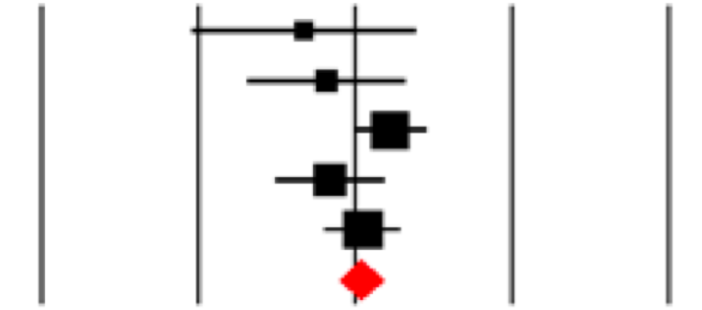
Hôpitaux de Toulouse

Pôle Cardiovasculaire et Métabolique

Bifurcation stenting with DES : a Meta-analysis

D. Side Branch Restenosis

Study	Year	Events / Total		MH risk ratio and 95% CI		
		Provisional	Two stents	MH risk ratio	Lower limit	Upper limit
Pan et al.	2004	2 / 47	4 / 44	0.47	0.09	2.43
Colombo et al.	2004	3 / 21	12 / 55	0.65	0.21	2.09
NORDIC	2006	29 / 151	18 / 156	1.66	0.97	2.87
Ferenc et al.	2008	9 / 101	13 / 101	0.69	0.31	1.55
CACTUS	2009	22 / 150	20 / 152	1.11	0.64	1.96
Overall		65 / 470	67 / 508	1.09	0.79	1.51



Test for heterogeneity: Q=5.3, df=4, P=0.26 I²=25%
Test for overall effect: Z= 0.53, P=0.60

Fixed Effects Model

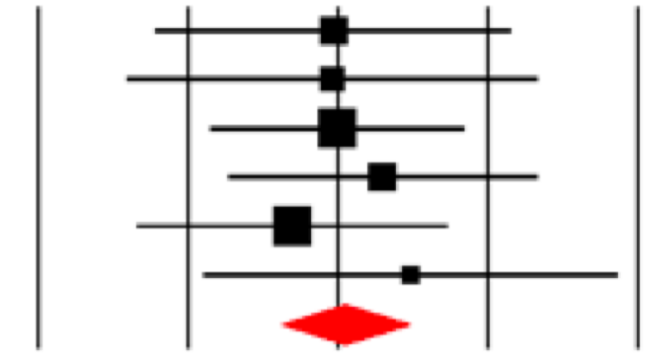
S Brar et al, EuroIntervention, 2009, Sep; 5(4): 475-84

Bifurcation stenting with DES : a Meta-analysis

A.

Death

Study	Year	Events / Total		MH risk ratio and 95% CI	MH risk ratio	Lower limit	Upper limit
		Provisional	Two stents				
Pan et al.	2004	1 / 47	1 / 44		0.94	0.06	14.52
Colombo et al.	2004	0 / 22	1 / 63		0.93	0.04	21.97
NORDIC	2006	2 / 207	2 / 206		1.00	0.14	7.00
Ferenc et al.	2008	2 / 101	1 / 101		2.00	0.18	21.71
BBC ONE	2008	1 / 250	2 / 250		0.50	0.05	5.48
CACTUS	2009	1 / 173	0 / 177		3.07	0.13	74.82
Overall		7 / 800	7 / 841		1.12	0.42	3.02



Test for heterogeneity: Q=1.1, df=5, P=0.96 I²=0%
Test for overall effect: Z= 0.23, P=0.82

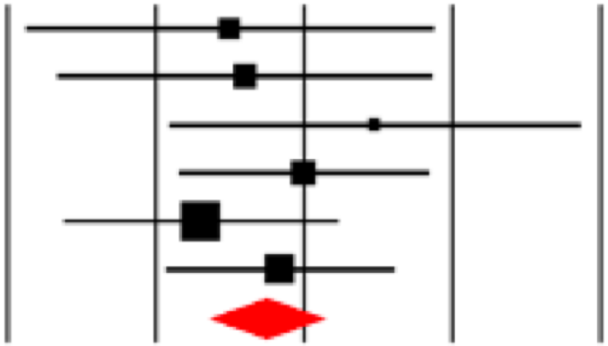
Fixed Effects Model

S Brar et al, EuroIntervention, 2009, Sep; 5(4): 475-84

Bifurcation stenting with DES : a Meta-analysis

E. Stent Thrombosis

Study	Year	Events / Total		MH risk ratio and 95% CI	MH risk ratio	Lower limit	Upper limit
		Provisional	Two stents				
Pan et al.	2004	0 / 47	1 / 44		0.31	0.01	7.47
Colombo et al.	2004	0 / 22	3 / 63		0.40	0.02	7.40
NORDIC	2006	1 / 207	0 / 206		2.99	0.12	72.87
Ferenc et al.	2008	2 / 101	2 / 101		1.00	0.14	6.96
BBC ONE	2008	1 / 250	5 / 250		0.20	0.02	1.70
CACTUS	2009	2 / 173	3 / 177		0.68	0.12	4.03
Overall		6 / 800	14 / 841		0.56	0.23	1.35



Test for heterogeneity: Q=2.2, df=3, P=0.52 I²=0%
Test for overall effect: Z= -0.76, P=0.45

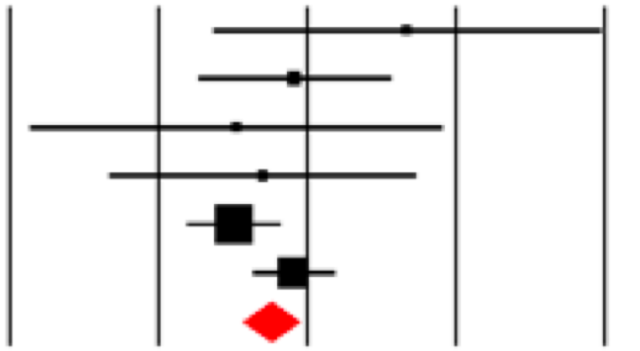
Fixed Effects Model

S Brar et al, EuroIntervention, 2009, Sep; 5(4): 475-84

Bifurcation stenting with DES : a Meta-analysis

B. Myocardial Infarction

Study	Year	Events / Total: Provisional	Events / Total: Two stents	MH risk ratio	Lower limit	Upper limit
Pan et al.	2004	2 / 47	0 / 44	4.69	0.23	95.00
Colombo et al.	2004	2 / 22	7 / 63	0.82	0.18	3.65
NORDIC	2006	0 / 207	1 / 206	0.33	0.01	8.10
Ferenc et al.	2008	1 / 101	2 / 101	0.50	0.05	5.43
BBC ONE	2008	9 / 250	28 / 250	0.32	0.15	0.67
CACTUS	2009	15 / 173	19 / 177	0.81	0.42	1.54
Overall		29 / 800	57 / 841	0.57	0.37	0.87



Test for heterogeneity: Q=5.72, df=5, P=0.33 I^2=13%
Test for overall effect: Z= -2.58, P=0.01

Fixed Effects Model

S Brar et al, EuroIntervention, 2009, Sep; 5(4): 475-84

2011 ACCF/AHA/SCAI Guideline for Percutaneous Coronary Intervention

4.7.3. Bifurcation Lesions

CLASS I

1. Provisional side-branch stenting should be the initial approach in patients with bifurcation lesions when the side branch is not large and has only mild or moderate focal disease at the ostium (383–386). *(Level of Evidence: A)*

CLASS IIa

1. It is reasonable to use elective double stenting in patients with complex bifurcation morphology involving a large side branch where the risk of side-branch occlusion is high and the likelihood of successful side-branch reaccess is low (387–390). *(Level of Evidence: B)*

Quelles techniques ?

- ✓ Comment je traite : 1 ou 2 stents?... Simple vs Complexe?
- ✓ Kissing final systématique?
- ✓ Quelle technique si je dois mettre 2 stents?

CACTUS

Final kissing balloon inflation

	YES	NO	P value
Myocardial infarction	7.5%	29.0%	<0.0001
Stent thrombosis	0.9%	6.5%	0.06

A.Colombo et al, circulation.2009;119:71-78

CACTUS

Final kissing balloon inflation

	YES	NO	P value
MB restenosis	4.7%	16%	0.03
SB restenosis	11.9%	36%	<0.001

A. Colombo et al, circulation.2009;119:71-78

Randomized Comparison of Final Kissing Balloon Dilatation Versus No Final Kissing Balloon Dilatation in Patients With Coronary Bifurcation Lesions Treated With Main Vessel Stenting

The Nordic-Baltic Bifurcation Study III

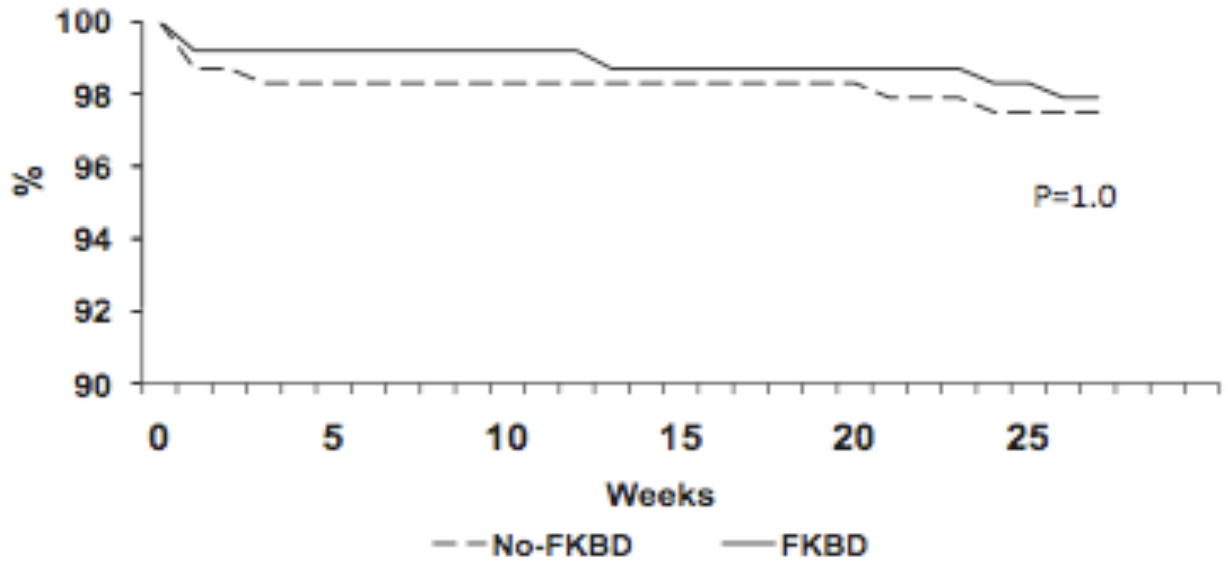


Figure 2. Kaplan-Meier curves for MACE-free survival (cardiac death, non–procedure-related index lesion MI, TLR, definite stent thrombosis) in the FKBD and no-FKBD groups during the 6-month of follow-up.

M. Niemelä et al Circulation 2011;123:79-86

Randomized Comparison of Final Kissing Balloon Dilatation Versus No Final Kissing Balloon Dilatation in Patients With Coronary Bifurcation Lesions Treated With Main Vessel Stenting

The Nordic-Baltic Bifurcation Study III

Table 5. True Versus Nontrue Bifurcation Subgroup Comparison: 8-Month Angiographic Follow-Up

	True Bifurcation Subgroup			Nontrue Bifurcation Subgroup		
Variable	FKBD (n=92)	No FKBD (n=80)	*P*	FKBD (n=72)	No FKBD (n=82)	*P*
In-segment MV						
DS, %	22±15	22±15	0.85	22±14	21±12	0.90
≥50% DS, n (%)	3 (3.8)	2 (2.2)	0.67	3 (4.2)	1 (1.2)	0.34
Ostial 5 mm of the SB						
MLD, mm	1.71±0.42	1.50±0.53	0.005	1.79±0.54	1.77±0.61	0.79
DS, %	25±14	32±21	0.009	23±15	27±19	0.21
≥50% DS, n (%)	7 (7.6)	16 (20)	0.024	6 (8.3)	9 (11)	0.79

DS indicates diameter stenosis; MLD, minimal luminal diameter. The Fisher exact test, χ^2 test, or independent-samples *t* test was used.

M. Niemelä et al Circulation 2011;123:79-86

Kissing Final au moins pour Les Crush

	Entire Cohort n = 181 Patients	FKB Group n = 116 Patients	Non-FKB Group n = 65 Patients	p*
Angiographic success, n (%)	178 (98.3)	116 (100)	62 (95.4)	0.13
Procedural success, n (%)	162 (89.5)	106 (91.4)	56 (86.2)	0.40
In-hospital MACE, n (%)	16 (8.8)	10 (8.6)	6 (9.2)	1.0
Cardiac death	0	0	0	—
Q-wave MI	1 (0.6)	0	1 (1.5)	0.77
Non–Q-wave MI	15 (8.3)	10 (8.6)	5 (7.7)	0.95
TLR	0	0	0	—
TVR	0	0	0	—
Cumulative nine-month MACE, n (%)	48 (26.5)	23 (19.8)	25 (38.5)	0.008
Cardiac death	2 (1.1)	2 (1.7)	0	0.54
Q-wave MI	6 (3.3)	2 (1.7)	4 (6.2)	0.28
Non–Q-wave MI	15 (8.3)	10 (8.6)	5 (7.7)	0.95
TLR	27 (14.9)	11 (9.5)	16 (24.6)	0.008
TVR	31 (17.1)	12 (10.3)	19 (29.2)	0.002
Postprocedural stent thrombosis	5 (2.8)	3 (2.6)	2 (3.1)	0.78
Subacute	1 (0.6)	0	1 (1.5)	0.77
Late	4 (2.2)	3 (2.6)	1 (1.5)	0.95

Ge et al. JACC 2005; 46: 613-20

Quelles techniques

- ✓ Comment je traite : 1 ou 2 stents?... Simple vs Complexe?
- ✓ Kissing final systématique?
- ✓ Quelle technique si je dois mettre 2 stents?

Traitement de la Fille

a) Dans quels cas stenter ?

1. Toutes les vrais bifurcations ? (111, 101, 011)
2. Uniquement si résultat insuffisant ?
3. D'emblée quand lésion longue de la fille ?
4. Jamais (ou presque)

Faut il prédilater la Fille ?

Les plus

✓ Amélioration de la lumière pour meilleurs accès

Les moins

✓ Inutile sur les lésions finissant par 0

✓ Risque de dissection rendant plus difficile l'accès à travers les mailles du stent de la principale

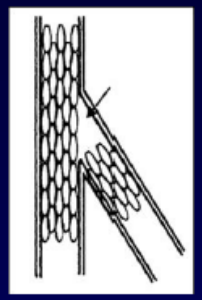
Traitement de la Fille

b) Comment Stenter ?

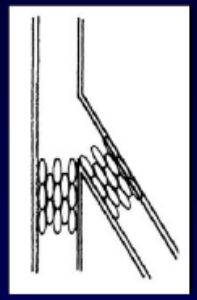
1. Crush ou internal crush ?
2. Culotte ?
3. T stenting d'emblée ?
4. V stenting ?
5. TAP stenting ?
6. Kissing stent ?

Bifurcation Stenting Techniques with Workhorse Stents

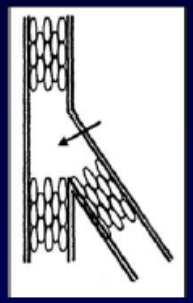
The Lindner Center



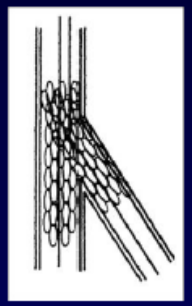
T Stenting



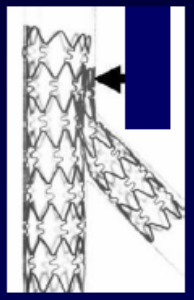
V Stenting



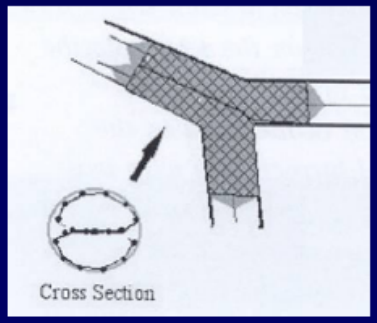
Y Stenting



Culotte

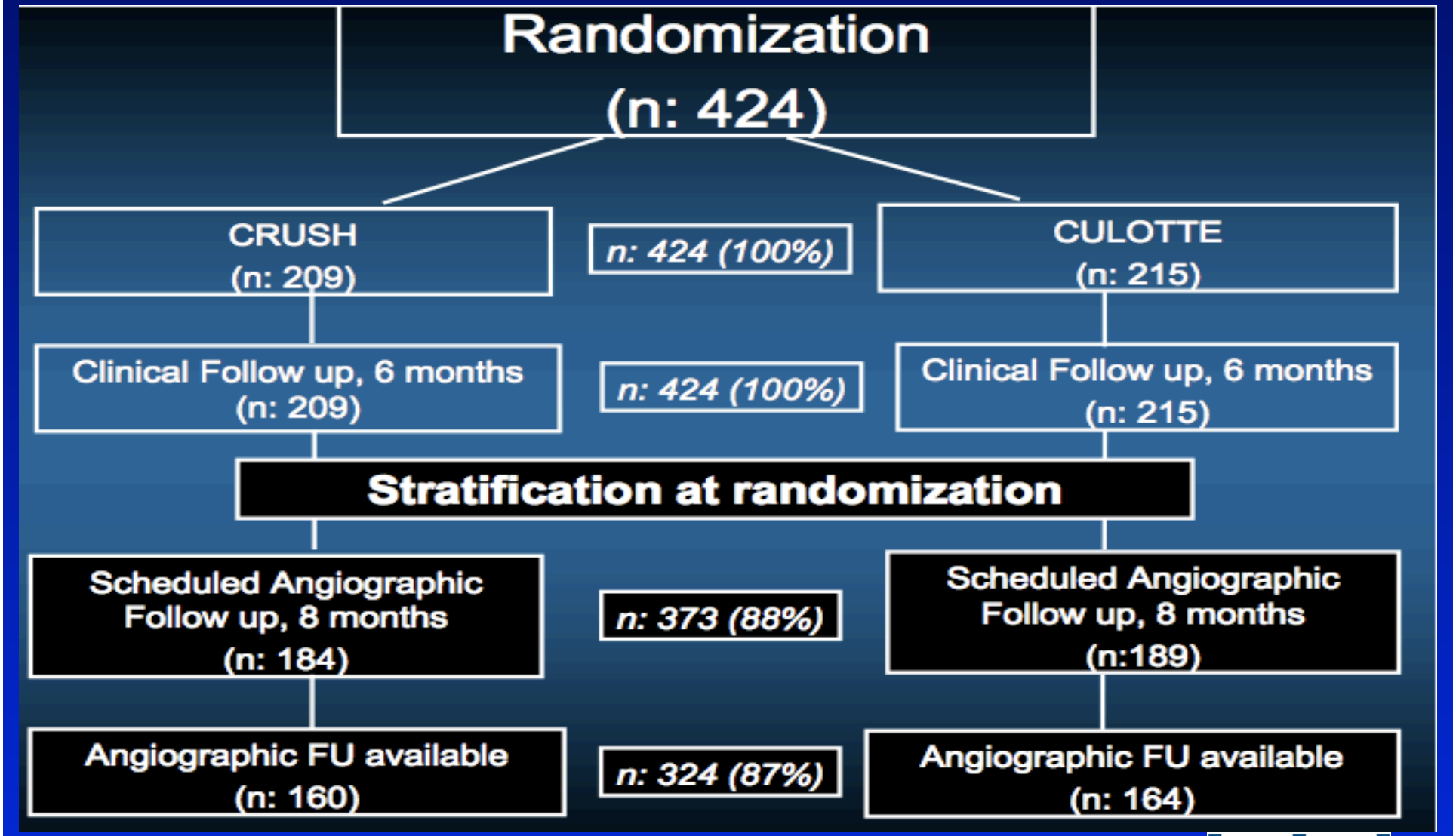


Crush



Kissing Stent

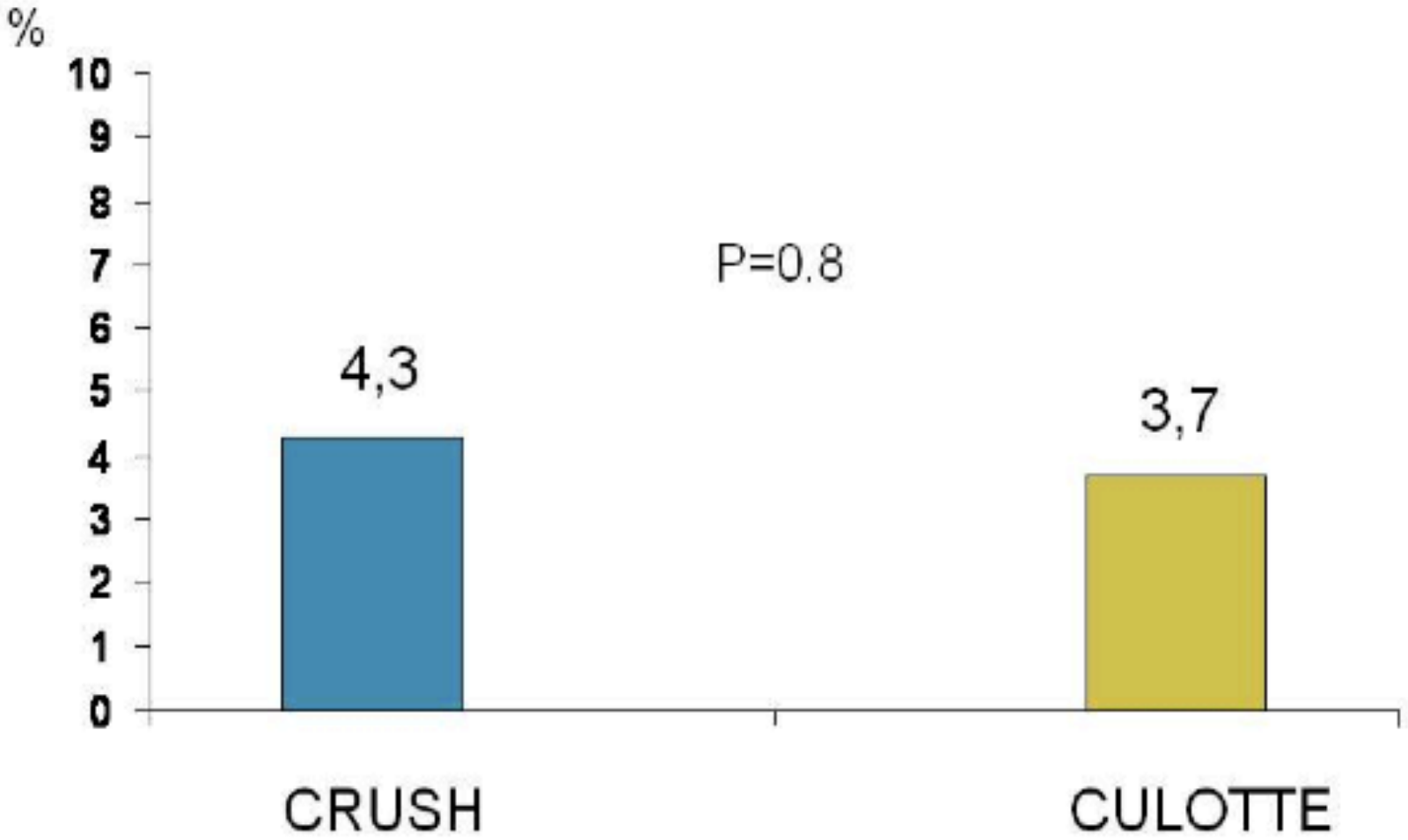
NORDIC 2



P. Gunnes,TCT 2007

Primary endpoint

Cardiac death, myocardial infarction, TVR and stent thrombosis after 6 months

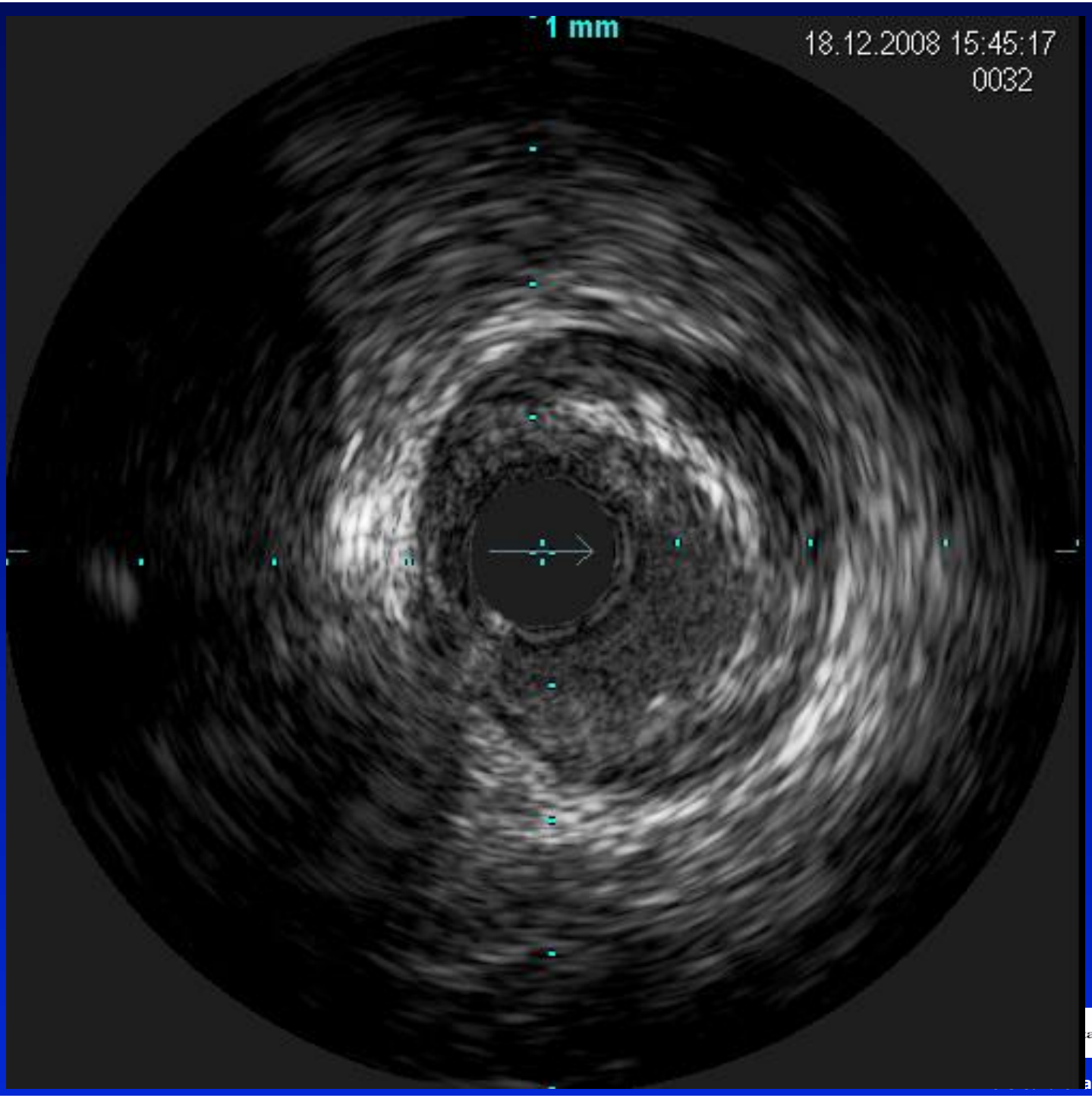


P. Gunnes,TCT 2007

Main lessons for trials

- Composite primary endpoints favour simple approach
- If you were only ever allowed to use one strategy, you should choose the single stent (provisional-T) approach
- A simple strategy minimises procedure duration, X-ray dose, contrast volume
- For complex stenting techniques, culotte has advantages over crush
- No systematic advantages to kissing in simple stenting (except >75% ostial narrowing)
- No subgroups have been identified in which the complex strategy appears more favourable (ongoing trials EBC 2, NORDIC IV)

QUELS OUTILS ?



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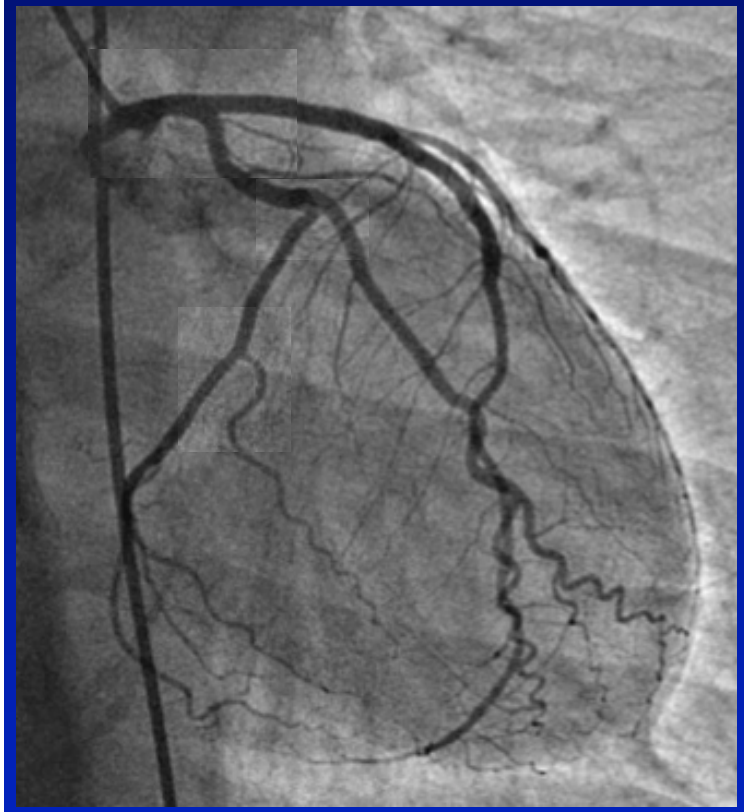
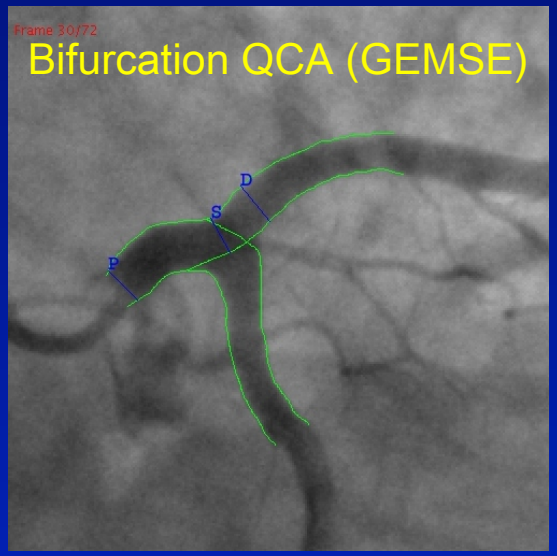
Fractals and Self-Similarity of the Coronary Tree





214 coronary bifurcations

$$R = \frac{D_{mother}}{D_{daughter\ 1} + D_{daughter\ 2}}$$

Ratio = 0.678

D>4.5 mm	D [4.5-4.0]	D [4.0-3.5]	D [3.5-3.0]	D [3.0-2.5]	D<2.5 mm
Ratio 0.66	0.67	0.66	0.69	0.66	0.66

Finet et al. Eurointrevention 2007; 490-8

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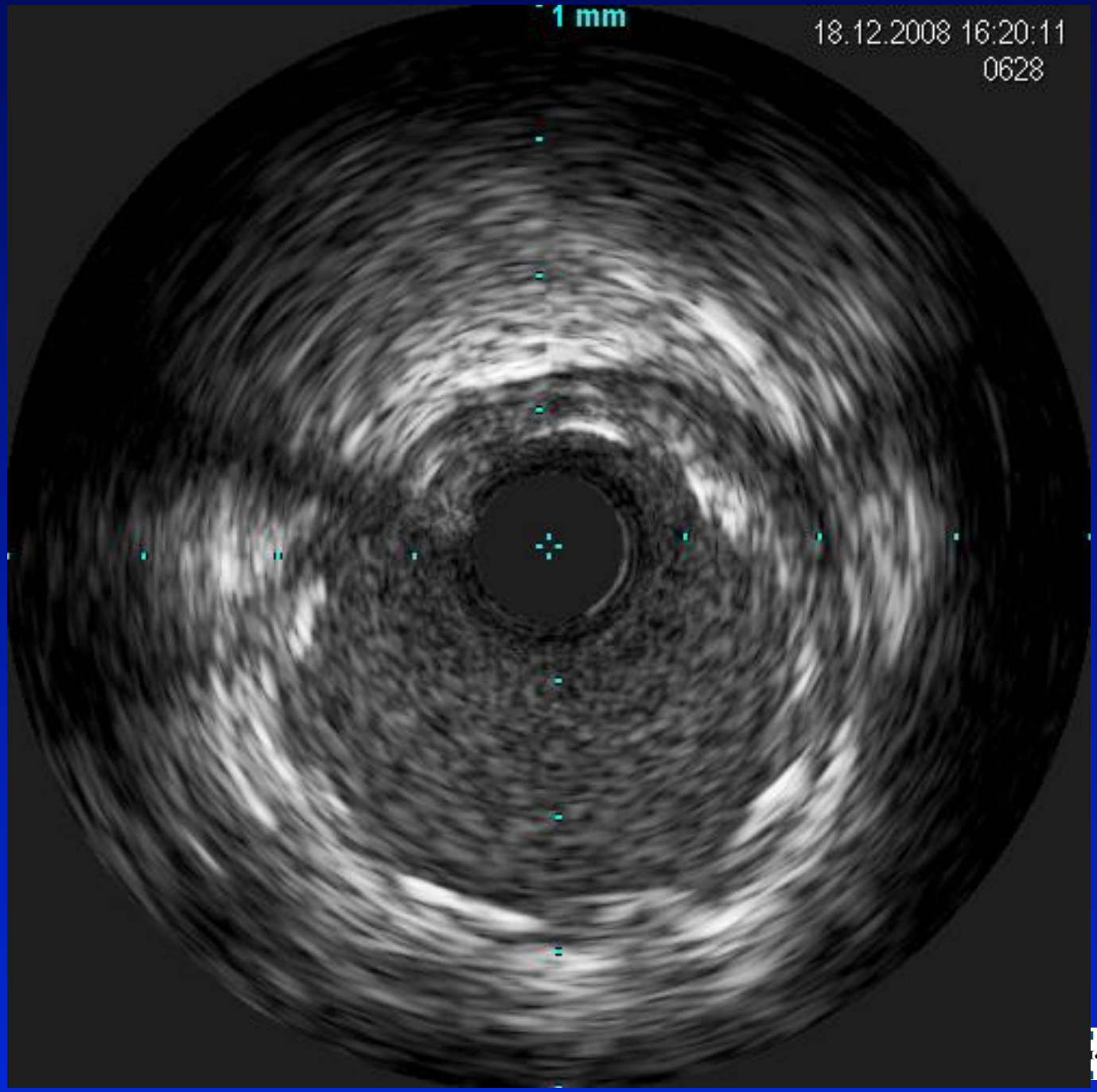
Pôle Cardiovasculaire et Métabolique



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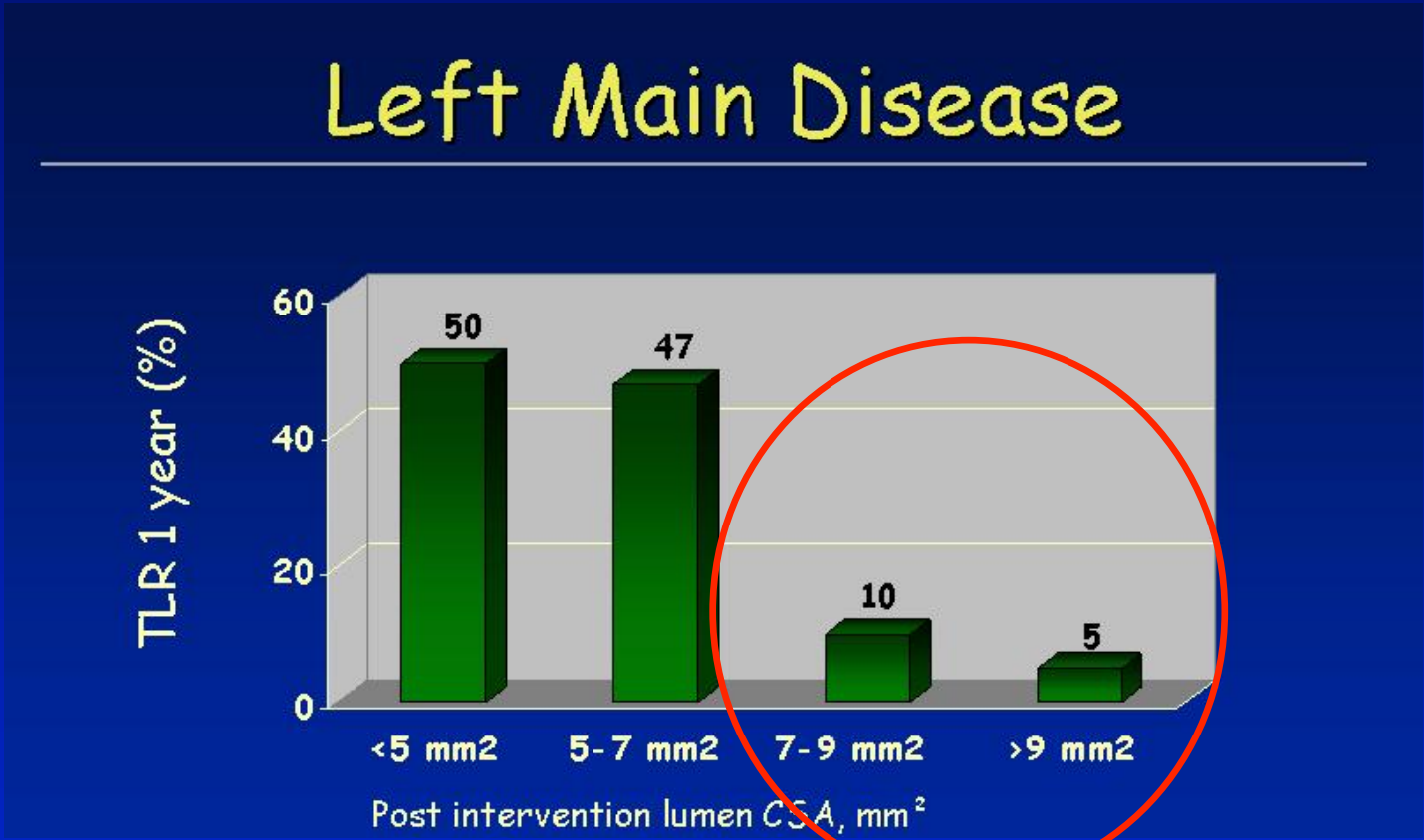
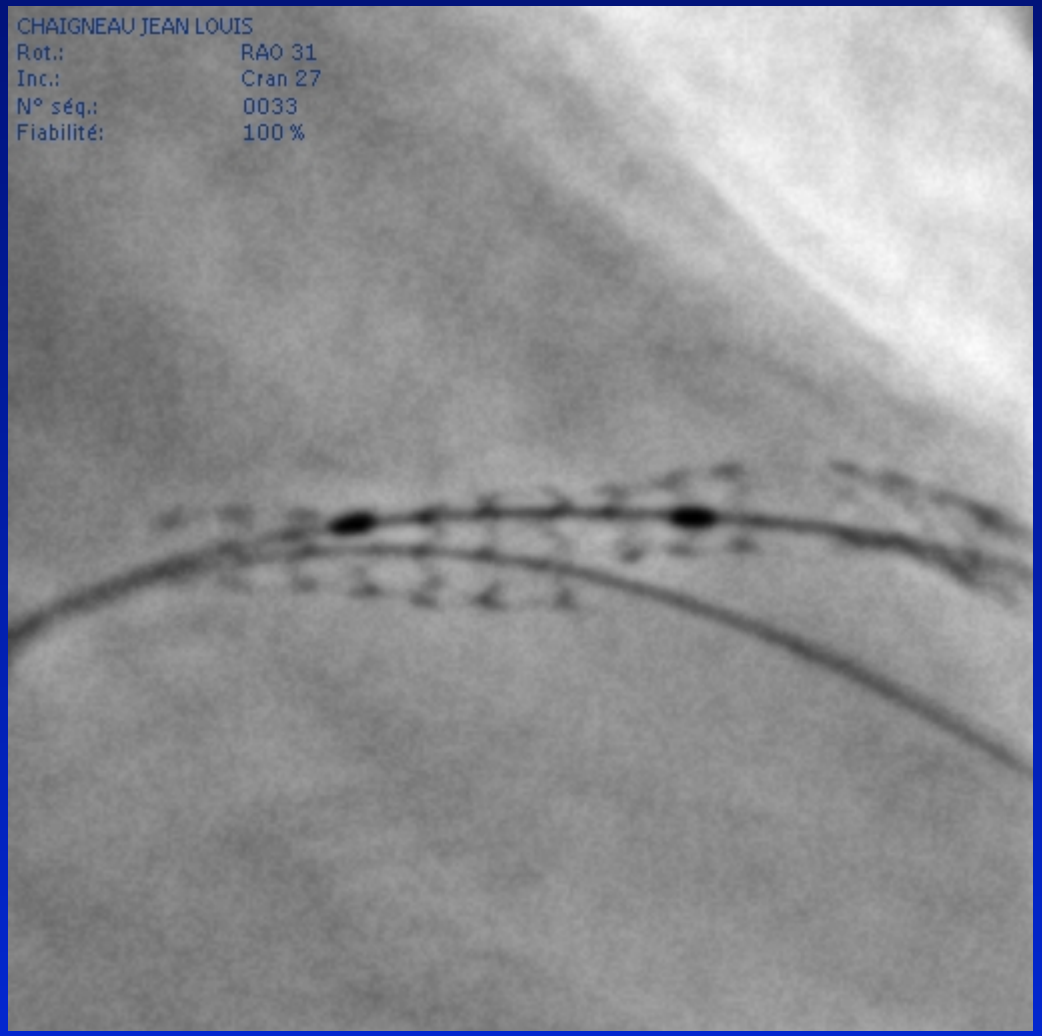
Intravascular Ultrasound



Hong et al Am J Cardiol 1999;83(2):175-9
Kornowski et al Am J Cardiol 1998 82:32-37

STENT BOOST IN BIFURCATION STENTING



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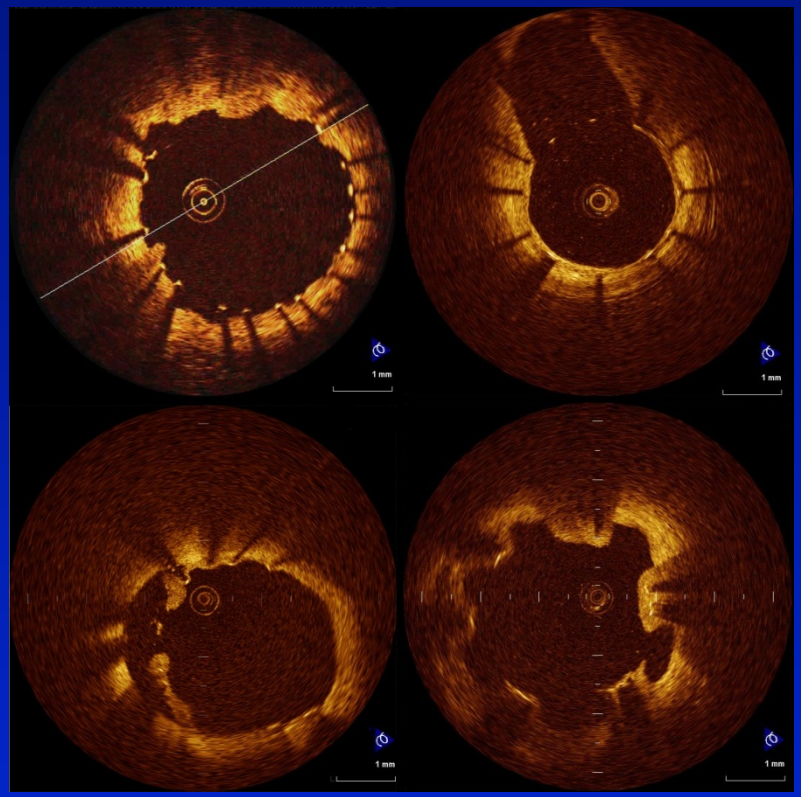
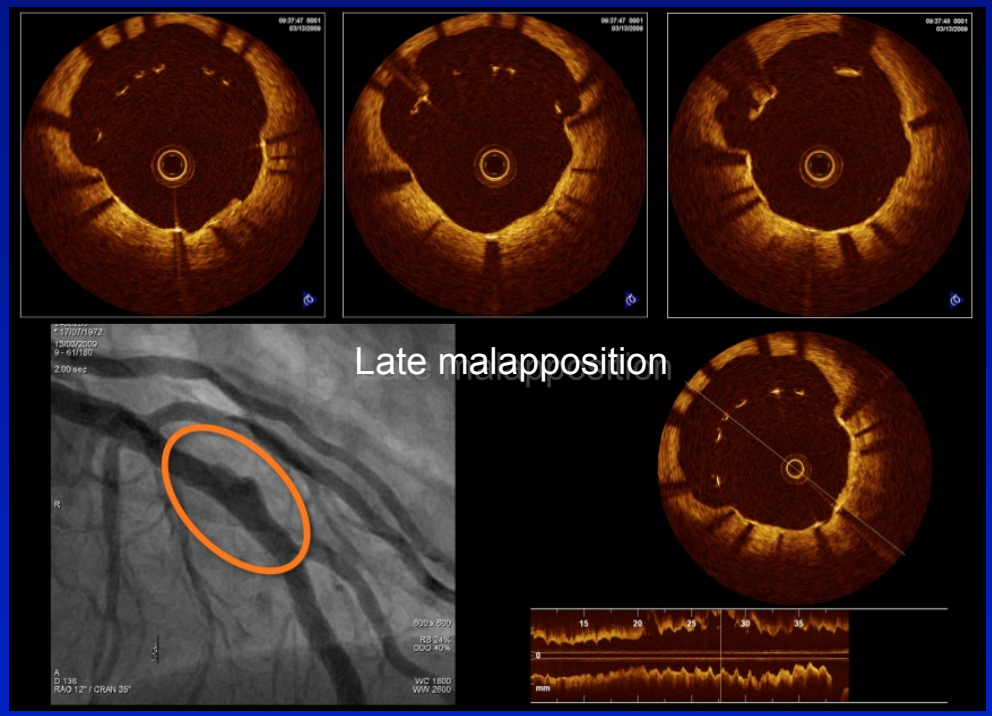
OCT indications

Stent assessment

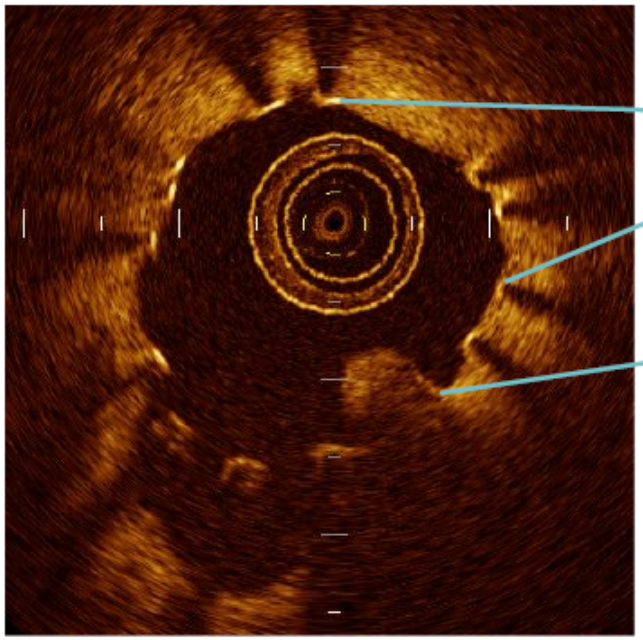
Post-stenting examination



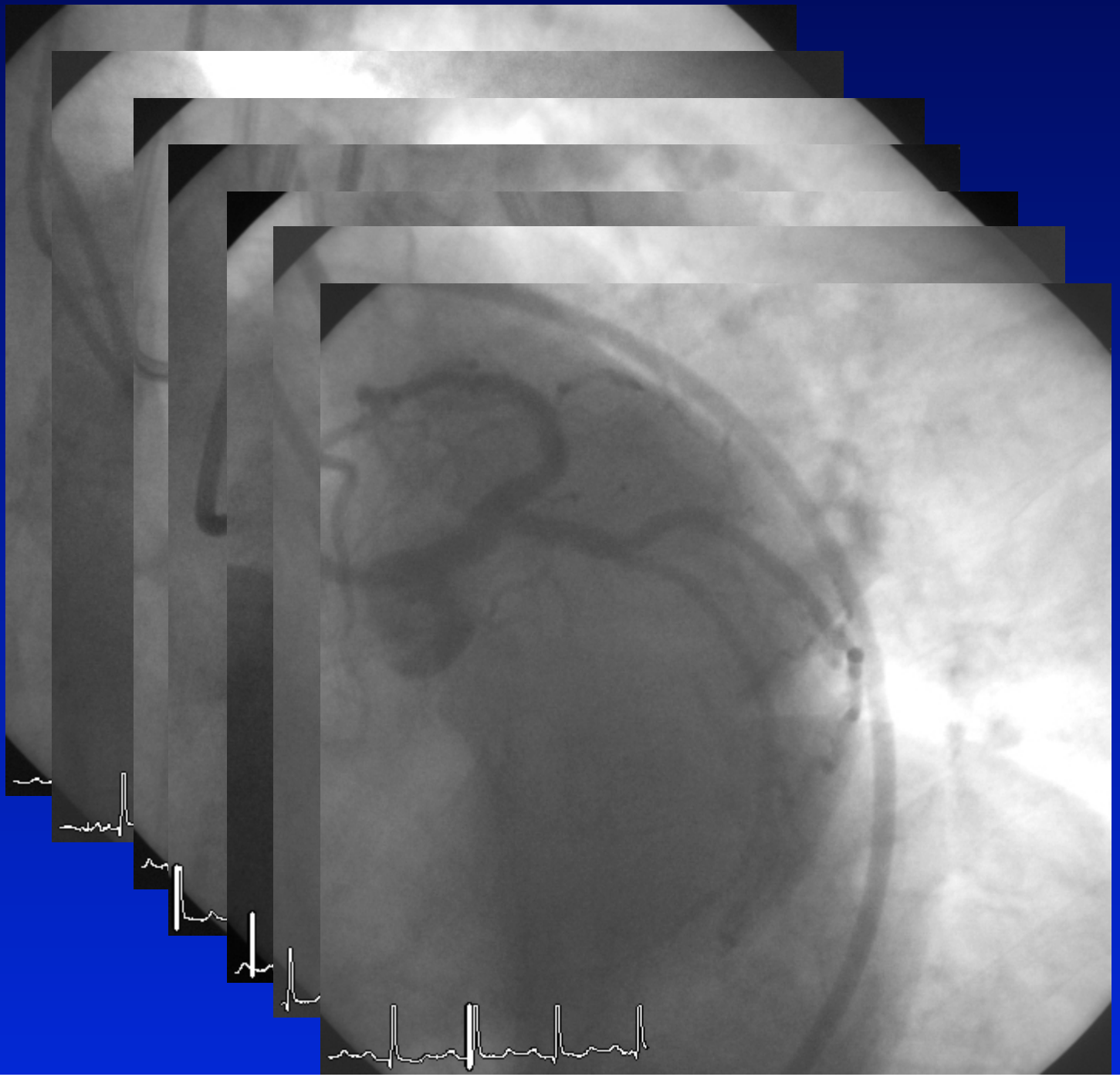


Stent malapposition imaging, Motreff P.

Qualitative analysis



- **Uncovered strut**
- **Covered strut**
- **Intracoronary thrombus** :
  Defined as a protruding irregular mass with various signal attenuation.



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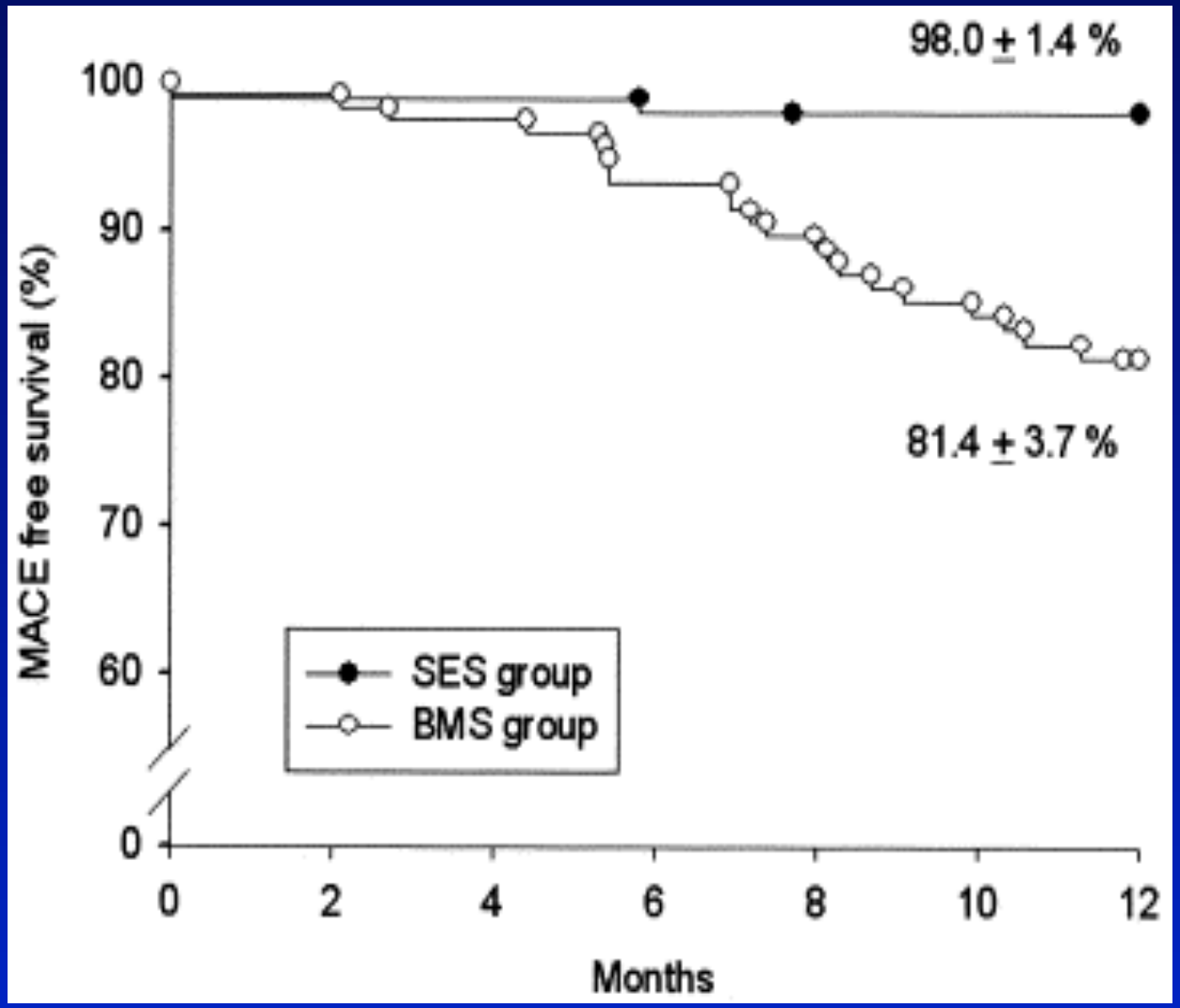
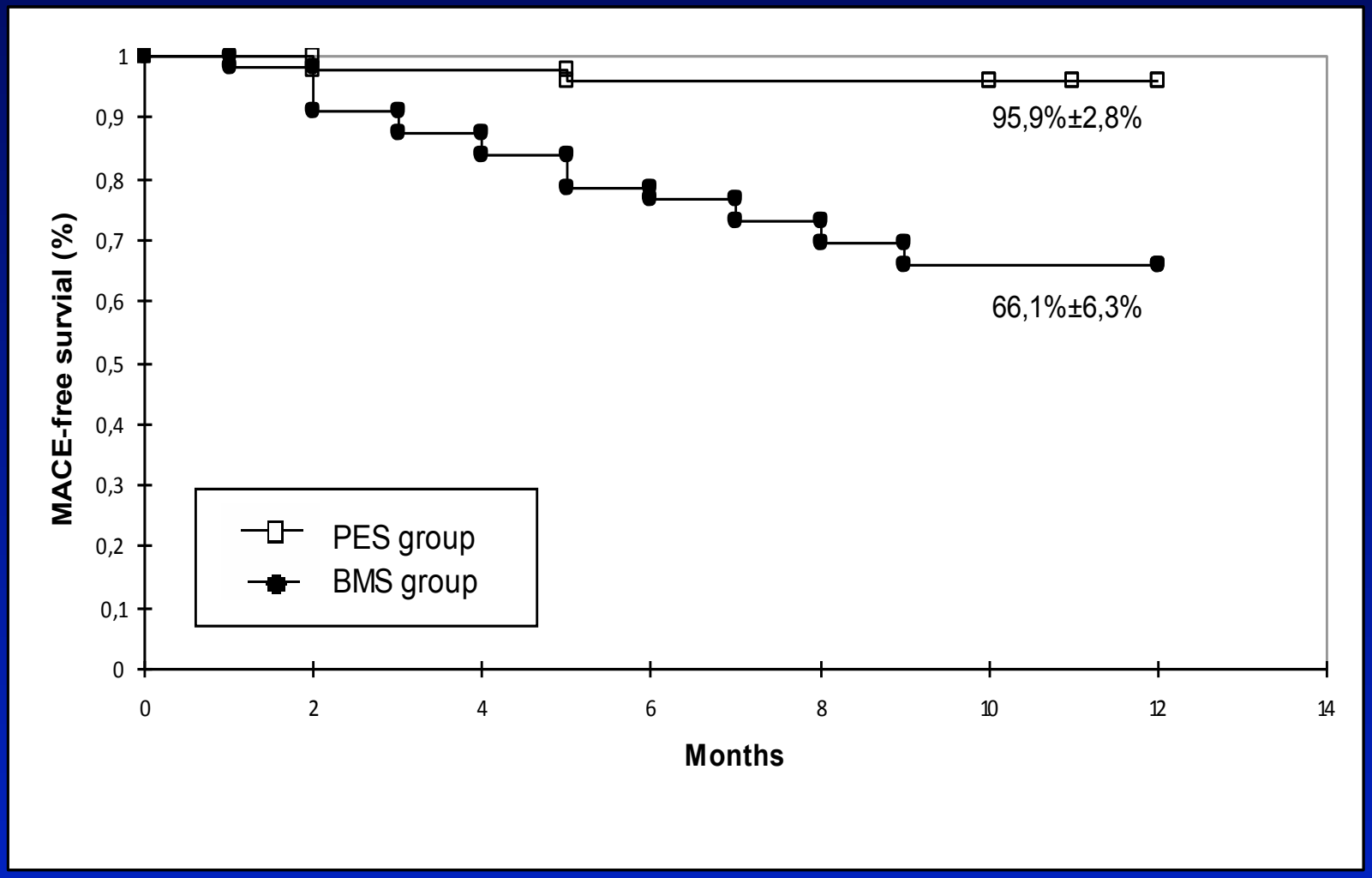


Kaplan-Meier curves for one-year MACE-free survival in patients treated with siroliumus-eluting stents (SES group) and bare metal stents (BMS group). A statistically significant difference was observed between the two groups (p = 0.0003).

Park SJ, JACC 2005; 45; 3, 351-56



Kaplan-Meier curves for ten-months MACE-free survival in patients treated with Paclitaxel-eluting stents (PES group) and bare metal stents (BMS group). A statistically significant difference was observed between the two groups (p = 0.0003).

Carrié et al., EuroIntervention 2006 Vol 1-N°4- 396-402

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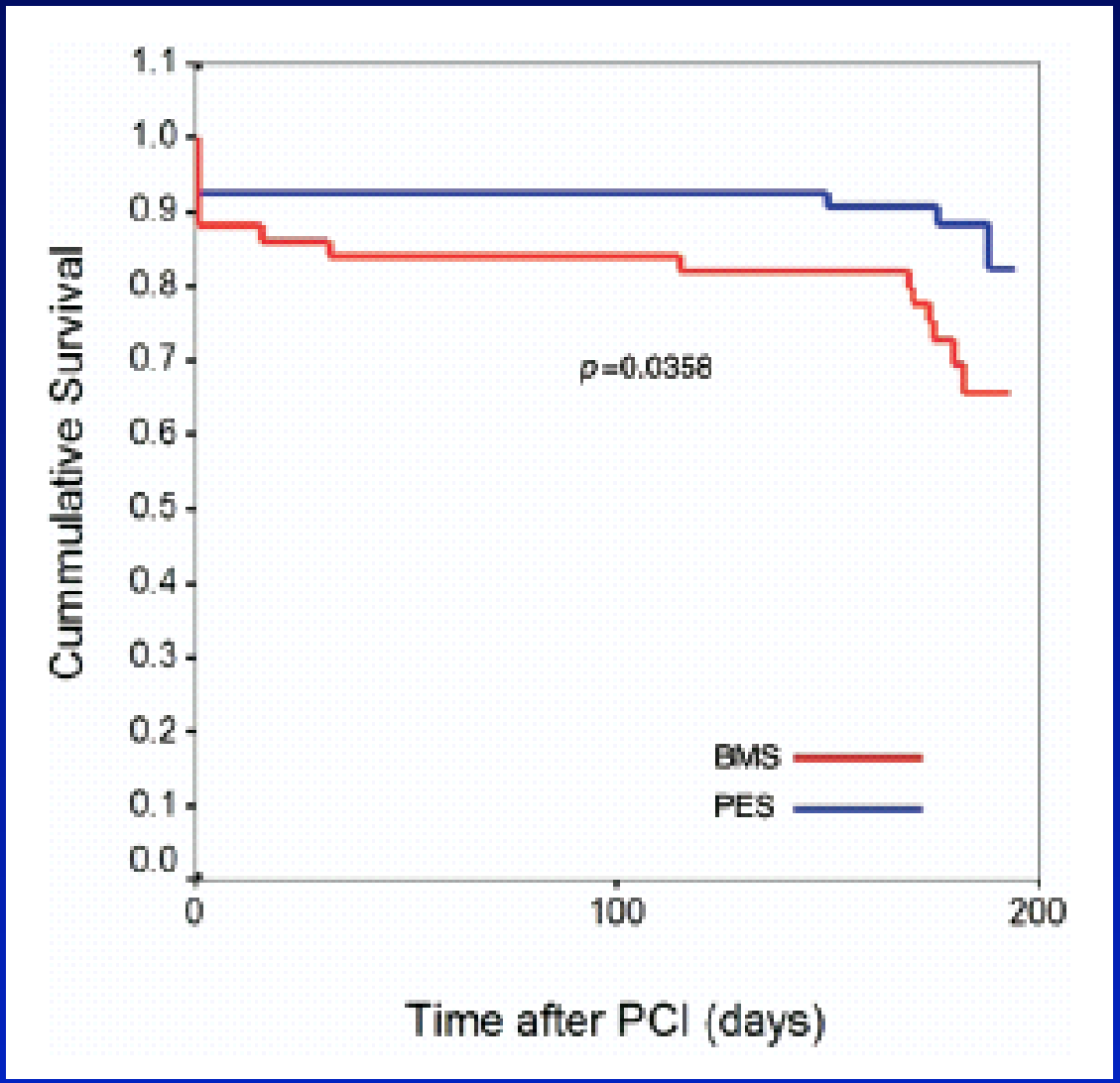


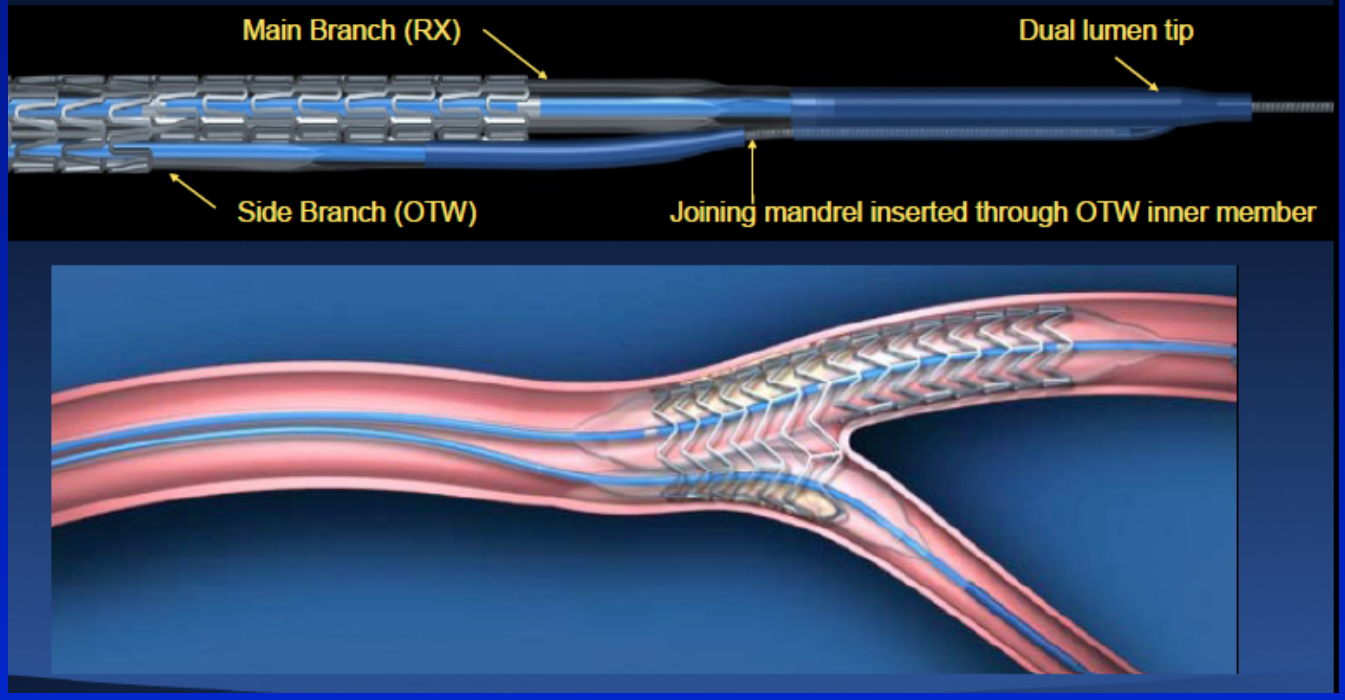
Kaplan-Meier Curves: Freedom From Major Adverse Coronary Events

Erglis JACC 2007;50:491-7.

Sidebranch Access MB Stents

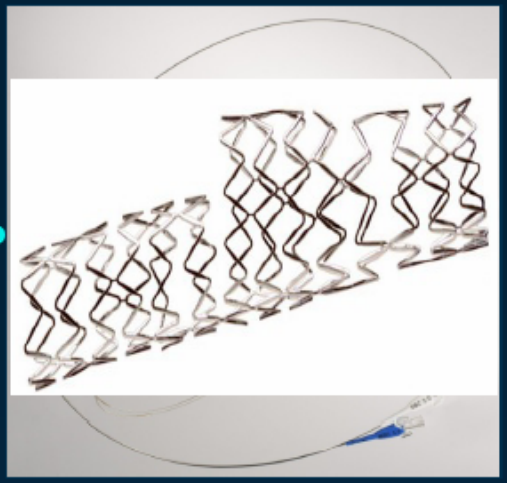
- Xience SBA
- Invatec Twinrail
- Minvasys Nile Pax
- BSC Petal
- Ymed Sidekick
- TriReme Medical (TMI)
- StentYs

Xience SBA is identical to Xience V with respect to metal, polymer, drug, elution kinetics and delivery characteristics



Minvasys Nile Pax
Design Summary

One System
Two independent catheters



Side branch
balloon

Main branch
Balloon + stent + tip

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Pôle Cardiovasculaire et Métabolique

BSC TAXUS Petal

Design Characteristics

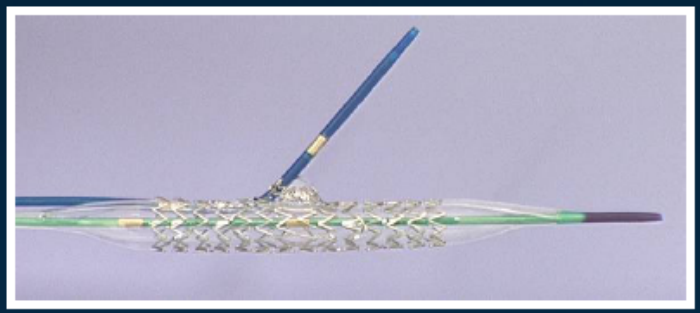
Element stent geometry

Stent Advantages

- Special stent feature to cover ostium of sidebranch (~2mm)
- Reduces sidebranch “gap” and need for 2nd stent
- Placing 2nd stent, when necessary, is technically simplified

Delivery System Advantages

- Side Branch wire lumen aids in alignment at ostium
- Side branch “pre-wired”, no need to re-access through stent
- Final Petal size determined by post dilatation balloon



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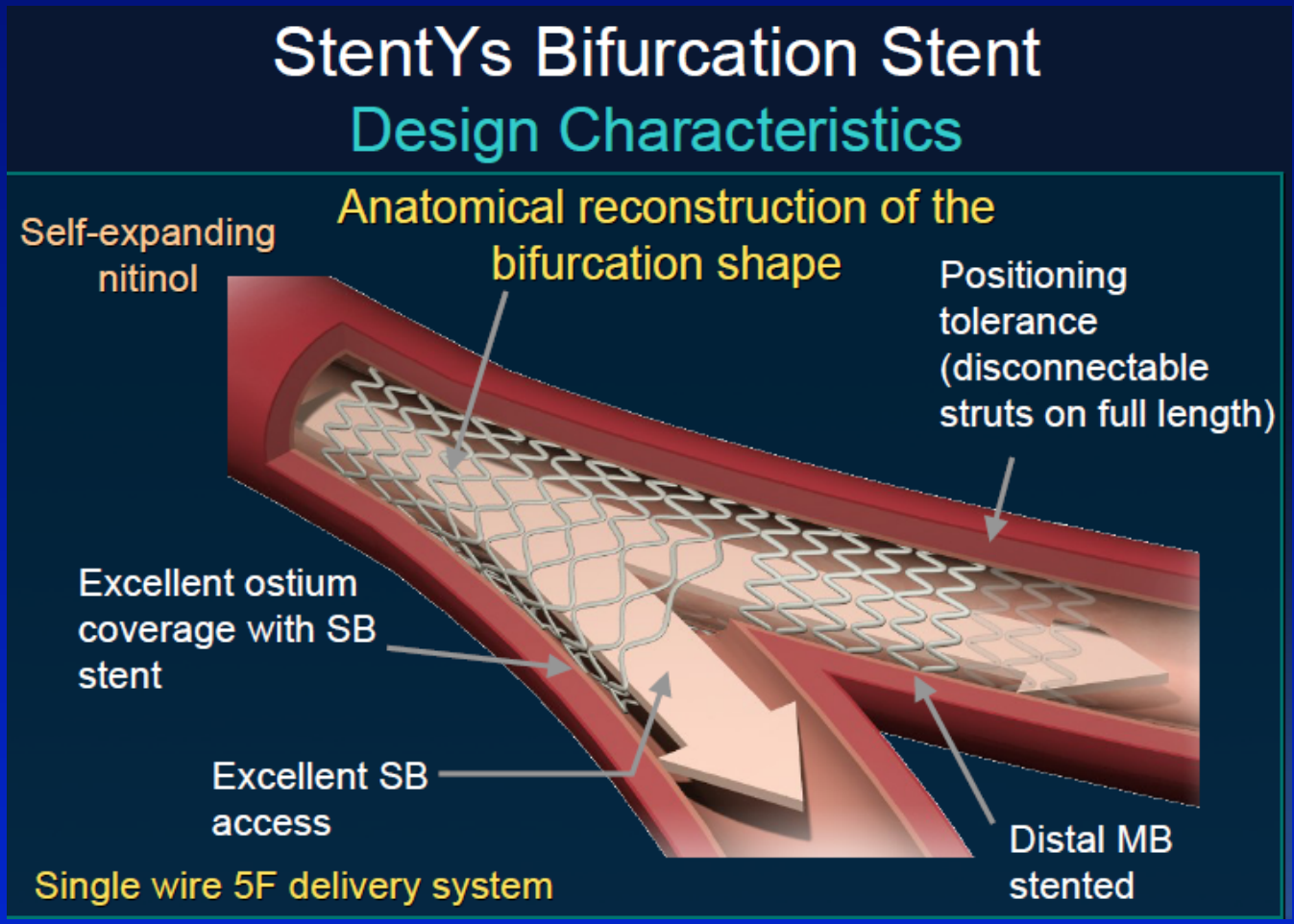
StentYs Bifurcation Stent

Design Characteristics



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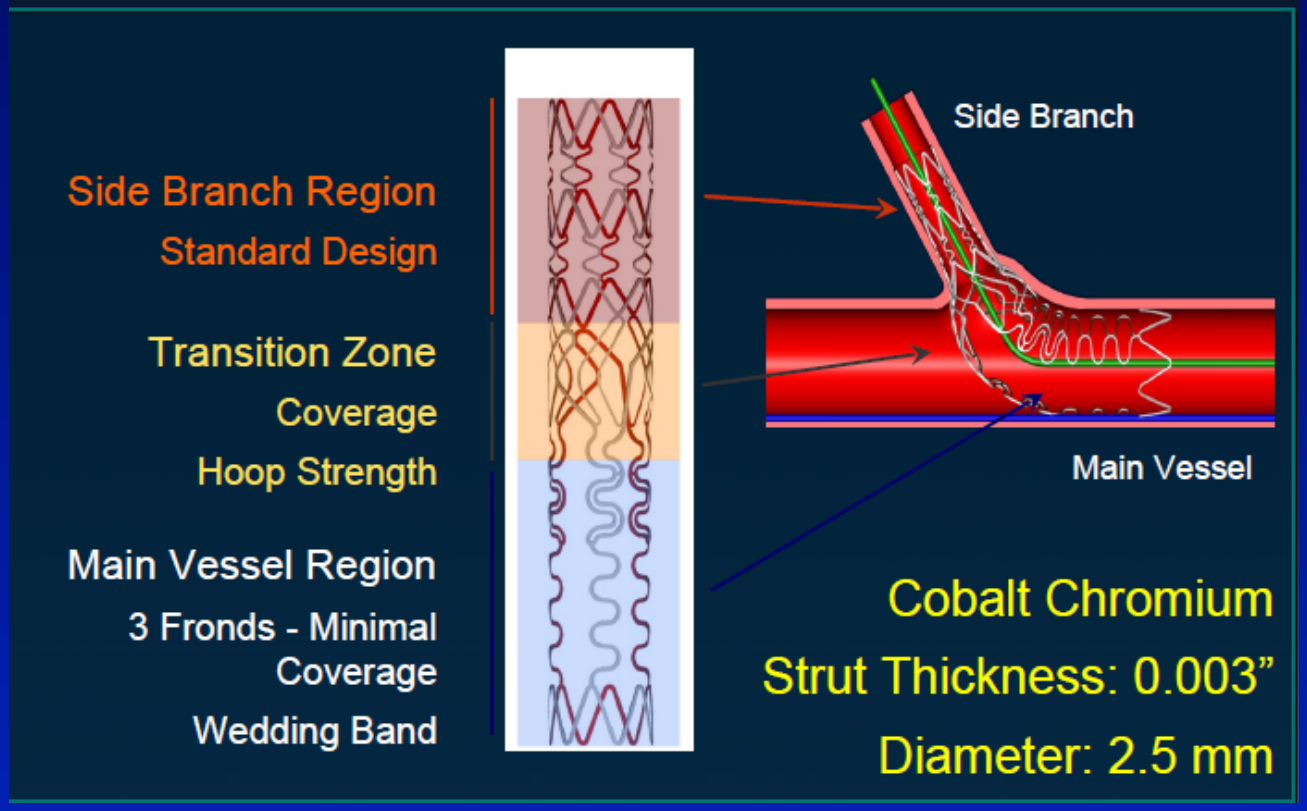
Sidebranch Only Stents

- Tryton
- Cappella

Tryton Side-Branch Stent



Etude randomisée TRYTON vs T-provisional stenting

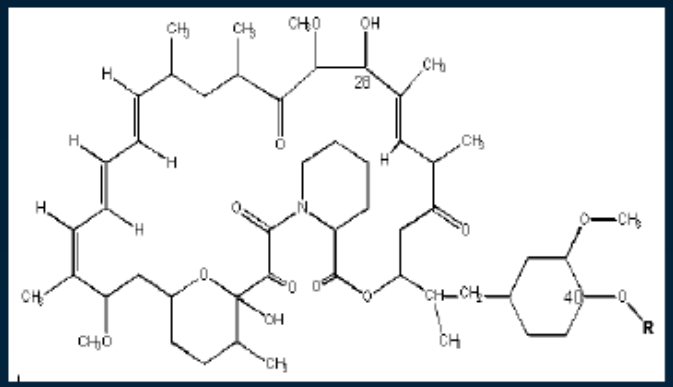
Specialty Designs

- Devax
- ABS (mother-daughter platform)

Devax AXXESS PLUS

Carina Expansion for Bifurcations

+



AXXESS
Stent

PLUS

Biolimus-A9
Anti-proliferative &
Bioerodable Polymer

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Pôle Cardiovasculaire et Métabolique

CONCLUSION

- 1 Stent si possible : T-Provisional stenting en intention de traiter
- Couverture entière du Tronc (sauf exception)
- Diamètre du stent 1:1 basé sur diamètre branche principale distale
- Optimisation proximale (loi de Murray)
- IVUS systématique
- Si 2 stents : T stenting si T shape angle

  : Culotte si Y shape
- Stents dédiés (Tryton, Stentys…)

French Multi-center LM studies with DES

	Pilot Taxus* 2004	FRIEND** 2006	LEMAX*** 2008
Nb patients	291	151	174
% distal lesion	78	69	81
% 2 stents	42 ↘	26 ↘	19 ↘
Mean LM stent diameter (mm)	3.44+0.39 ↗	3.59+0.49 ↗	3.64+0.32 ↗
12 month TVR	5.9	2.7	2

*B. Vaquerizo et al. Circulation 2009; 119: 2349-56

**D. Carrié et al., EuroInterv 2009; 4: 449-56

***N. Salvaltella et al., EuroInterv 2011; 7, 6: 689-96

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