Is there any role for intravascular ultrasound in bifurcation lesions?

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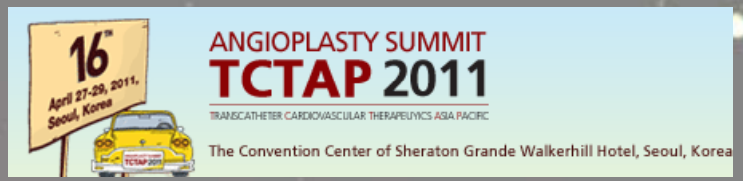
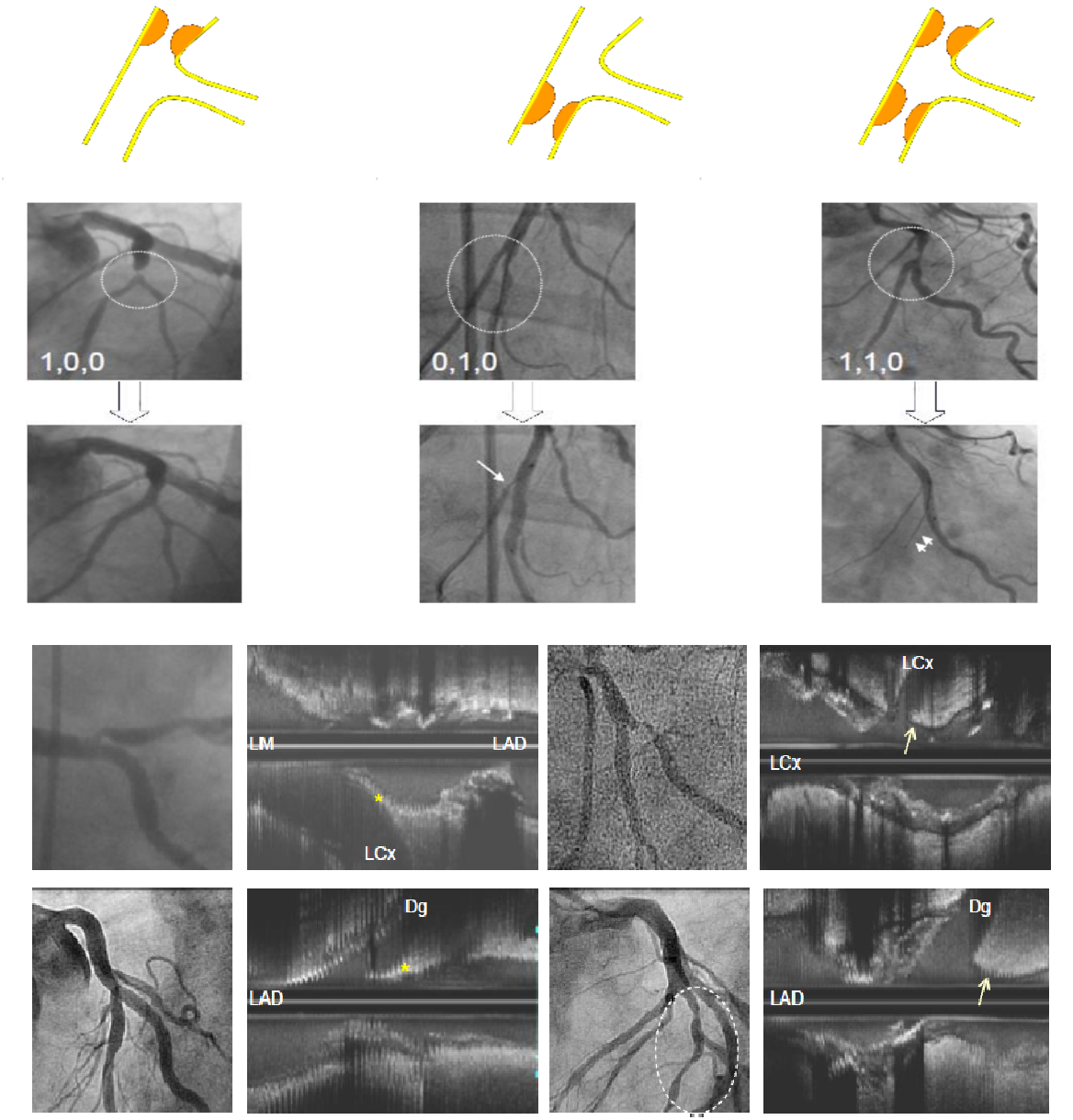


MODERN APPROACH TO CORONARY BIFURCATIONS



Suarez de Lezo et al, TCT 2009

ROLE OF IVUS IN BIFURCATIONS

PRE-INTERVENTION

- Accurate evaluation of bifurcation lesion
- Assessment of plaque distribution
- Assessment of SB disease
- Choice of Treatment strategy & device selection
- In-stent restenosis
- Stent thrombosis

POST-INTERVENTION

- Recognition of an ambiguous appearance
- Recognition of stent underexpansion or malappostion
- IVUS-guided optimal stenting and SB ostial coverage

HISTORICAL EVIDENCE OF IMPACT OF IVUS ON PALMAZ-SCHATZ IMPLANTATION

(*Circulation.* 1997;96:2997-3005.)

Articles

Comparison of Immediate and Intermediate-Term Results of Intravascular Ultrasound Versus Angiography-Guided Palmaz-Schatz Stent Implantation in Matched Lesions

Remo Albiero, MD; Thomas Rau, MD; Michael Schlüter, PhD; Carlo Di Mario, MD; Bernhard Reimers, MD; Detlef G. Mathey, MD; Jonathan M. Tobis, MD; Joachim Schofer, MD; ; Antonio Colombo, MD

From the Centro Cuore Columbus, Milan, Italy (R.A., C.D., B.R., A.C.); the Center for Cardiology Othmarschen, Hamburg, Germany (T.R., M.S., D.G.M., J.S.); and the University of California, Irvine (J.M.T.).

Background Intravascular ultrasound (IVUS) provides more precise information than angiography about vascular dimensions. This information is used by some centers to optimize intracoronary stent implantation. There are no direct comparisons of the effects on restenosis of optimal IVUS-guided versus angiography-directed high-pressure stenting.

Methods and Results Lesions of patients who had a 6-month angiographic follow-up study were eligible for matching. From 445 consecutive lesions treated by Palmaz-Schatz (P-S) stenting guided by IVUS (IVUS group) in Milan, 173 lesions were individually matched with 173 of 476 consecutive lesions treated by P-S stenting directed by angiography (Angio group) in Hamburg. Lesions were selected by a computerized program according to baseline clinical, angiographic, and procedural variables. Immediate and 6-month angiographic results were retrospectively compared, distinguishing an "early phase" from a "late phase." This distinction was based on the more aggressive dilation strategy with larger balloons and more demanding IVUS criteria for optimal stent expansion used in Milan in the early phase. In both phases, a larger minimum lumen diameter (MLD) immediately after stenting and after 6 months was achieved in the IVUS group than in the Angio group. In the early phase, the dichotomous restenosis rate was lower in the IVUS group than in the Angio group (9.2% versus 22.3%; P=.04). In the late phase, there was no difference in restenosis between the groups (22.7% versus 23.7%; P=1.0).

Conclusions In matched lesions treated with high-pressure stenting, IVUS guidance achieved a larger MLD than angiographic guidance. However, in the IVUS group, the restenosis rate was lower only in the early phase, when balloons larger than currently used were selected to maximize the stent lumen area.

Albiero et al, Circulation 1997

EVIDENCE FROM RANDOMIZED TRIALS: THE BMS ERA

Randomized Comparison of Coronary Stent Implantation Under Ultrasound or Angiographic Guidance to Reduce Stent Restenosis (OPTICUS Study)

Harald Mudra, MD; Carlo di Mario, MD; Peter de Jaegere, MD; Hans Reiner Figulla, MD; Carlos Macaya, MD; Ralf Zahn, MD; Bertil Wennerblom, MD; Wolfgang Rutsch, MD; Vasilj Voudris, MD; Evelyn Regar, MD; Karl-Heinz Henneke, MD; Volker Schächinger, MD; Andreas Zeiher, MD; for the OPTICUS (OPTimization with ICUS to reduce stent restenosis) Study Investigators

Background—Observational studies in selected patients have shown remarkably low restenosis rates after ultrasound-guided stent implantation. However, it is unknown whether this implantation strategy improves long-term angiographic and clinical outcome in routine clinical practice.

Methods and Results—A total of 550 patients with a symptomatic coronary lesion or silent ischemia were randomly assigned to either ultrasound-guided or angiography-guided implantation of ≤2 tubular stents. The primary end points were angiographic dichotomous restenosis rate, minimal lumen diameter, and percent diameter stenosis after 6 months as determined by quantitative coronary angiography. Secondary end points were the occurrence rates of major adverse cardiac events (death, myocardial infarction, coronary bypass surgery, and repeat percutaneous intervention) after 6 and 12 months of follow-up. At 6 months, repeat angiography revealed no significant differences between the groups with ultrasound- or angiography-guided stent implantation with respect to dichotomous restenosis rate (24.5% versus 22.8%, $P=0.68$), minimal lumen diameter (1.95±0.72 mm versus 1.91±0.68 mm, $P=0.52$), and percent diameter stenosis (34.8±20.6% versus 36.8±19.6%, $P=0.29$), respectively. At 12 months, neither major adverse cardiac events (relative risk, 1.07; 95% CI 0.75 to 1.52; $P=0.71$) nor repeat percutaneous interventions (relative risk 1.04; 95% CI 0.64 to 1.67; $P=0.87$) were reduced in the ultrasound-guided group.

Conclusions—This study does not support the routine use of ultrasound guidance for coronary stenting. Angiography-guided optimization of tubular stents can be performed with comparable angiographic and clinical long-term results. (***Circulation*. 2001;104:1343-1349.**)

ANY IMPACT OF IVUS ON LEFT MAIN

Comparison of Early Outcome of Percutaneous Coronary Intervention for Unprotected Left Main Coronary Artery Disease in the Drug-Eluting Stent Era With Versus Without Intravascular Ultrasonic Guidance

Pierfrancesco Agostoni, MD, Marco Valgimigli, MD, Carlos A.G. Van Mieghem, MD, Gaston A. Rodriguez-Granillo, MD, Jiro Aoki, MD, Andrew T.L. Ong, MBBS, Keiichi Tsuchida, MD, Eugène P. McFadden, MD, Jurgen M. Ligthart, BSc, Pieter C. Smits, MD, PhD, Peter de Jaegere, MD, PhD, George Sianos, MD, PhD, Willem J. Van der Giessen, MD, PhD, Pim De Feyter, MD, PhD, and Patrick W. Serruys, MD, PhD

The aim of this study was to assess the short- and mid-term clinical impact of intravascular ultrasound guidance in 58 patients referred for elective percutaneous treatment of unprotected left main coronary artery disease with drug-eluting stents. The use of intravascular ultrasound, used in 41% of the procedures, was not associated with additional clinical benefit with respect to angiographic-assisted stent deployment.
(Am J Cardiol 2005;95:644–647)

Cordis Europa, NV, Roden, The Netherlands) and paclitaxel-eluting stents (Taxus, Boston Scientific Corp., Natick, Massachusetts) have been used as part of the Rapamycin-Eluting Stent Evaluated At Rotterdam Cardiology Hospital and the Taxus-Stent Evaluated At Rotterdam Cardiology Hospital registries, respectively. These protocols were approved by the hospital ethics committee and are in accordance with the Declaration of Helsinki. Written informed consent was obtained from every patient.

Angiographic success was defined as residual ste-

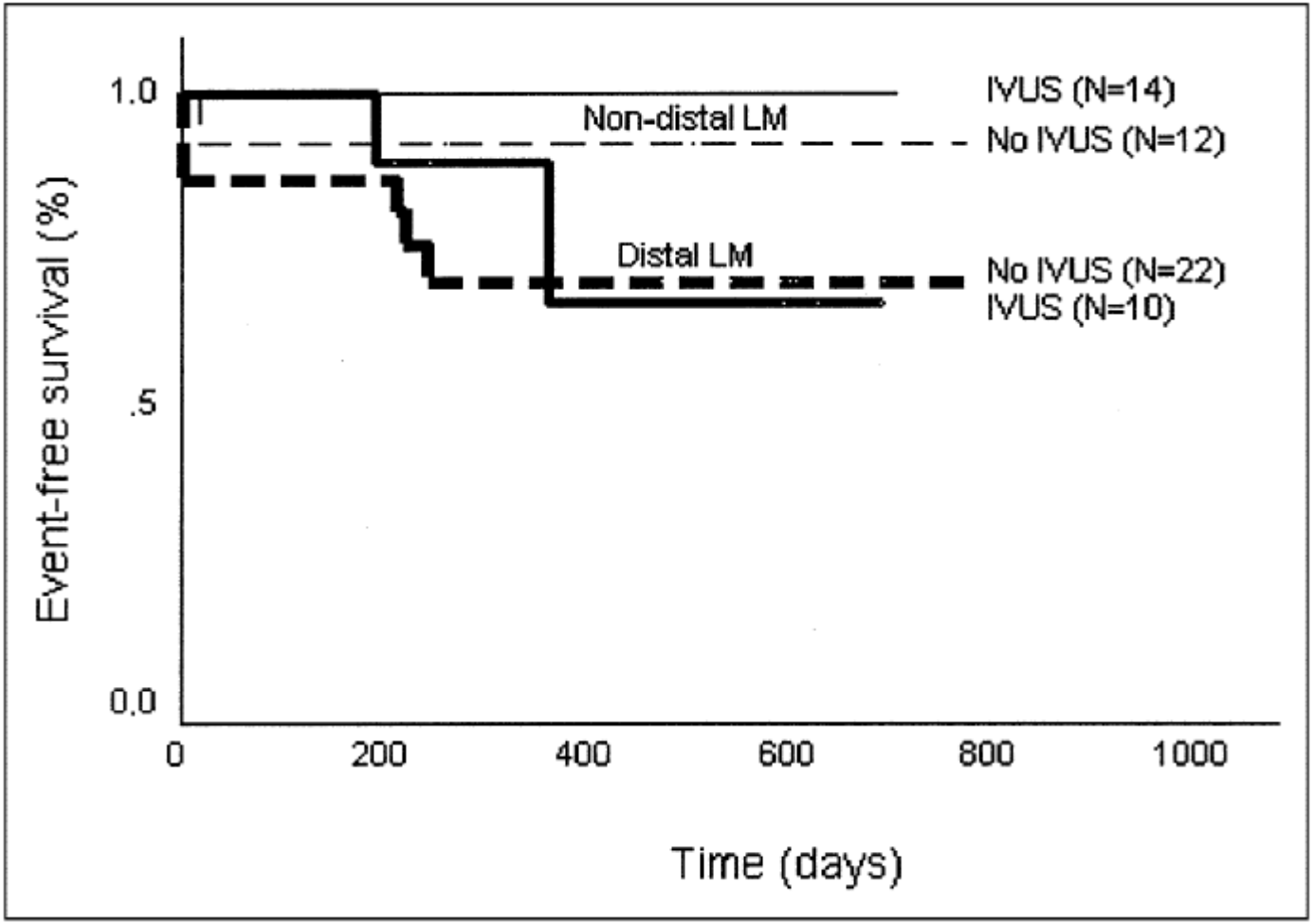


FIGURE 1. Kaplan-Meier major adverse events: free survival curves of IVUS versus non–IVUS-guided procedures, stratified according to the anatomic location of atherosclerotic disease in the LM artery.

Agostoni et al, Am J Cardiol 2005

WHY IVUS MIGHT BE BENEFICIAL

Late stent malapposition risk is higher after drug-eluting stent compared with bare-metal stent implantation and associates with late stent thrombosis

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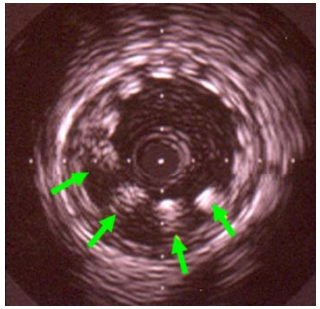
Received 13 June 2008; revised 17 September 2008; accepted 19 November 2008; online publish-ahead-of-print 21 January 2009

Aims Late stent malapposition (LSM) may be acquired (LASM) or persistent. LSM may play a role in patients who develop late stent thrombosis (ST). Our objective was to compare the risk of LASM in bare metal stents (BMS) with drug-eluting stents (DES) and to investigate the possible association of both acquired and persistent LSM with (very) late ST.

Methods and results We searched PubMed and relevant sources from January 2002 to December 2007. Inclusion criteria were: (a) intravascular ultrasonography (IVUS) at both post-stent implantation and follow-up; (b) 6–9-month-follow-up IVUS; (c) implantation of either BMS or the following DES: sirolimus, paclitaxel, everolimus, or zotarolimus; and (d) follow-up for LSM. Of 33 articles retrieved for detailed evaluation, 17 met the inclusion criteria. The risk of LASM in patients with DES was four times higher compared with BMS (OR = 4.36, CI 95% 1.74–10.94) in randomized clinical trials. The risk of (very) late ST in patients with LSM (five studies) was higher compared with those without LSM (OR = 6.51, CI 95% 1.34–34.91).

Conclusion In our meta-analysis, the risk of LASM is strongly increased after DES implantation compared with BMS. Furthermore, LSM seems to be associated with late and very late ST.



Study	DES (*n*/total)	BMS (*n*/total)	OR (95% CI)
Weissman *et al.*	24/287	9/260	2.5 (1.1 – 6.3)
Tanabe *et al.*	20/229	13/240	1.7 (0.8 – 3.8)
Ako *et al.*	7/80	0/61	7.8 (1.1 to infinite)
Chechi *et al.*	2/39	1/37	1.9 (0.1 – 118)
vd Hoeven *et al.*	26/104	4/80	6.2 (2 – 25.9)
Jimenez-Quevedo *et al.*	11/75	0/65	15.2 (2.4 to infinite)
Hong *et al.*	1/56	0/25	0.4 (0.01 to infinite)
Total	**91/870**	**27/768**	**4.4 (1.8 – 10.9)**

Hassan et al, Eur Heart J 2010

USE of IVUS MIGHT PREVENT STENT THROMBOSIS

The potential clinical utility of intravascular ultrasound guidance in patients undergoing percutaneous coronary intervention with drug-eluting stents

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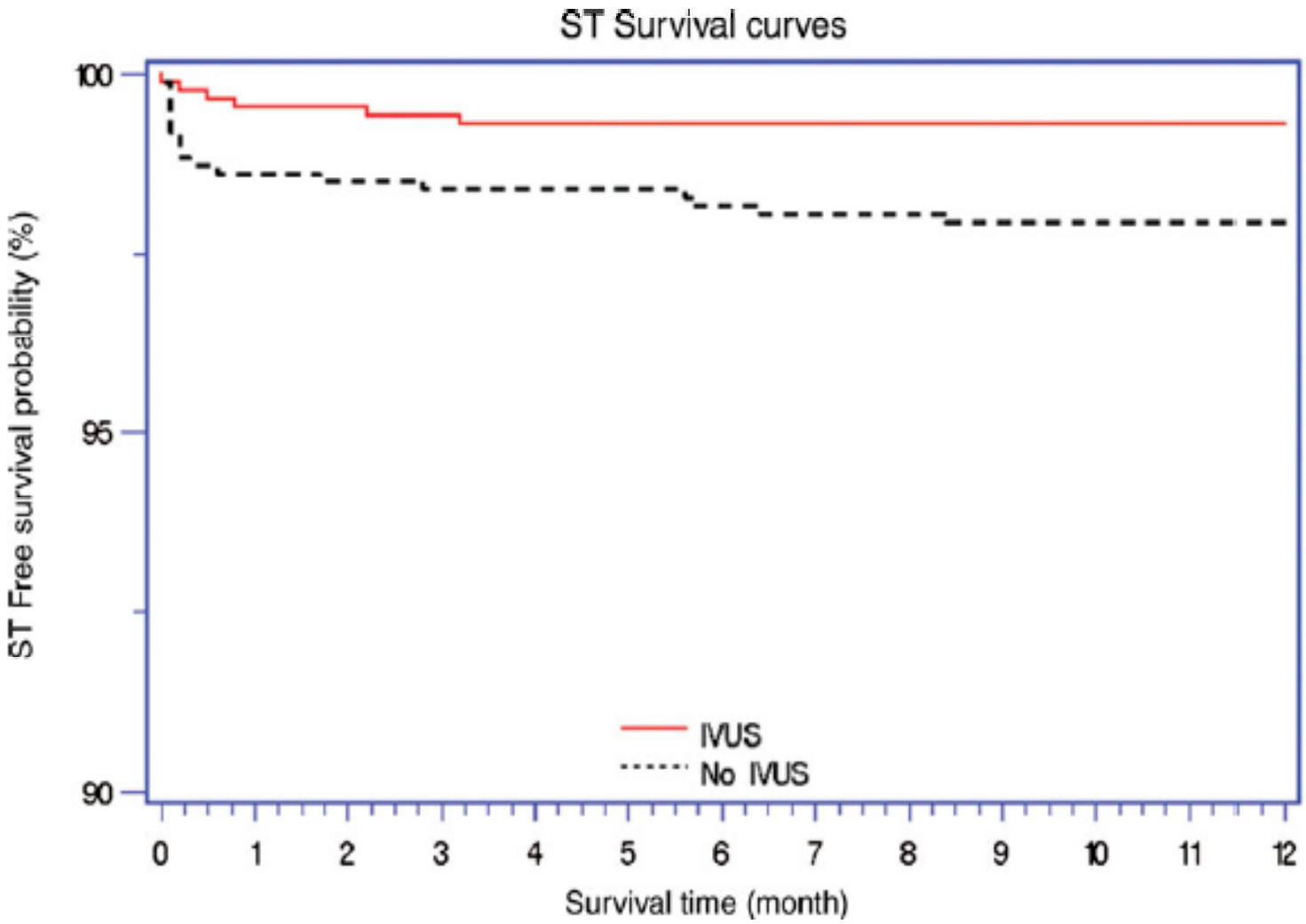
Received 25 October 2007; revised 19 May 2008; accepted 22 May 2008; online publish-ahead-of-print 11 June 2008

Aims To assess the impact on clinical outcomes of intravascular ultrasound (IVUS) guidance during drug-eluting stent (DES) implantation. IVUS guidance during percutaneous coronary intervention (PCI) has been demonstrated to be useful in optimizing stent deployment. However, it is not proved that routine use of IVUS guidance with DES implantation can prevent stent thrombosis or restenosis.

Methods and results The clinical outcomes of 884 patients undergoing IVUS-guided intracoronary DES implantation from April 2003 to May 2006 were compared with the outcomes of a propensity-score matched population undergoing DES implantation with angiographic guidance alone. The primary endpoint of the study was definite stent thrombosis at 12 months. The secondary endpoint was major adverse cardiac events (MACE). After propensity-score matching, the two groups were well matched for clinical and angiographic characteristics. Patients undergoing IVUS-guided DES implantation underwent less direct stenting, more post-dilation, and had greater cutting balloon and rotational atherectomy use. At 30 days and at 12 months, a higher rate of definite stent thrombosis was seen in the No IVUS group (0.5 vs. 1.4%; $P = 0.046$) and (0.7 vs. 2.0%; $P = 0.014$), respectively. There were no major differences in late stent thrombosis and MACE (14.5 vs. 16.2%; $P = 0.33$) at 12 month follow-up between the groups. Rates of death and Q-wave myocardial infarction were similar, and there was no significant difference between groups in target vessel revascularization. However, a trend was seen in favour of the IVUS group in target lesion revascularization (5.1 vs. 7.2%; $P = 0.07$). IVUS guidance was an independent predictor of freedom from cumulative stent thrombosis at 12 months (adjusted HR 0.5, CI 0.1–0.8; $P = 0.02$).

Conclusion IVUS guidance during DES implantation has the potential to influence treatment strategy and reduce both DES thrombosis and the need for repeat revascularization.



Roy et al, Eur Heart J 2008

CAN IVUS REDUCE DEATH AND STENT THROMBOSIS BUT NOT TLR?

Long-Term Outcomes of Intravascular Ultrasound-Guided Stenting in Coronary Bifurcation Lesions

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Stenting for bifurcation lesions is still challenging, and the effect of intravascular ultrasound (IVUS) guidance on long-term outcomes has not been evaluated. We assessed the long-term outcomes of IVUS-guided stenting in bifurcation lesions. We evaluated 758 patients with de novo nonleft main coronary bifurcation lesions who underwent stent implantation from January 1998 to February 2006. We compared the adverse outcomes (i.e., death, stent thrombosis, and target lesion revascularization) within 4 years, after adjustment using a multivariate Cox proportional hazard model and propensity scoring. IVUS-guided stenting significantly reduced the long-term all-cause mortality (hazard ratio [HR] 0.31, 95% confidence interval [CI] 0.13 to 0.74, p = 0.008) in the total population and in the patients receiving drug-eluting stents (DESs) (HR 0.24, 95% CI 0.06 to 0.86, p = 0.03), but not in the patients receiving bare metal stents (HR 0.41, 95% CI 0.13 to 1.26, p = 0.12). IVUS-guided stenting had no effect on the rate of stent thrombosis (HR 0.48, 95% CI 0.16 to 1.43, p = 0.19) or target lesion revascularization (HR 1.47, 95% CI 0.79 to 2.71, p = 0.21). In patients receiving DESs, however, IVUS guidance reduced the development of very late stent thrombosis (0.4% vs 2.8%, p = 0.03, log-rank test). In conclusion, in patients receiving DESs, IVUS-guided stenting for treatment of bifurcation lesions significantly reduced the 4-year mortality compared to conventional angiographically guided stenting. In addition, IVUS guidance reduced the development of very late stent thrombosis in patients receiving DESs. (Am J Cardiol

Outcome	DES Group		BMS Group	
	HR (95% CI)	p Value	HR (95% CI)	p Value
Unadjusted				
Death	0.21 (0.06–0.72)	0.01	0.27 (0.09–0.81)	0.02
Stent thrombosis	0.27 (0.06–1.22)	0.09	0.78 (0.17–3.48)	0.74
Target lesion revascularization	0.94 (0.39–2.24)	0.88	2.13 (1.00–4.55)	0.05
Multivariate adjusted				
Death	0.24 (0.06–0.86)	0.03	0.41 (0.13–1.26)	0.12
Stent thrombosis	0.35 (0.08–1.64)	0.18	1.09 (0.22–5.34)	0.92
Target lesion revascularization	0.92 (0.38–2.25)	0.86	2.27 (0.99–5.25)	0.05
Propensity score adjusted				
Death	0.21 (0.06–0.73)	0.01	0.4 (0.1–1.2)	0.11
Stent thrombosis	0.28 (0.06–1.25)	0.10	1.0 (0.2–4.9)	0.98
Target lesion revascularization	0.90 (0.33–2.54)	0.84	1.67 (0.75–3.72)	0.21

Kim et al, Am J Cardiol 2010

CAN IVUS REDUCE DEATH AND STENT THROMBOSIS BUT NOT TLR?

Impact of Intravascular Ultrasound Guidance on Long-Term Mortality in Stenting for Unprotected Left Main Coronary Artery Stenosis

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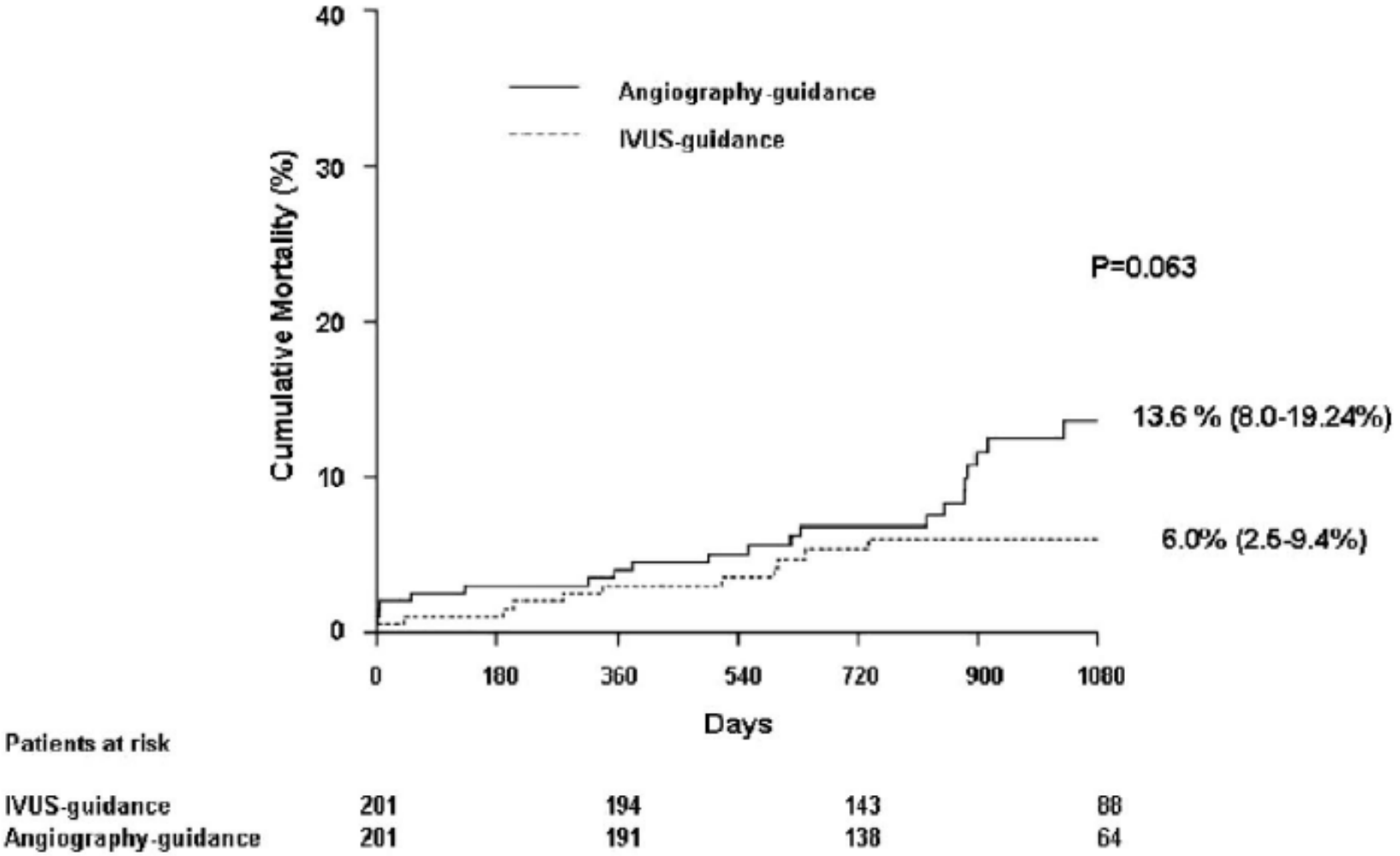
Background—Although intravascular ultrasound (IVUS) guidance has been useful in stenting for unprotected left main coronary artery stenosis, its impact on long-term mortality is still unclear.

Methods and Results—In the MAIN-COMPARE registry, patients with unprotected left main coronary artery stenosis in a hemodynamically stable condition underwent elective stenting under the guidance of IVUS (756 patients) or conventional angiography (219 patients). Patients with acute myocardial infarction were excluded. The 3-year outcomes between the 2 groups were primarily compared using propensity-score matching in the entire and separate populations according to stent type. In 201 matched pairs of the overall population, there was a tendency of lower risk of 3-year morality with IVUS guidance compared with angiography guidance (6.0% versus 13.6%, log-rank $P=0.063$; hazard ratio, 0.54; 95% CI, 0.28 to 1.03; Cox-model $P=0.061$). In particular, in 145 matched pairs of patients receiving drug-eluting stent, the 3-year incidence of mortality was lower with IVUS guidance as compared with angiography guidance (4.7% versus 16.0%, log-rank $P=0.048$; hazard ratio, 0.39; 95% CI, 0.15 to 1.02; Cox model $P=0.055$). In contrast, the use of IVUS guidance did not reduce the risk of mortality in 47 matched pairs of patients receiving bare-metal stent (8.6% versus 10.8%, log-rank $P=0.35$; hazard ratio, 0.59; 95% CI, 0.18 to 1.91; Cox model $P=0.38$). The risk of myocardial infarction or target vessel revascularization was not associated with the use of IVUS guidance.

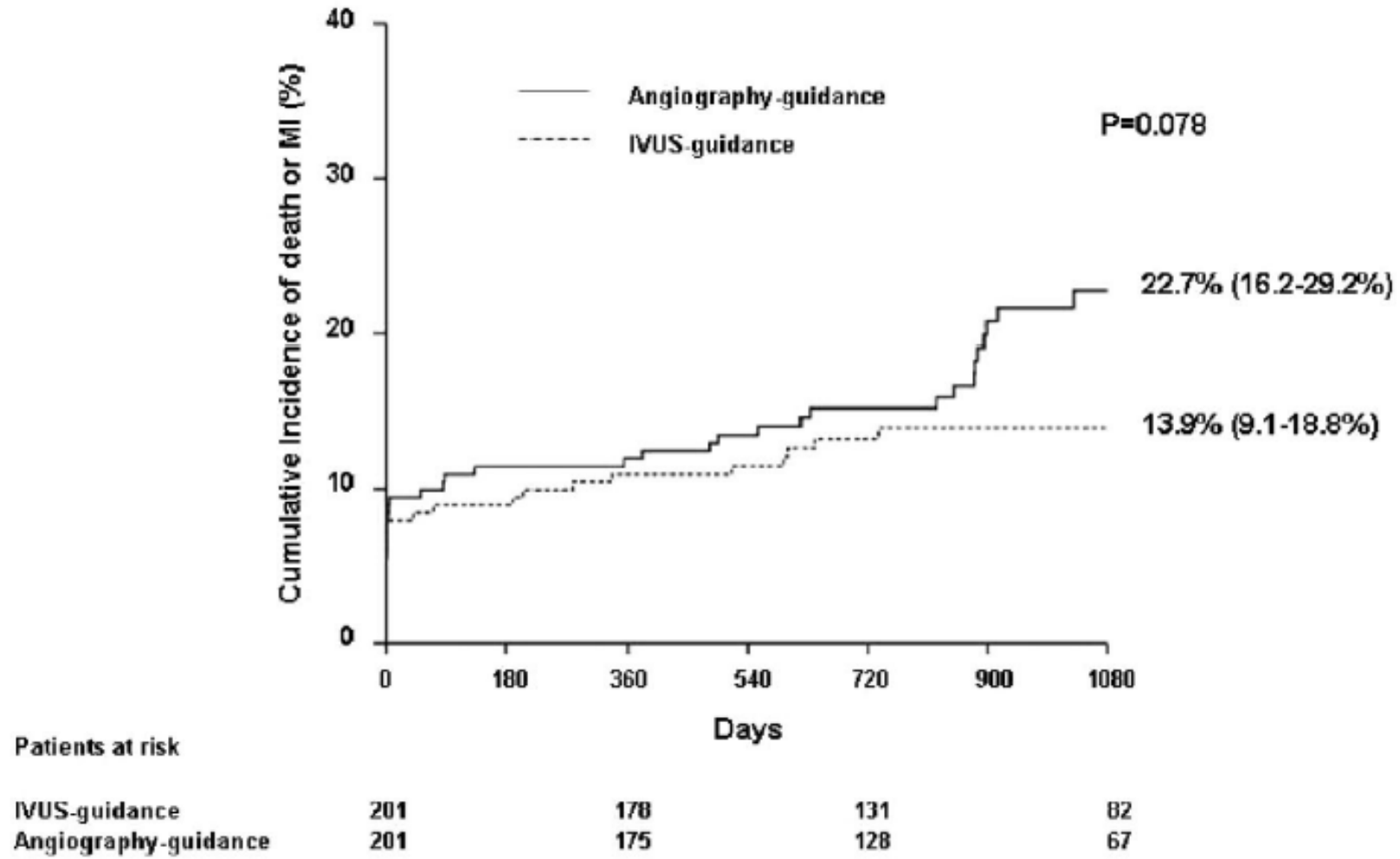
Conclusions—Elective stenting with IVUS guidance, especially in the placement of drug-eluting stent, may reduce the long-term mortality rate for unprotected left main coronary artery stenosis when compared with conventional angiography guidance. (***Circ Cardiovasc Intervent.* 2009;2:167-177.**)

	Drug-Eluting Stent			Bare-Metal Stent		
Outcome	HR	95% CI	*P*	HR	95% CI	*P*
Death	0.39	0.15 to 1.02	0.055	0.59	0.18 to 1.91	0.38
MI	0.83	0.43 to 1.57	0.56	0.97	0.23 to 4.16	0.97
Death or MI	0.61	0.35 to 1.07	0.082	0.70	0.27 to 1.8	0.46
TVR	0.80	0.35 to 1.86	0.62	2.31	0.68 to 7.9	0.18
Death, MI, or TVR	0.64	0.39 to 1.04	0.074	1.12	0.52 to 2.41	0.78

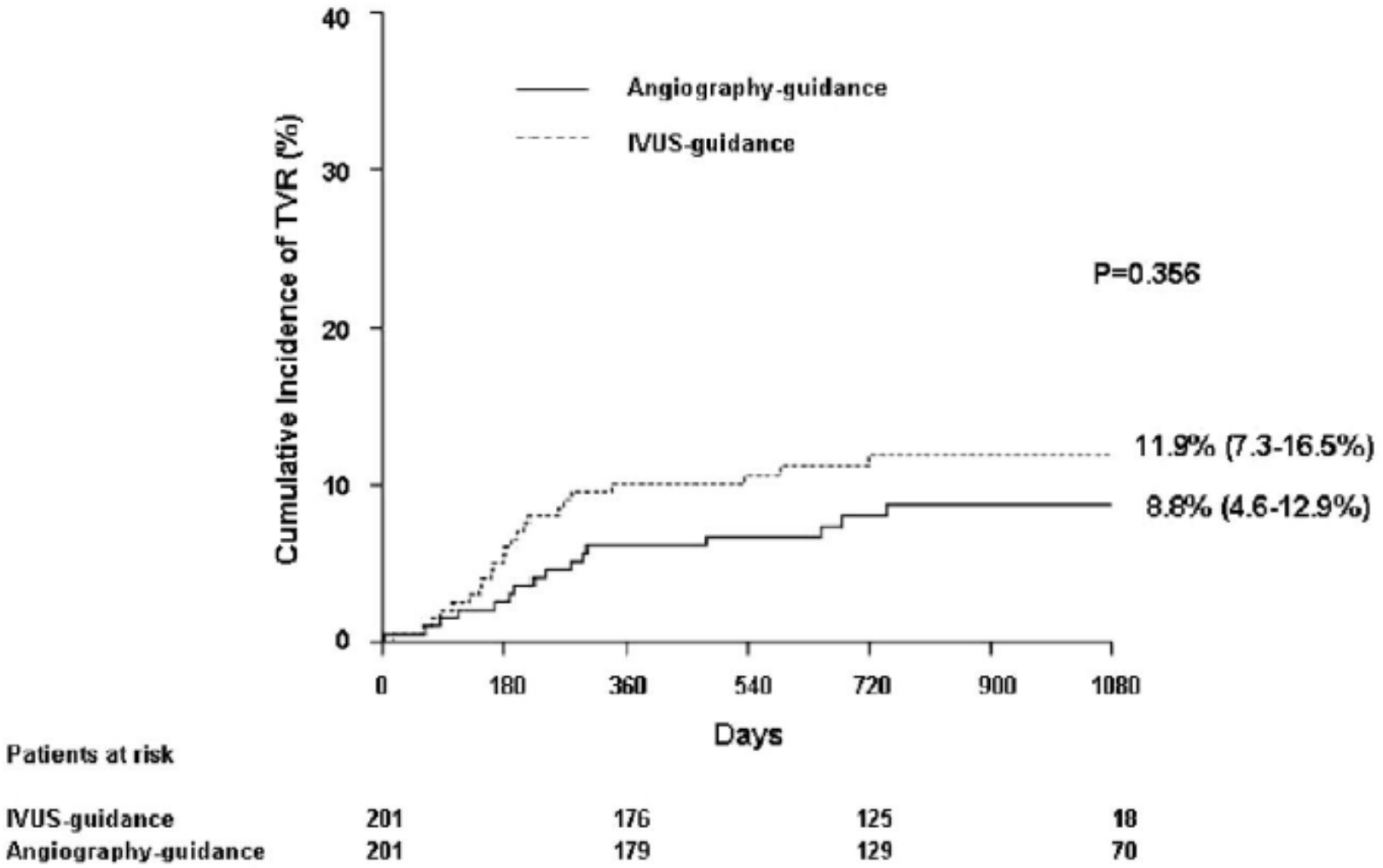
Park et al, Circ Cardiovasc Intervent 2009



Park et al, Circ Cardiovasc Intervent 2009



Park et al, Circ Cardiovasc Intervent 2009



Park et al, Circ Cardiovasc Intervent 2009

I-BIGIS Registry EXPERIENCE

Is intravascular ultrasound beneficial for percutaneous coronary intervention of bifurcation lesions? Evidence from a 4314-patient registry On behalf of the I-BIGIS Investigators

- **A multicenter, retrospective study was conducted enrolling consecutive patients undergoing bifurcation PCI between January 2002 and January 2006 at 22 Italian centers.**
- **The primary end-point was the long-term rate of major adverse cardiac events (MACE, i.e. death, myocardial infarction or target lesion revascularization [TLR])**

BASELINE PATIENT CHARACTERISTICS

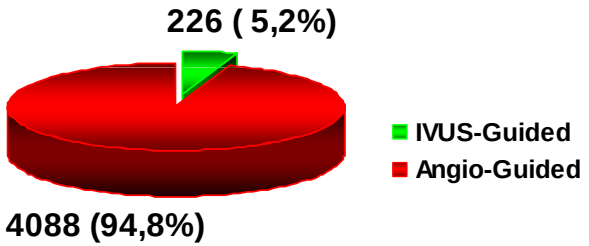
Feature	IVUS-guided PCI (Patients=226)	Standard PCI (Patients=4088)	P value
Age (years)	65 (56-72)	65 (57-73)	0.690
Male gender (%)	188 (83.2)	3295 (80.6)	0.338
Family history of coronary artery disease (%)	103 (46.2)	1378 (35.6)	0.001
Hypertension (%)	142 (63.1)	2657 (66.8)	0.255
Dyslipidemia (%)	141 (62.7)	2296 (57.7)	0.143
Smoking history (%)	125 (55.6)	2065 (51.9)	0.290
Diabetes mellitus (%)	51 (22.7)	1045 (26.3)	0.231
Chronic kidney disease (serum creatinine >1.7 mg/dl) (%)	15 (6.7)	352 (9.1)	0.235
Prior myocardial infarction (%)	92 (40.9)	1166 (31.8)	0.005
Prior percutaneous coronary intervention (%)	78 (34.7)	950 (26.0)	0.004
Prior coronary artery bypass grafting (%)	22 (9.8)	340 (9.3)	0.816
Multivessel coronary artery disease (%)	174 (77.0)	2509 (67.2)	0.002
Concomitant unprotected left main disease	49 (21.7)	278 (6.8)	<0.001
Left ventricular ejection fraction (%)	55 (50-60)	55 (50-60)	0.440
Admission diagnosis			<0.001
Stable angina (%)	152 (67.3)	2077 (50.8)	
Unstable angina (%)	59 (26.1)	979 (23.9)	
Non-ST-elevation myocardial infarction (%)	10 (4.4)	465 (11.4)	
ST-elevation myocardial infarction (%)	5 (2.2)	567 (13.9)	
Admission in a high-volume center	138 (61.1)	3091 (75.6)	<0.001
Year of admission	2005(2003-2006)	2005 (2004-2006)	0.080

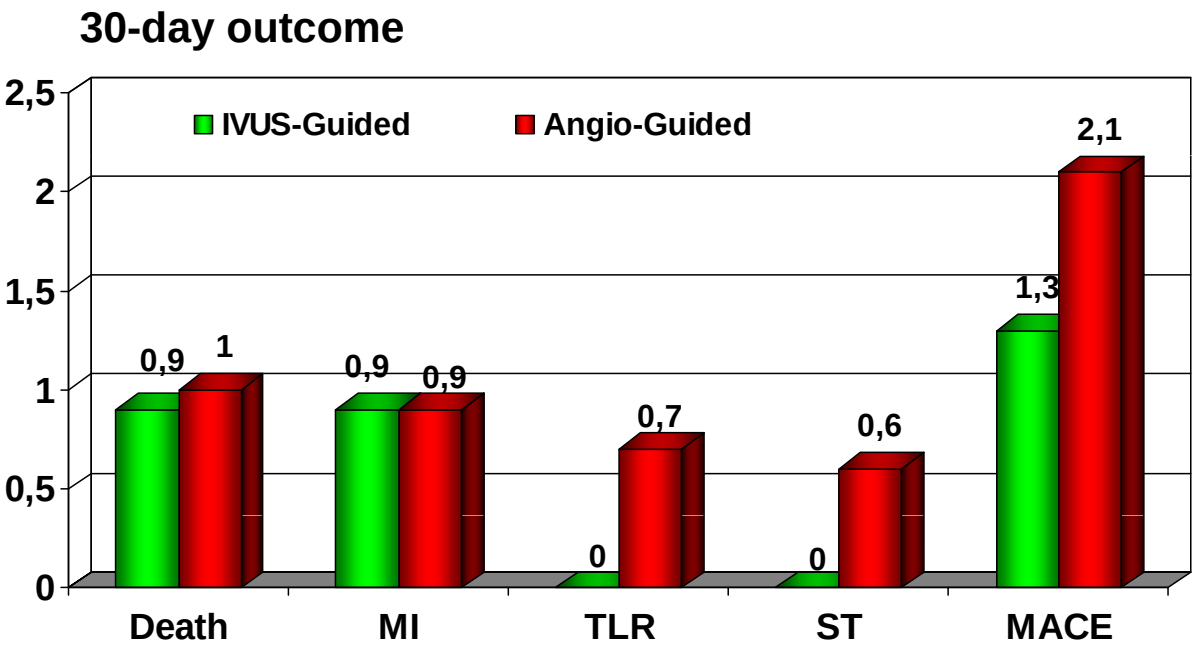
PROCEDURAL CHARACTERISTICS

Feature	IVUS-guided PCI (Patients=226; lesions=252)	Standard PCI (Patients=4088; lesions=4235)	P value
Bifurcation site (%)			<0.001
Left main	58 (23.0)	331 (7.8)	
Left anterior descending/diagonal artery	149 (59.1)	2690 (63.5)	
Left circumflex/obtuse marginal artery	33 (13.1)	940 (22.2)	
Distal right coronary/posterior descending artery/postero-lateral branch	12 (4.8)	274 (6.5)	
True bifurcation lesion (%)	162 (64.3)	2465 (63.6)	0.830
Multiple lesions on the target vessel (%)	75 (30.0)	666 (17.5)	<0.001
Restenosis treatment (%)	11 (4.9)	194 (5.2)	0.837
Stenting technique (%)			<0.001
Main vessel stenting	94 (37.5)	2795 (67.2)	
T	25 (10.0)	538 (12.9)	
V	14 (5.6)	118 (2.8)	
Crushing	101 (40.2)	605 (14.5)	
Culottes	16 (6.4)	97 (2.3)	
Other	1 (0.4)	6 (0.1)	
Drug-eluting stent use (%)	244 (96.8)	3255 (76.9)	<0.001
Main branch stent diameter (mm)	3.00 (3.00-3.50)	3.00 (2.75-3.50)	<0.001
Cumulative stent length on main branch (mm)	23 (18-32)	20 (16-28)	<0.001
Side branch stent diameter (mm)	2.75 (2.50-3.00)	2.50 (2.50-3.00)	<0.001
Cumulative stent length on side branch (mm)	18 (13-24)	18 (12-23)	<0.001
Final kissing balloon performed (%)	203 (80.6)	2156 (50.9)	<0.001
Dual antiplatelet therapy duration (months)	12 (6-12)	9 (6-12)	<0.001
Angiographic control during follow-up	135 (60.5)	1293 (32.3)	<0.001

RESULTS

- A total of 4314 patients

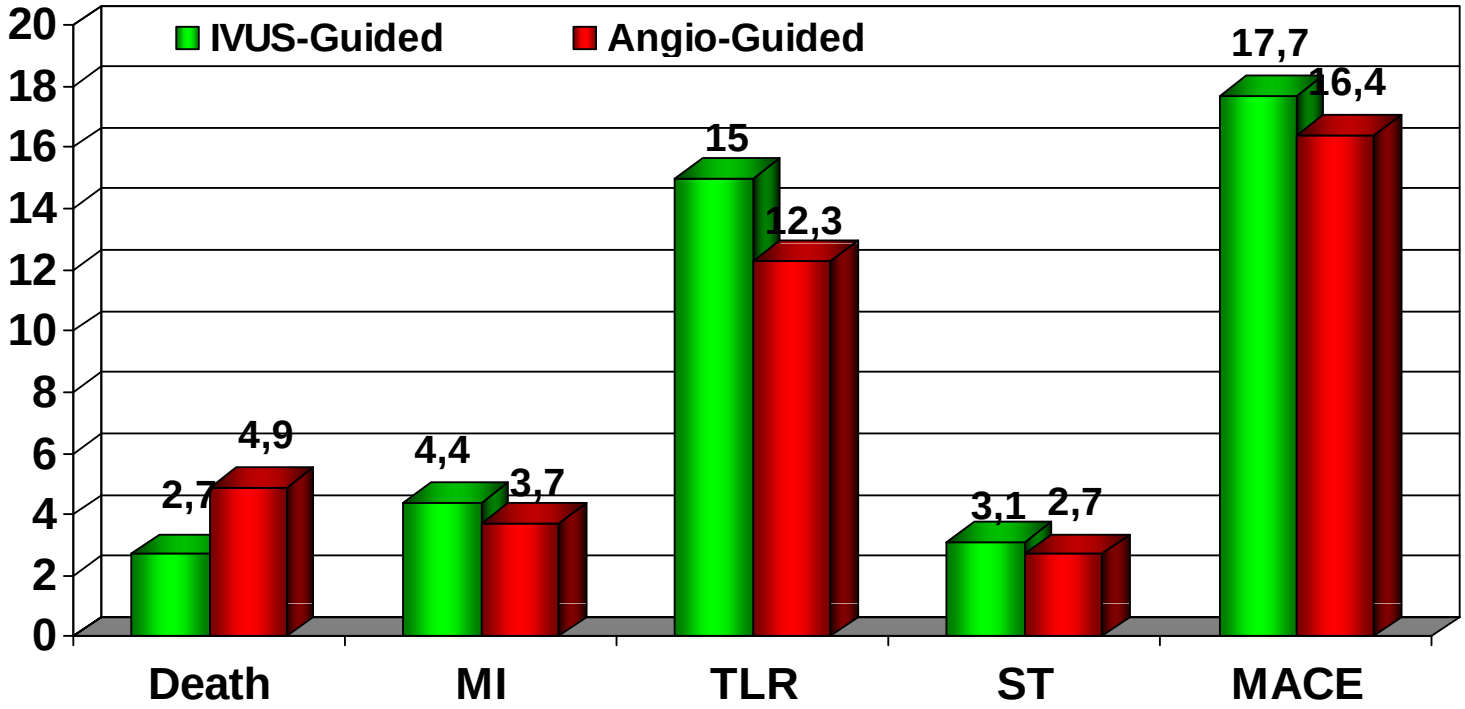




RESULTS

Long-Term Outcome (24.4 ± 15.1 months)

- **Even at extensive multivariable analysis with propensity adjustment, IVUS guidance was not associated with any statistically significant impact on the risk of MACE, death, myocardial infarction, TLR (neither on the main branch nor on the side branch), or stent thrombosis (all p>0.05).**



MULTIVARIABLE OUTCOME PREDICTORS

Event	Predictor(s)
Thirty-day outcomes	
Major adverse cardiac events	Diabetes mellitus (OR=1.762 [p=0.014) Drug-eluting stent us .265-0.664], p<0.001) Cumulative stent length o =1.029 [1.004-1.054], p=0.020)
Death	Multives .867 [1.374-5.986], p=0.005) Stable co dmission (OR=0.119 [0.057-0.250], p<0.001)
Definite stent thrombosis	S ease at admission (OR=0.347 [0.117-0.983], p=0.047)

IVUS was not a predictor

MULTIVARIABLE OUTCOME PREDICTORS

Long-term outcomes (24.4±15.1 months)	
Major adverse cardiac events	Admission in a high-volume center (HR=1.457 [1.191-1.783], p<0.001) Diabetes mellitus (HR=1.575 [1.339-1.854], p<0.001) Prior percutaneous coronary intervention (HR=1.549 [1.317-1.820], p<0.001) Left main bifurcation (HR=1.742 [1.405-2.161], p<0.001) Drug-eluting stent use (HR=0.765 [0.629-0.931], p=0.007) Main branch stent diameter (HR=1.333 [1.035-[illegible]17], p=0.026) Side branch stent cumulative length (HR=[illegible]40], p<0.001)†
Death	Angiographic follow-up (HR=[illegible], p<0.001) Diabetes mellitus [illegible]1], p<0.001) Multivessel [illegible].923-4.402], p<0.001) Side branch [illegible]gth (HR=1.039 [1.021-1.058], p<0.001) Stable coronary disease at admission (HR=0.410 [2.71-0.620], p<0.001)†
Myocardial infarction	[illegible]es mellitus (HR=1.653 [1.175-2.325], p=0.004) [illegible]esions on the target vessel (HR=1.579 [1.082-2.304], p=0.018)†
Target lesion revascularization	Angiographic follow-up (HR=4.929 [4.045-6.007], p<0.001) Diabetes mellitus (HR=1.647 [1.379-1.968], p<0.001) Drug-eluting stent use (HR=0.561 [0.453-0.694], p<0.001) Left main bifurcation (HR=1.801 [1.421-2.284], p<0.001) Main branch stent diameter (HR=0.339 [0.231-0.498], p<0.001) Side branch stent cumulative length (HR=1.023 [1.010-1.037], p=0.001)†
Definite stent thrombosis	No statistically significant independent predictor identified
Definite, probable or possible thrombosis	Diabetes mellitus (HR=2.129 [1.436-3.157], p<0.001) Multiple lesions on the target vessel (HR=1.675 [1.081-2.597], p=0.021) Stable coronary disease at admission (HR=0.481 [0.273-0.846], p=0.011) Single stenting technique (HR=0.594 [0.394-0.897], p=0.013)†

IVUS was not a predictor

In Randomized trial on Bifurcation lesions :

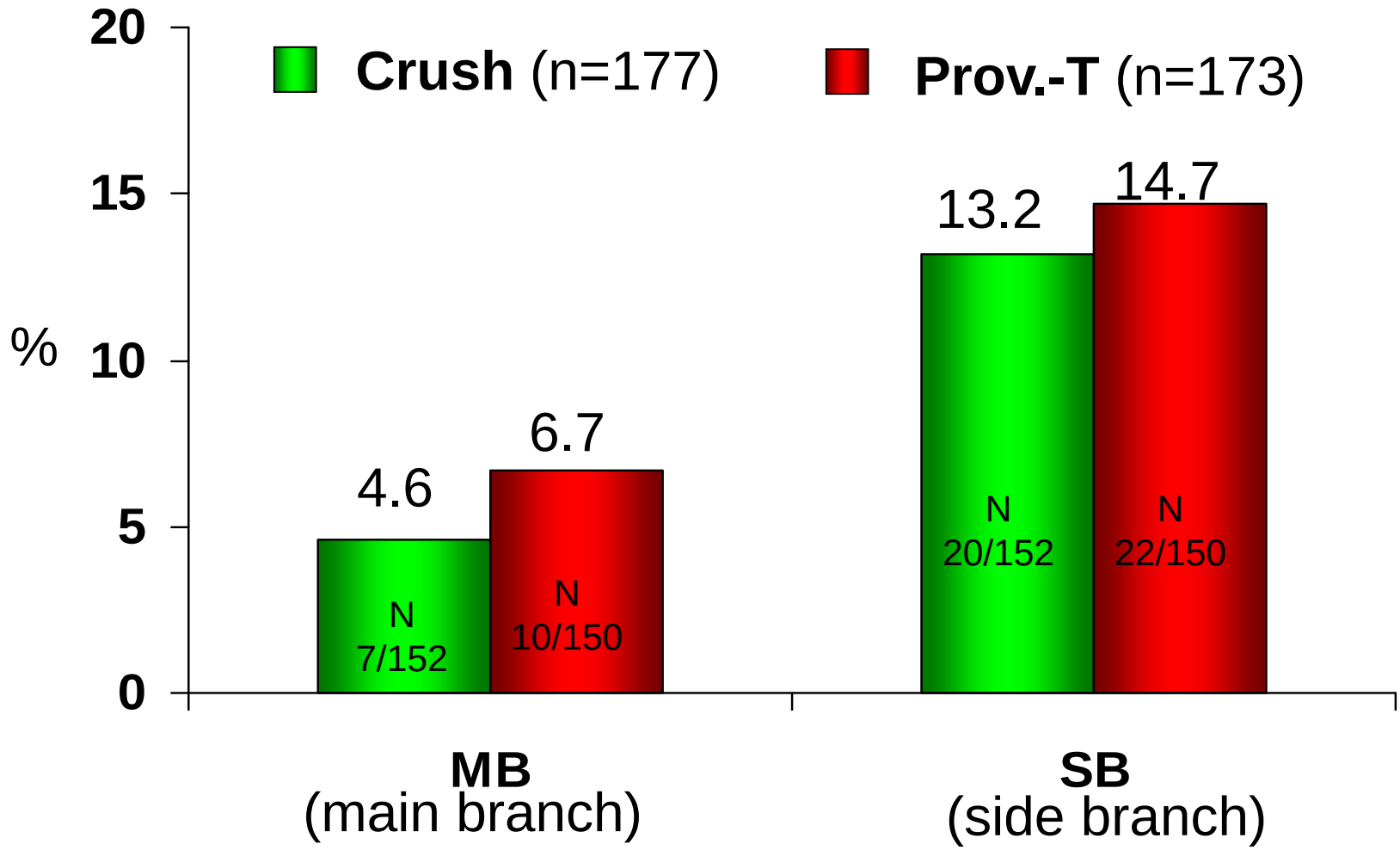
(Nordic Study , CACTUS , BBC One , SYNTAX ……)

- **Use of IVUS was < 10%**
- **Procedures were angio-guided**
- **Clinical outcome was similar except for stent thrombosis, in some of these studies ,which was increased in patients treated with 2-stent strategy**

CACTUS trial

6-month in-segment binary restenosis

Angiographic F.U. performed in 86% of pts in both groups



CACTUS trial

Stent thrombosis

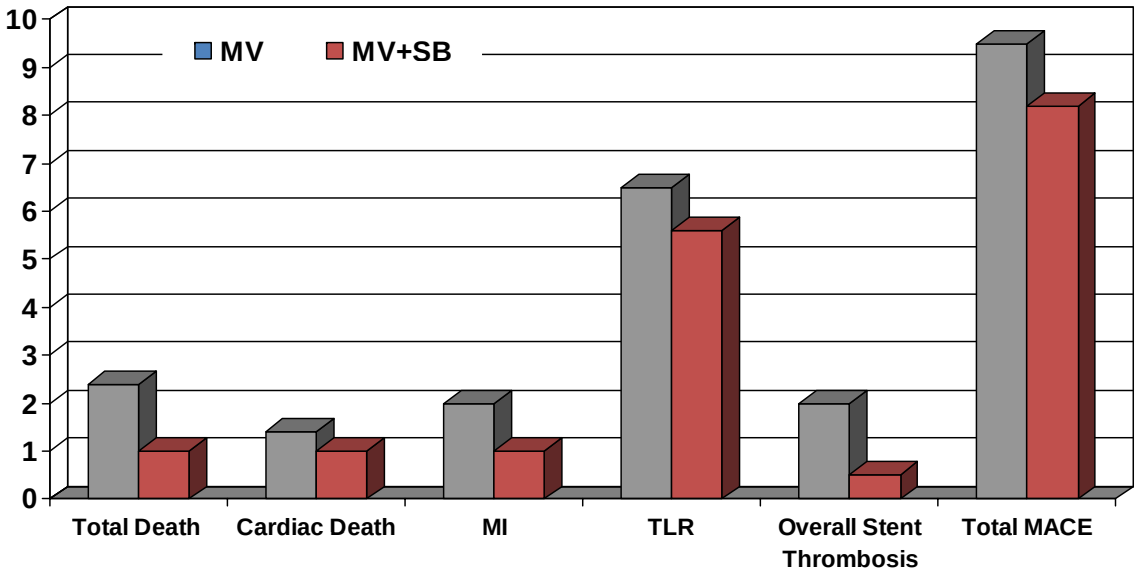
	Total	Acute (first day)	Subacute (days 2-30)	Late (days 31-180)
Crush (n=177)	**3 (1.7%)**	**1 (0.5%)**	**2* (1.1%)**	**0**
Prov.T (n=173)	**2 (1.1%)**	**0**	**1 (0.5%)**	**1 (0.5%) (definitive)**

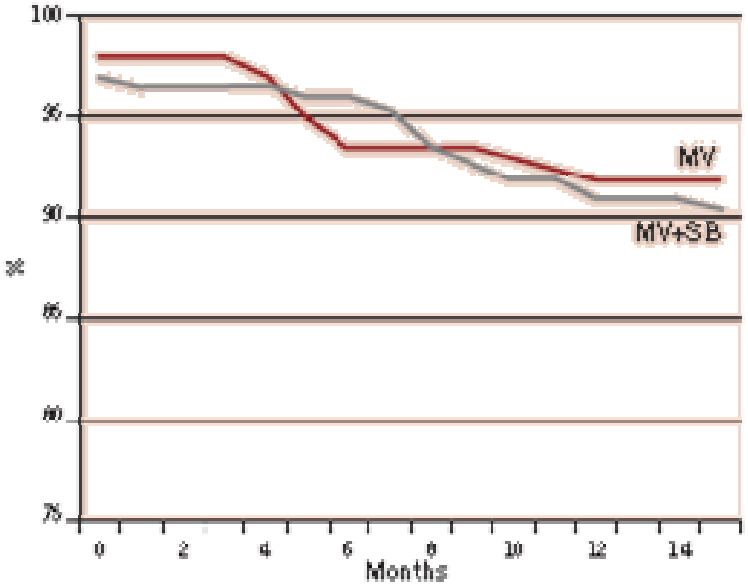
p = 0.62 for comparisons between crush and prov.-T

* *One patient did not take thienopyridine therapy after discharge*

The NORDIC Bifurcation Study

Jan S. Jewnsen et al , EuroInterv 2008; 4: 229-33





Event–free survival

BBC One : **PRIMARY ENDPOINT**

Composite (9months) Death, MI, TVF

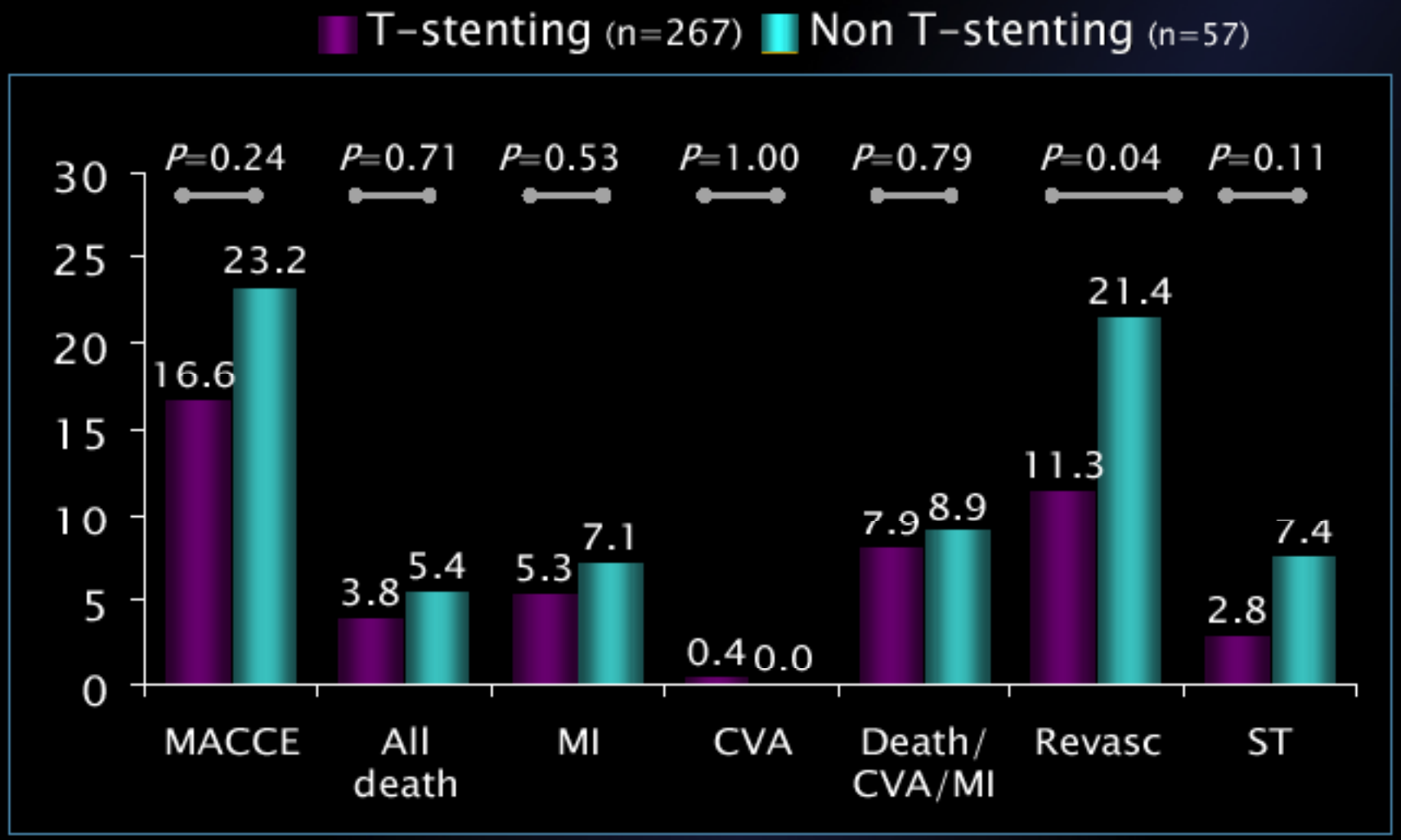
	Complex	Simple	P value
Death	2 (0.8%)	1 (0.4%)	-
Myocardial infarction	28 (11.2%)	9 (3.6%)	-
Target vessel failure	18 (7.2%)	14 (5.6%)	-
Primary endpoint	38 (15.2%)	20 (8.0%)	0.009 HR 2.0 (1.2 to 3.5)

BBC One :Target vessel failure

	Complex	Simple
No. patients	18 (7.2%)	14 (5.6%)
Immediate CABG	2 (0.8%)	0
Inpatient CABG	1(0.4%)	0
Stent thrombosis (ARC definite)	5 (2.0%)	1 (0.4%)
Revascularisation (restenosis)	9	12
Revascularisation (distant lesion)	1	1

MACCE to 12 Months

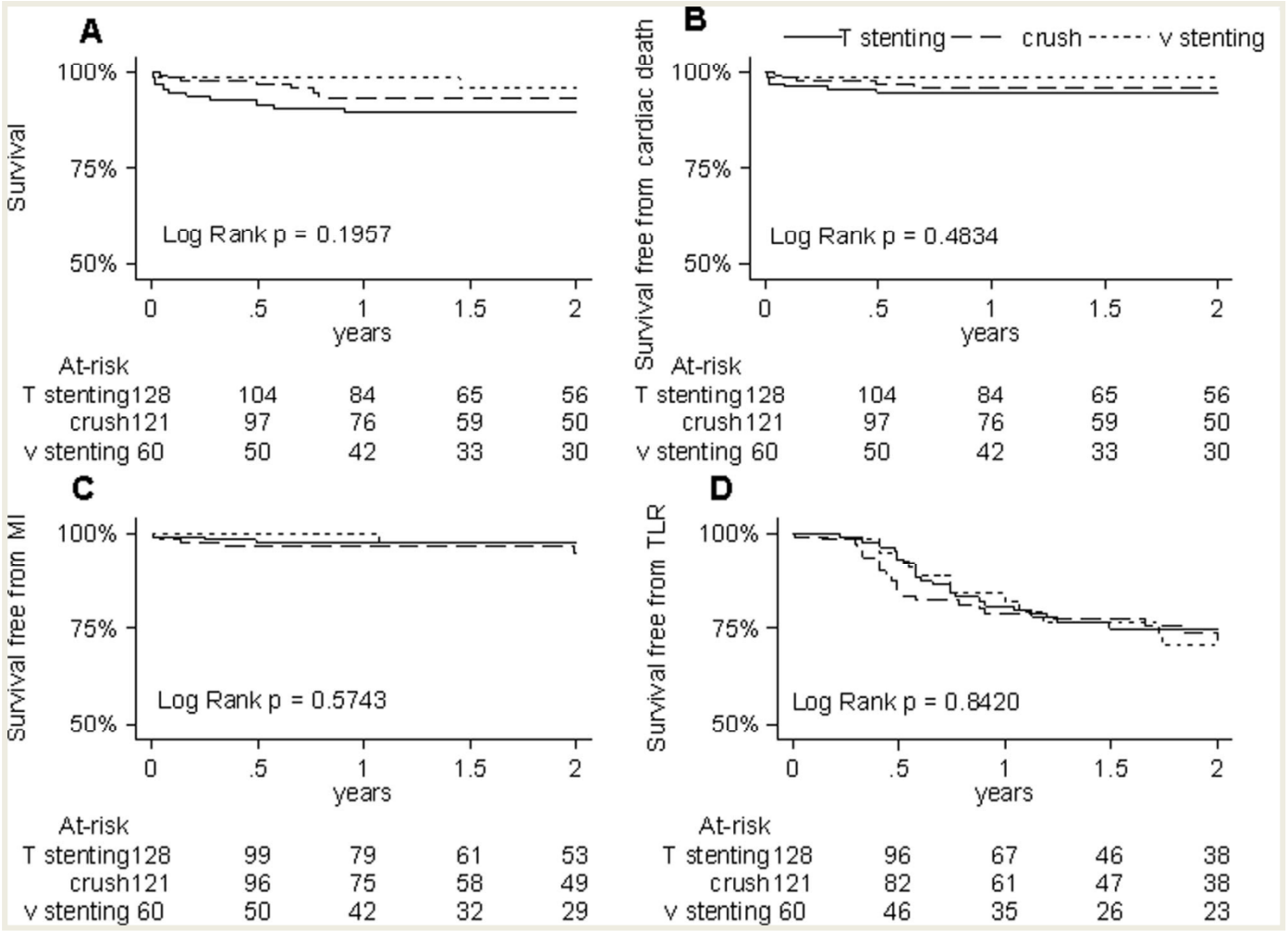
PCI Bifurcation/Trifurcation Subset



ST=Per-protocol stent thrombosis

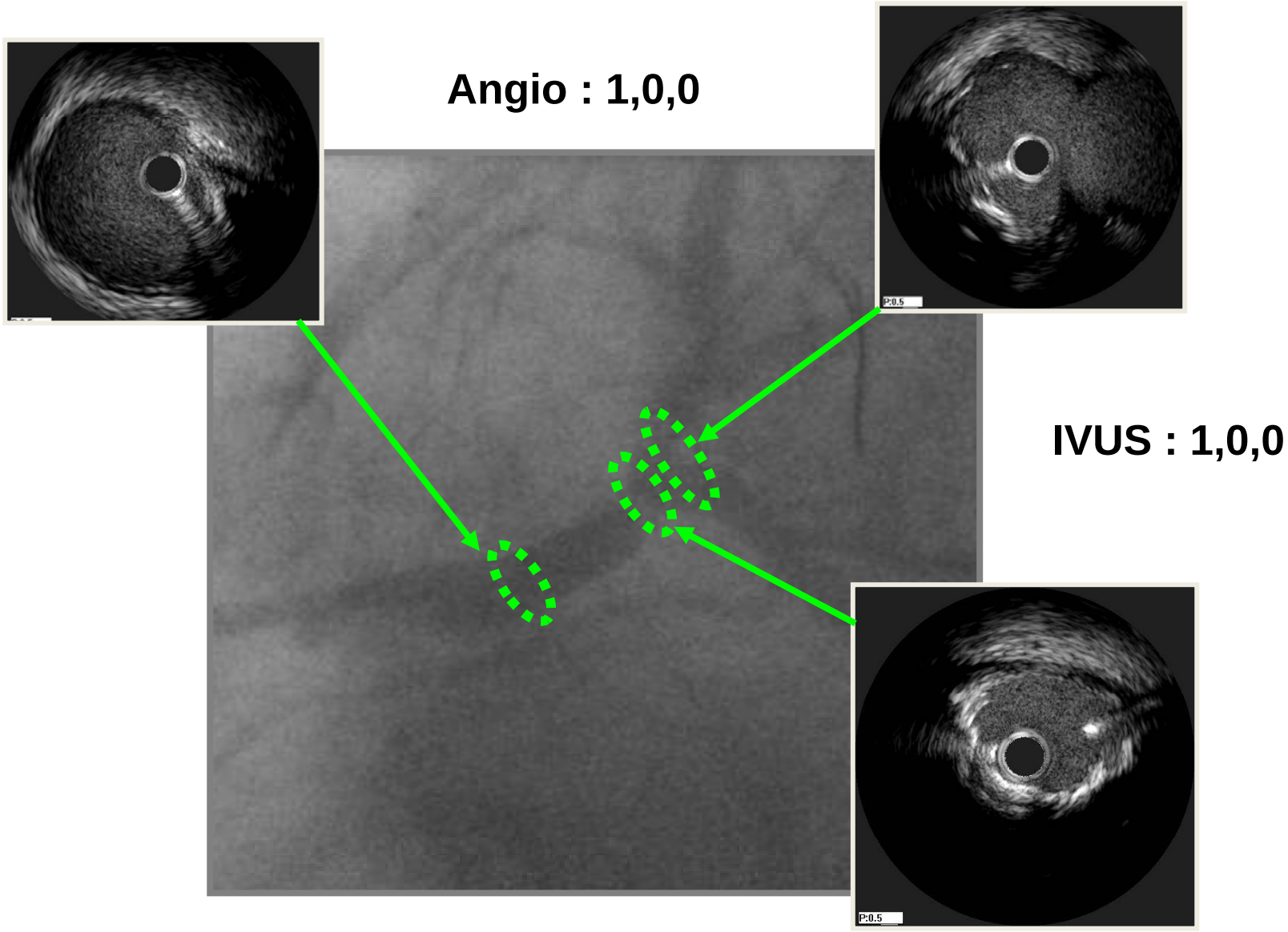
*Patients with 1 bifurcation identified at baseline and 1 bifurcation treated

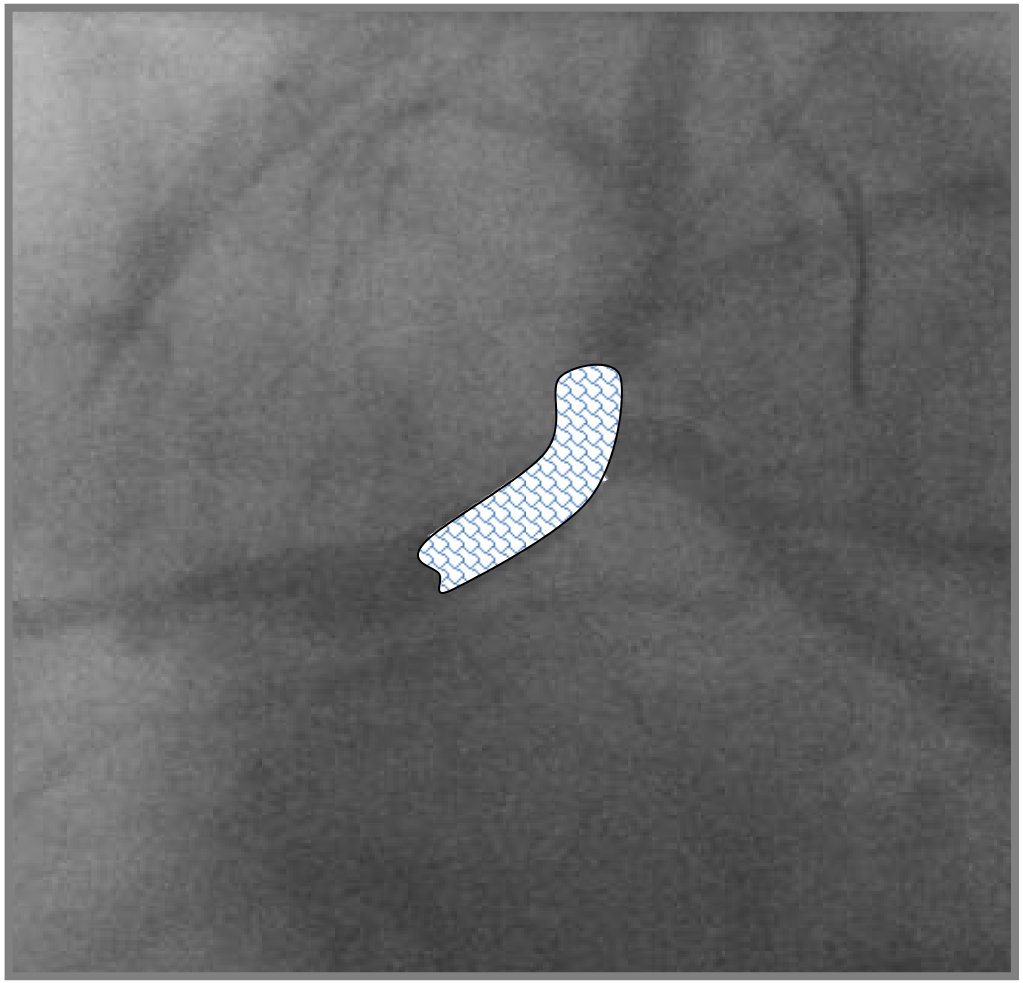
Does Strategy Matter ? :
2-year MACE in patients with bifurcations lesions vs Treatment Strategy :



Palmerini T et al , Circ Cardiovasc Interv 2008;1;185-192

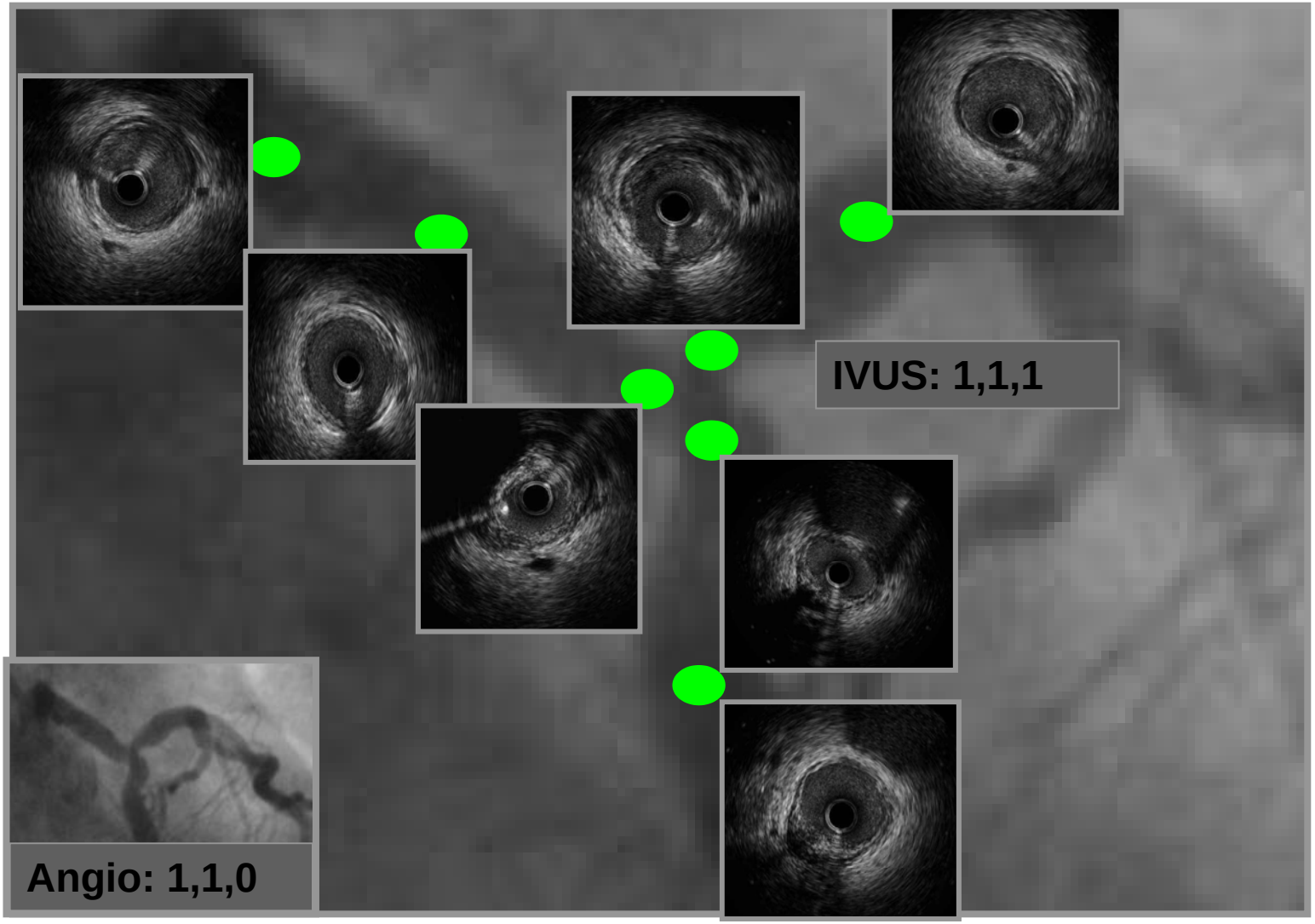
Role of IVUS in Bifurcation Treatment





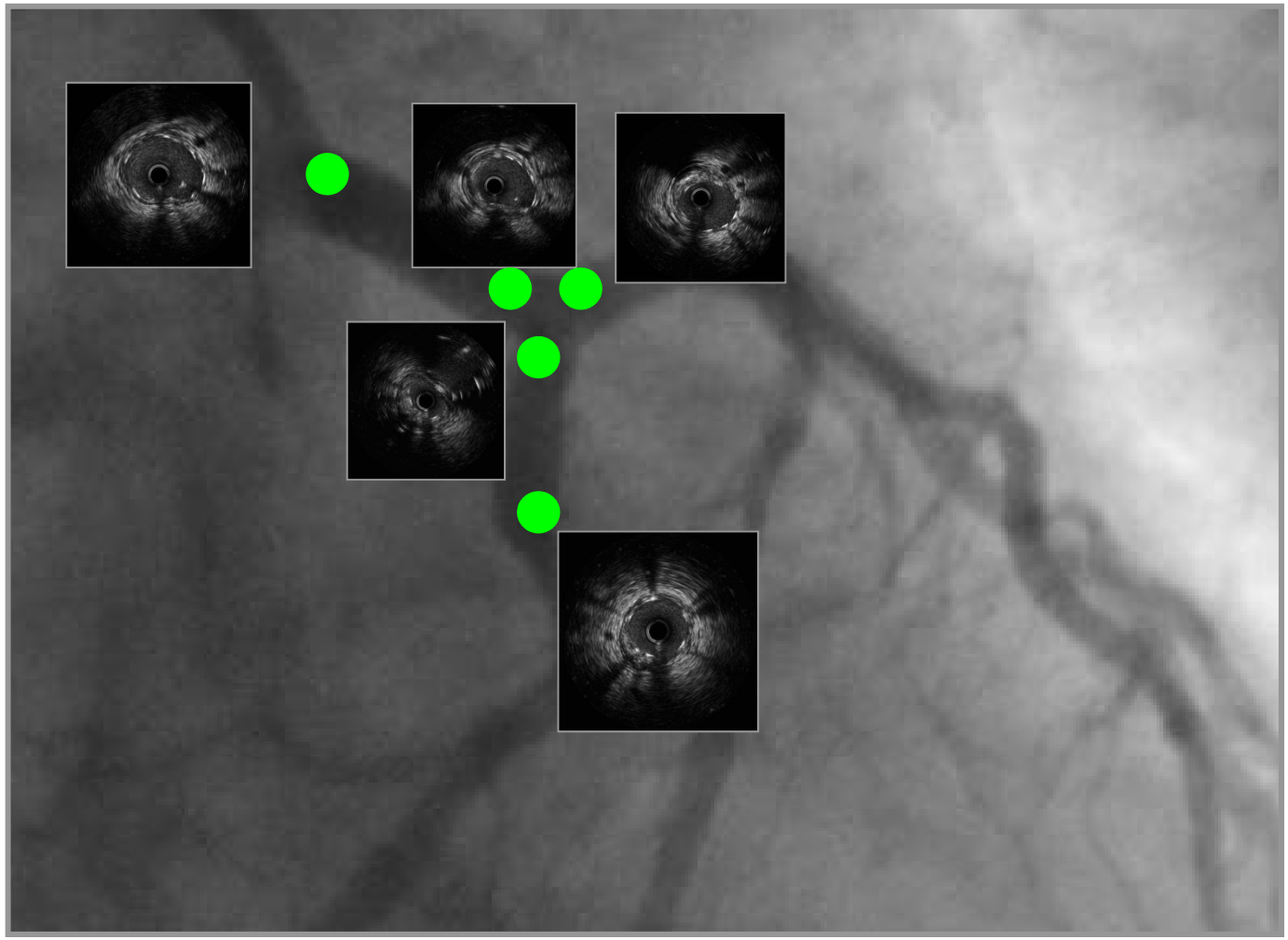
Should a different strategy (only LM stenting or Cross-over stenting LM to LAD) make any difference in the outcome?

The Use of IVUS in Bifurcastion Treatment



Would the use of IVUS change the strategy and the outcome ?

The Use of IVUS in Bifurcastion Treatment



Still having some ambigous angiographic appearance ?

CONCLUSIONS

- IVUS background provides the operator a more accurate angiographic evaluation
- IVUS evaluation in stent thrombosis or in-stent restenosis could be essential to better understand and treat the underlying mechanism
- Use of IVUS could be useful in selected cases
- Despite a sound rationale to define revascularization strategy, choose stent size, optimize stent expansion and guide kissing inflation, the role of routine IVUS for coronary bifurcation lesions treatment is still unclear