Long-term follow-up after treatment of coronary in-stent restenosis with a paclitaxel coated balloon catheter

PACCOCATH ISR I/II

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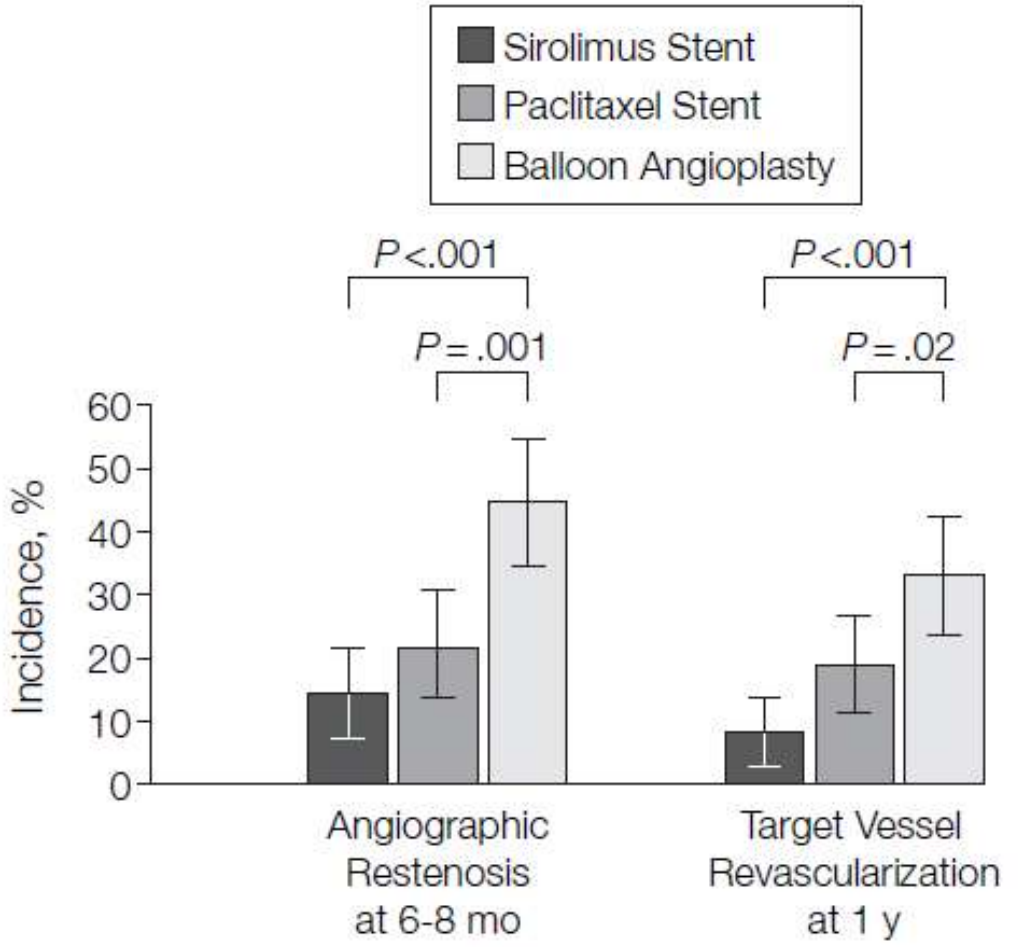
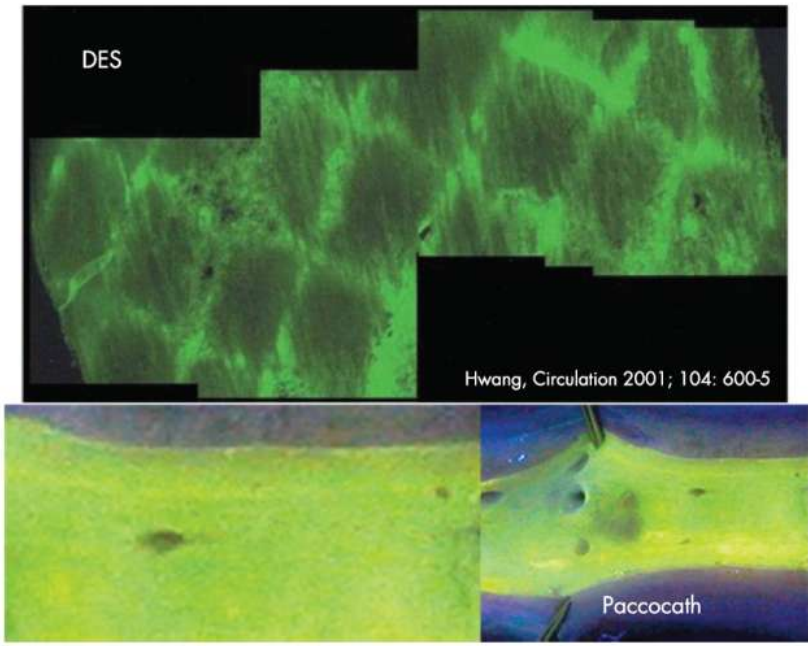
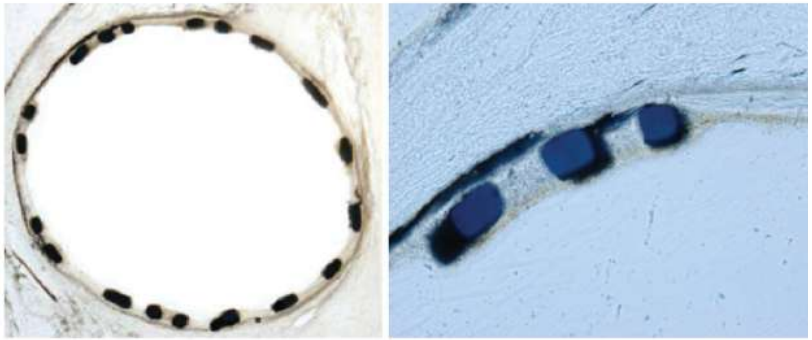
Sirolimus-Eluting Stent or Paclitaxel-Eluting Stent vs Balloon Angioplasty for Prevention of Recurrences in Patients With Coronary In-Stent Restenosis



ISAR-DESIRE. Kastrati, JAMA. 2005; 293: 165-171

Drug Coated Balloon



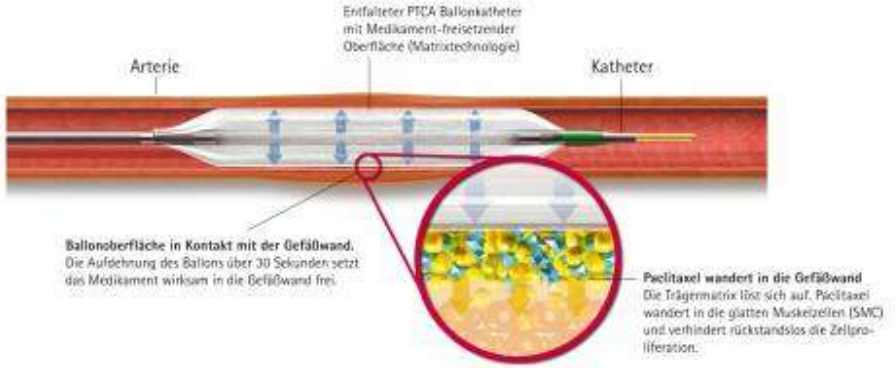


Drug Eluting Stent

- Slow release
- Persistent exposure
- ~ 100 - 200 µg dose
- Polymer
- Stent mandatory

Drug Coated Balloon

- Immediate release
- Short-lasting exposure
- ~ 300 - 600 µg dose
- No polymers
- Premounted stent optional



Circulation 2004; 110: 810-4
Heart 2007, 93: 539-41

BMS-ISR - Drug Coated Balloons

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

New Engl J Med 2006, 355: 2113-24

Treatment of Coronary In-Stent Restenosis with a Paclitaxel-Coated Balloon Catheter

Bruno Scheller, M.D., Christoph Hehrlein, M.D., Wolfgang Bocksch, M.D., Wolfgang Rutsch, M.D., Dariush Haghi, M.D., Ulrich Dietz, M.D., Michael Böhm, M.D., and Ulrich Speck, Ph.D.

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Two year follow-up after treatment of coronary in-stent restenosis with a paclitaxel-coated balloon catheter

Clin Res Cardiol 2008; 97: 779-81

Table 33 Recommendations for specific percutaneous coronary intervention devices and pharmacotherapy

	Class[a]	Level[b]	Ref.[c]
FFR-guided PCI is recommended for detection of ischaemia-related lesion(s) when objective evidence of vessel-related ischaemia is not available.	I	A	15, 28
DES[d] are recommended for reduction of restenosis/re-occlusion, if no contraindication to extended DAPT.	I	A	45, 46, 55, 215
Distal embolic protection is recommended during PCI of SVG disease to avoid distal embolization of debris and prevent MI.	I	B	171, 213
Rotablation is recommended for preparation of heavily calcified or severely fibrotic lesions that cannot be crossed by a balloon or adequately dilated before planned stenting.	I	C	—
Manual catheter thrombus aspiration should be considered during PCI of the culprit lesion in STEMI.	IIa	A	204–208
For PCI of unstable lesions, i.v. abciximab should be considered for pharmacological treatment of no-reflow.	IIa	B	55, 209, 212
Drug-eluting balloons[d] should be considered for the treatment of in-stent restenosis after prior BMS.	IIa	B	174, 175
Proximal embolic protection may be considered for preparation before PCI of SVG disease.	IIb	B	214
For PCI of unstable lesions, intracoronary or i.v. adenosine may be considered for pharmacological treatment of no-reflow.	IIb	B	209
Tornus catheter may be used for preparation of heavily calcified or severely fibrotic lesions that cannot be crossed by a balloon or adequately dilated before planned stenting.	IIb	C	—
Cutting or scoring balloons may be considered for dilatation of in-stent restenosis, to avoid slipping-induced vessel trauma of adjacent segments.	IIb	C	—
IVUS-guided stent implantation may be considered for unprotected left main PCI.	IIb	C	—
Mesh-based protection may be considered for PCI of highly thrombotic or SVG lesions.	IIb	C	—
For PCI of unstable lesions, intracoronary nitroprusside or other vasodilators may be considered for pharmacological treatment of no-reflow.	IIb	C	—

[a]Class of recommendation.
[b]Level of evidence.
[c]References.
[d]Recommendation is only valid for specific devices with proven efficacy/safety profile, according to the respective lesion characteristics of the studies.
DAPT = dual antiplatelet therapy; DES = drug-eluting stent; FFR = fractional flow reserve; IVUS = intravascular ultrasound; MI = myocardial infarction; PCI = percutaneous coronary intervention; STEMI = ST-segment elevation myocardial infarction; SVG = saphenous vein graft.

Eur Heart J. 2010 Aug 29

Paclitaxel-Coated Balloon Catheter Versus Paclitaxel-Coated Stent for the Treatment of Coronary In-Stent Restenosis

Martin Unverdorben, MD; Christian Vallbracht, MD; Bodo Cremers, MD; Hubertus Heuer, MD; Christian Hengstenberg, MD; Christian Maikowski, MD; Gerald S. Werner, MD; Diethmar Antoni, MD; Franz X. Kleber, MD; Wolfgang Bocksch, MD; Matthias Leschke, MD; Hanns Ackermann, PhD; Michael Boxberger, PhD; Ulrich Speck, PhD; Ralf Degenhardt, PhD; Bruno Scheller, MD

Circulation 2009; 119: 2986-2994

Longest available follow-up of studies leading to class IIa recommendation: 2 years

Aim of the presentation: long-term follow-up of PACCOCATH ISR I/II as defíned in the study protocol.

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

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Primary endpoint (late lumen loss in-segment)

Uncoated balloon	**PACCOCATH®**
0.74 ± 0.86 mm	**0.03 ± 0.48 mm**

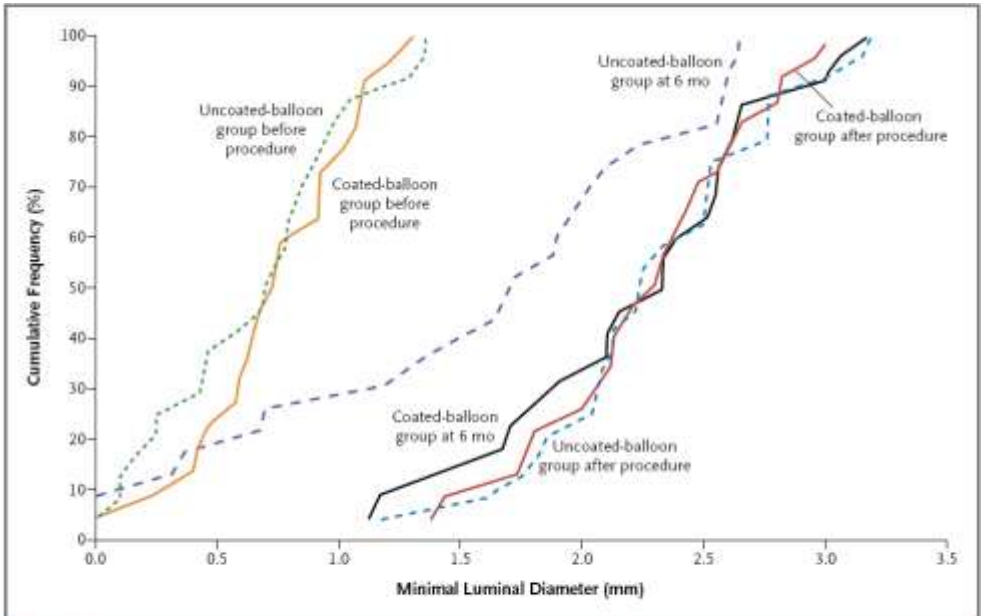


Figure 1. **Cumulative Frequency Distribution of In-Segment Minimal Luminal Diameter on Quantitative Coronary Angiography (Intention-to-Treat Analysis).**

Data are shown for the uncoated-balloon group and the coated-balloon group before the procedure, after the procedure, and at 6 months.

New Engl J Med 2006, 355: 2113-24

PACCOCATH ISR I / II

Table 1 Baseline clinical and angiographic data, procedural data (intention-to-treat analysis)[a]

	Uncoated balloon	Drug coated balloon	*P*
n	54	54	
Age	66.3 ± 9.8 years	65.4 ± 10.3 years	0.805
Male gender	31 (57%)	42 (78%)	0.125
Diabetes mellitus	17 (31%)	12 (17%)	0.313
Insulin dependent	6 (11%)	3 (6%)	
Hyperlipidema	39 (72%)	42 (78%)	0.485
Smoking	26 (48%)	23 (43%)	0.772
Hypertension	44 (82%)	44 (82%)	0.866
Unstable angina	22 (41%)	20 (37%)	1.000
Single vessel disease	13 (24%)	9 (17%)	
Two vessel disease	19 (35%)	24 (44%)	0.495
Three vessel disease	22 (41%)	21 (39%)	
RCA	17 (32%)	18 (33%)	
CX	12 (22%)	13 (24%)	0.611
LAD	25 (46%)	23 (43%)	
Patterns of ISR[b]			
IA	0	0	
IB	3 (6%)	0	
IC	8 (15%)	11 (20%)	0.377
ID	2 (4%)	0	
II	25 (46%)	26 (48%)	
III	14 (26%)	11 (20%)	
IV	2 (4%)	6 (11%)	
Study balloon			
Diameter	3.0 ± 0.3 mm	3.0 ± 0.3 mm	1.000
Length	24.3 ± 5.0 mm	24.1 ± 4.9 mm	0.592
Mean pressure	12.7 ± 2.7 atm	12.5 ± 2.6 atm	0.819
Balloon inflation time	68.9 ± 37.7 s	77.2 ± 42.2 s	0.063
Restenotic stent type	BMS 52 (96%) DES 2 (4%)	BMS 52 (96%) DES 2 (4%)	1.000
Restenotic stent diamteter	3.0 ± 0.3 mm	3.0 ± 0.3 mm	0.910
Restenotic stent length	18.4 ± 4.9 mm	20.8 ± 7.3 mm	0.058
Additional stents	2 (4%)	3 (6%)	1.000
GP IIb/IIIa antagonists	7 (13%)	5 (9%)	1.000

CAD coronary artery disease, *RCA* right coronary artery, *CX* left circumflex coronary artery, *LAD* left anterior descending coronary artery

[a]All values are mean ± standard deviation or *N* (%)

[b]Patterns of in-stent restenosis according to the Mehran classification [19]. *P*-values adjusted according to Fisher's method of combining independent tests

Clin Res Cardiol 2008; 97: 779-81

PACCOCATH ISR I / II

Table 2 Angiographic findings at treatment and 6-month follow-up (intention-to-treat analysis)[a]

	Uncoated balloon	Drug coated balloon	Difference (95% CI)	*P*
Procedural data				
N	54	54		
Angiographic measurements at treatment				
Left ventricular function	60.3 ± 13.9%	60.8 ± 14.5%	−0.49 [−6.2 to 5.2]	0.862
Lesion length	18.6 ± 8.3 mm	18.3 ± 9.7 mm	0.28 [−3.41 to 3.97]	0.845
Reference diameter	2.94 ± 0.37 mm	2.94 ± 0.35 mm	−0.05 [−0.25 to 0.14]	0.731
Minimal lumen diameter initial	0.70 ± 0.35 mm	0.63 ± 0.29 mm	0.07 [−0.06 to 0.21]	0.015
Minimal lumen diameter post angioplasty	2.34 ± 0.44 mm	2.43 ± 0.47 mm	−0.09 [−0.27 to 0.09]	0.955
Findings at follow-up angiography				
Follow-up angiography	49 (91%)	48 (87%)		0.944
Left ventricular function	61.1 ± 14.1%	60.1 ± 14.7%	1.0 [−5.2 to 7.2]	0.816
Minimal lumen diameter at follow-up				
In-stent	1.53 ± 0.81 mm	2.30 ± 0.62 mm	−0.77 [−1.06 to 0.47]	0.003
In-segment	1.50 ± 0.79 mm	2.23 ± 0.57 mm	−0.72 [−1.01 to 0.44]	0.004
Late lumen loss				
In-stent	0.81 ± 0.79 mm	0.14 ± 0.46 mm	0.67 [0.41–0.93]	0.001
In-segment	0.80 ± 0.79 mm	0.11 ± 0.44 mm	0.69 [0.44–0.96]	0.001
Binary restenosis rate				
In-stent	24 (49%)	3 (6%)	0.39 [0.24–0.54]	0.001
In-segment	25 (51%)	3 (6%)	0.41 [0.26–0.56]	0.001

P-values adjusted according to Fisher's method of combining independent tests
CI confidence interval
[a]All values are mean ± standard deviation or *N* (%)

Clin Res Cardiol 2008; 97: 779-81

PACCOCATH ISR I / II

Table 3 Clinical follow-up (intention-to-treat analysis)[a]

	Uncoated balloon	Drug coated balloon	Risk estimate –OR (95% CI)	*P*
n	54	54		
12-month clinical follow-up (total event rate)				
Target lesion revascularization	20 (37%)	2 (4%)	0.07 [0.01–0.30]	0.001
Myocardial infarction	5 (9%)	1 (2%)	0.19 [0.02–1.64]	0.577
Death	3 (6%)	2 (4%)	0.65 [0.11–4.08]	0.912
Stroke	2 (4%)	2 (4%)	1.00 [0.14–7.37]	1.000
MACE	24 (44%)	5 (9%)	0.13 [0.04–0.37]	0.001
24-month clinical follow-up (total event rate)				
Target lesion revascularization	20 (37%)	3 (6%)	0.10 [0.03–0.36]	0.001
Myocardial infarction	5 (9%)	1 (2%)	0.19 [0.02–1.64]	0.577
Death	3 (6%)	2 (4%)	0.65 [0.11–4.08]	0.912
Stroke	3 (6%)	2 (4%)	0.65 [0.11–4.08]	0.840
MACE	25 (46%)	6 (11%)	0.15 [0.05–0.40]	0.001

MACE includes target lesion revascularization, myocardial infarction, acute and subacute stent thrombosis, stroke, and death. *P*-values adjusted according to Fisher's method of combining independent tests

CI confidence interval

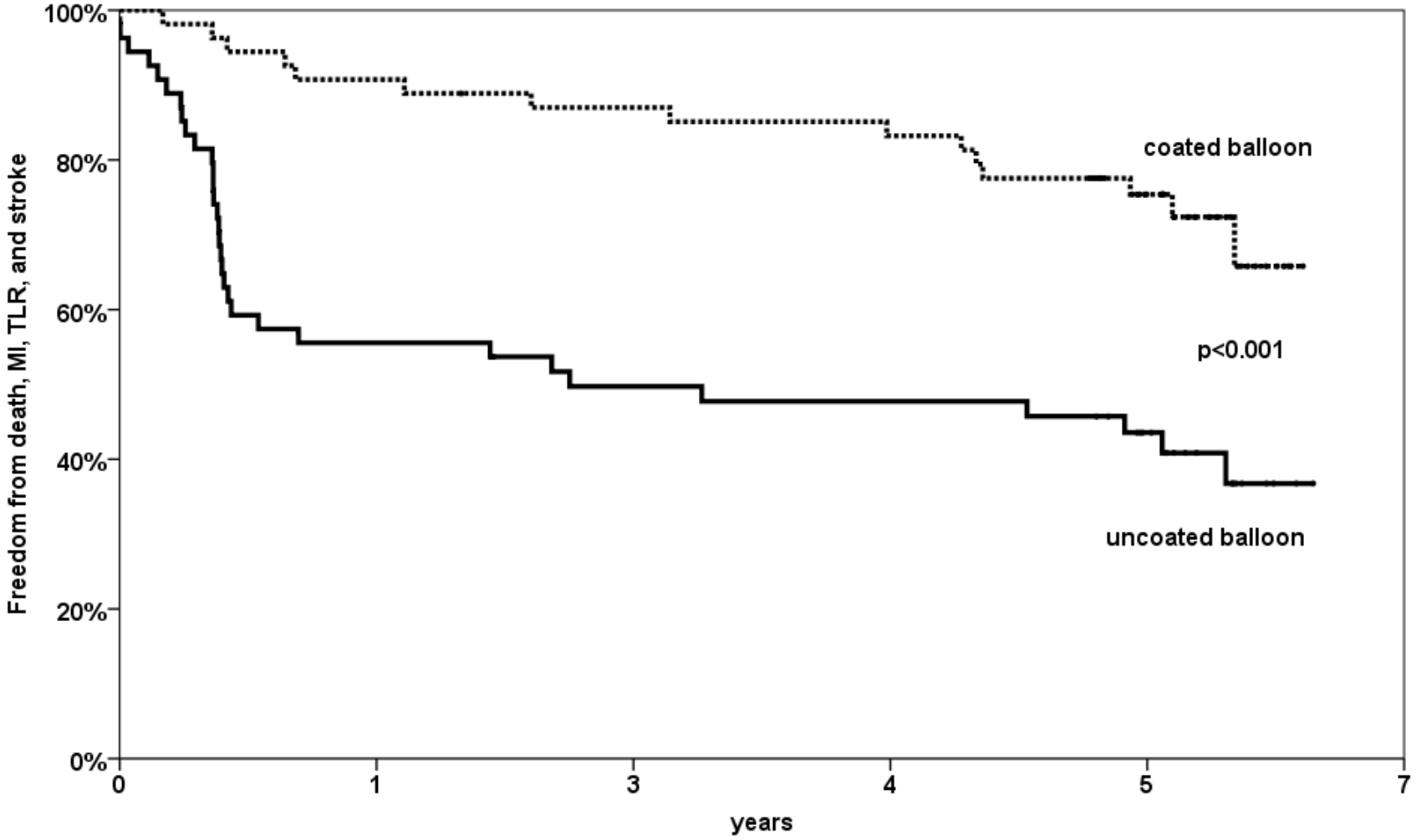
[a]All values are *N* (%)

Clin Res Cardiol 2008; 97: 779-81

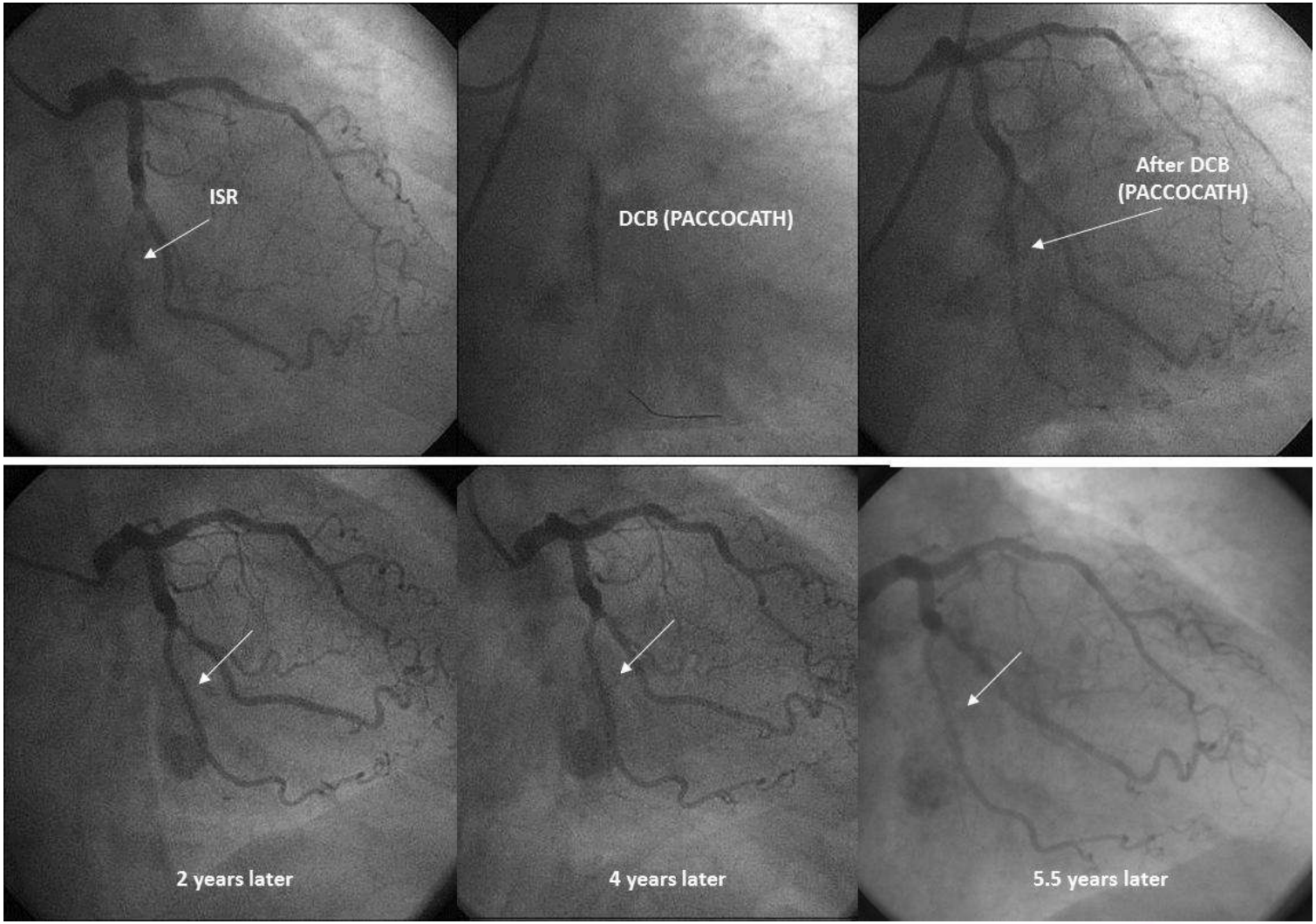
PACCOCATH ISR I / II – long-term

	Uncoated Balloon	Drug Coated Balloon	p
n	54	54	
Follow-up	5.2 ± 1.5 yrs	5.6 ± 0.9 yrs	0.108
Death	8 (14.8 %)	5 (9.3 %)	0.556
MI	8 (14.8 %)	5 (9.3 %)	0.556
TLR	21 (38.9 %)	5 (9.3 %)	0.001
Stent thrombosis	0	0	1.000
Stroke	5 (9.3 %)	5 (9.3 %)	1.000
MACE	32 (59.3 %)	15 (27.8 %)	0.002

PACCOCATH ISR I / II – long-term



PACCOCATH ISR I/II – Follow-up 5.5 years



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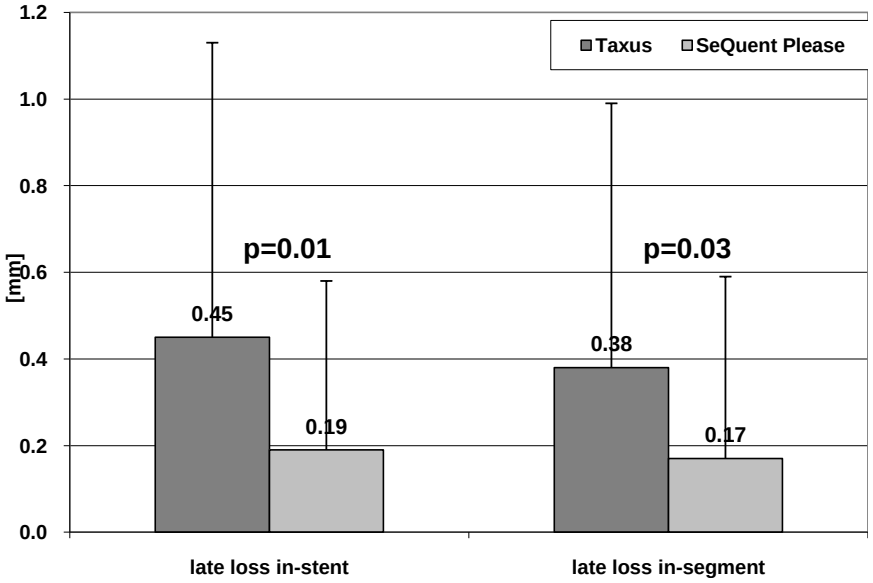
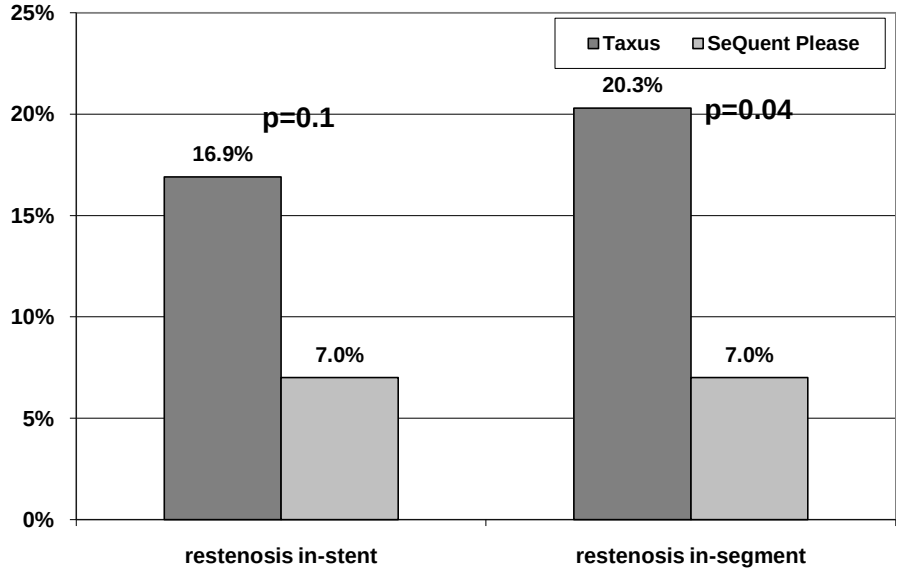




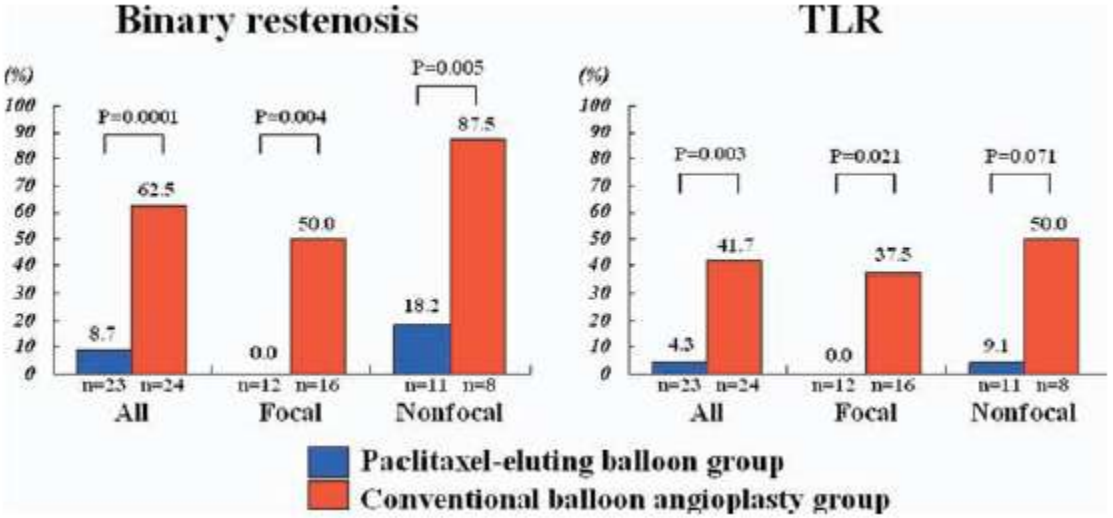
SeQuent Please vs. Taxus

Circulation 2009; 119: 2986-2994

Effectiveness of Paclitaxel-Eluting Balloon Catheter in Patients With Sirolimus-Eluting Stent Restenosis

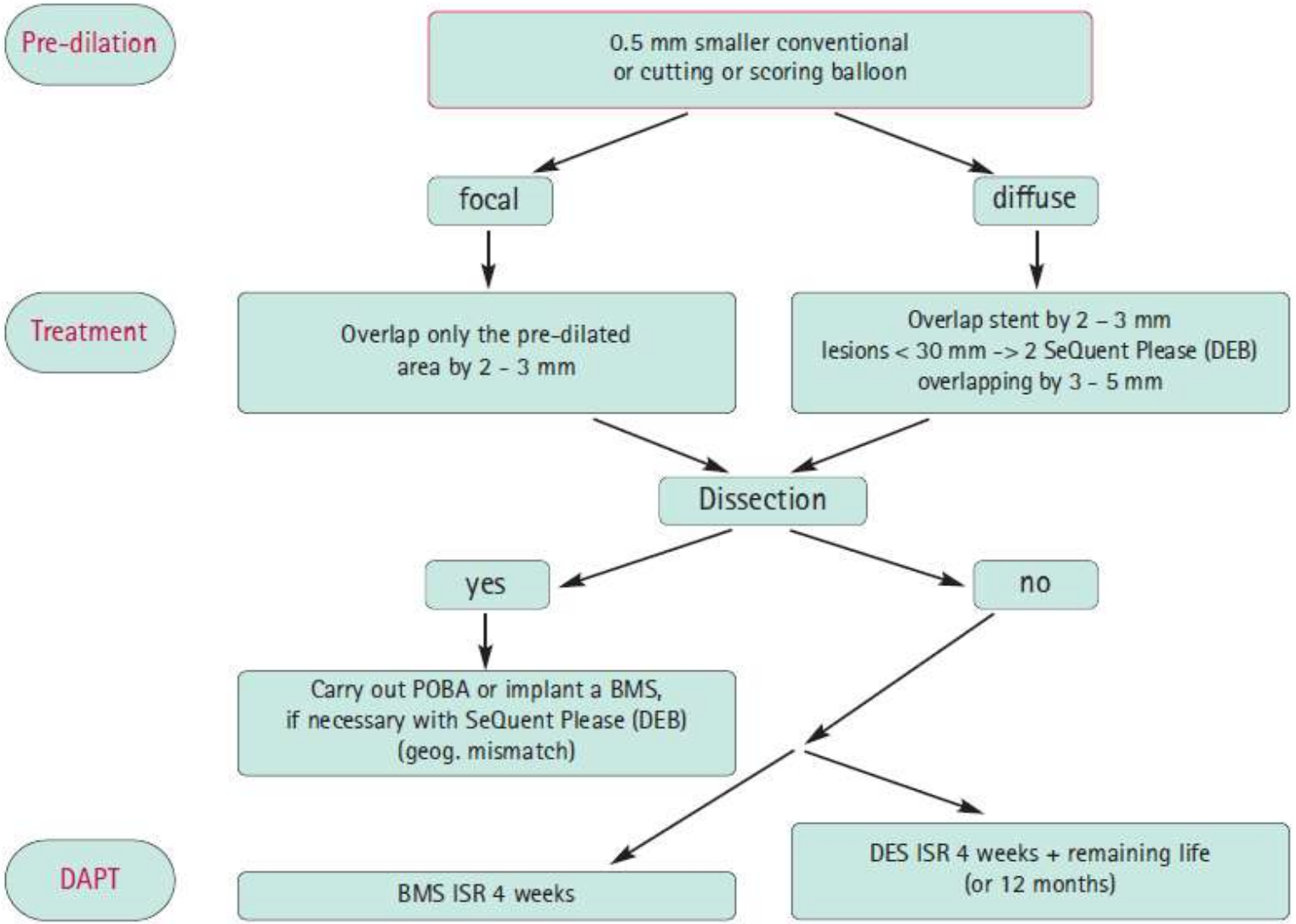
Seiji Habara, MD, Kazuaki Mitsudo, MD, Kazushige Kadota, MD, Tsuyoshi Goto, MD, Satoki Fujii, MD, Hiroyuki Yamamoto, MD, Harumi Katoh, MD, Naoki Oka, MD, Yasushi Fuku, MD, Shingo Hosogi, MD, Akitoshi Hirono, MD, Takeshi Maruo, MD, Hiroyuki Tanaka, MD, Yoshikazu Shigemoto, MD, Daiji Hasegawa, MD, Hiroshi Tasaka, MD, Mana Kusunose, MD, Suguru Otsuru, MD, Yoji Okamoto, MD, Naoki Saito, MD, Yuki Tsujimoto, MD, Haruki Eguchi, MD, Koshi Miyake, MD, Mitsuru Yoshino, MD

Late luminal loss (in-lesion)	0.17 ± 0.45	0.72 ± 0.56	0.001
Late luminal loss (in-segment)	0.18 ± 0.45	0.72 ± 0.55	0.001
Binary restenosis	2 (8.7)	15 (62.5)	0.0001
Target lesion revascularization)	1 (4.3)	10 (41.7)	0.003



JACC: Cardiovascular Interventions, 2011; 4: 149-54

‚DEB only‘ in ISR – German Consensus Group



Mathey, EuroIntervention Suppl. 2011, in press

Drug Coated Balloon – 2011

Proven Indications from RCT (Paccocath):

- **Treatment of coronary BMS-ISR (avoids a second stent)**
  - **DAPT 4 weeks; ESC class IIa**
  - **Long-term efficacy**
- **(Treatment of coronary DES-ISR)**
- **De-novo and restenotic lesions in SFA**

Potential Indications (ongoing trials)

- **Patients with chronic anticoagulation therapy, small coronary vessels (avoid BMS), coronary bifurcations (best scenario?), long lesions (vs. full-metal jacket)**
- **Pediatric interventions, cerebrovascular applications**
- **SFA, BTK, dialysis shunts**

Not all drug coated balloon catheters are equally effective.

DCB are not a replacement for DES. New (fourth) platform in interventional cardiology and angiology.