6th EBC meeting. Budapest
October 22-23rd 2010

Dr. Goran Stankovic

European Bifurcation Club

EBC

What's new since last year ?

Summary of Bifurcation Publications since last EBC

October 22nd: 15:35 - 15:45

British Bifurcation Study (BBC ONE)

Circulation
JOURNAL OF THE AMERICAN HEART ASSOCIATION

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Randomized Trial of Simple Versus Complex Drug-Eluting Stenting for Bifurcation Lesions: The British Bifurcation Coronary Study: Old, New, and Evolving Strategies

David Hildick-Smith, Adam J. de Belder, Nina Cooter, Nicholas P. Curzen, Tim C. Clayton, Keith G. Oldroyd, Lorraine Bennett, Steve Holmberg, James M. Cotton, Peter E. Glennon, Martyn R. Thomas, Philip A. MacCarthy, Andreas Baumbach, Niall T. Mulvihill, Robert A. Henderson, Simon R. Redwood, Ian R. Starkey and Rodney H. Stables

Circulation 2010;121;1235-1243; originally published online Mar 1, 2010;
DOI: 10.1161/CIRCULATIONAHA.109.888297
Circulation is published by the American Heart Association. 7272 Greenville Avenue, Dallas, TX 72514
 Print ISSN: 0009-7322. Online ISSN: 1524-4539

Hildick-Smith D, et al. *Circulation. 2010;121:1235-1243.*

BBC ONE

The British Bifurcation Coronary study: Old, New and Evolving strategies

a randomized comparison of simple versus complex drug-eluting stenting for bifurcation lesions

Simple – stepwise provisional T-stenting

Complex – total lesion coverage: crush or culotte

(according to operator preference)

PRIMARY ENDPOINT

composite at 9 months of:

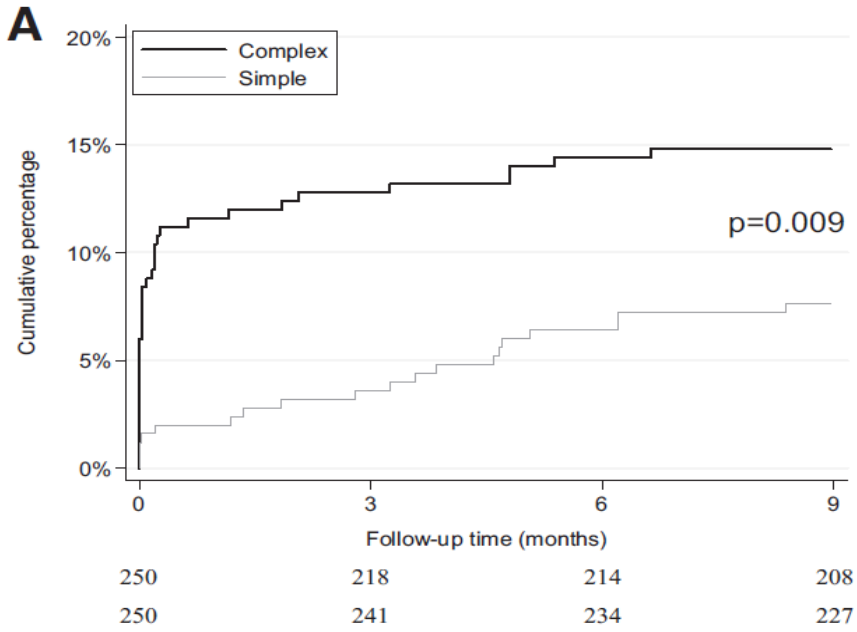
- Death
- Target vessel failure
- Myocardial infarction

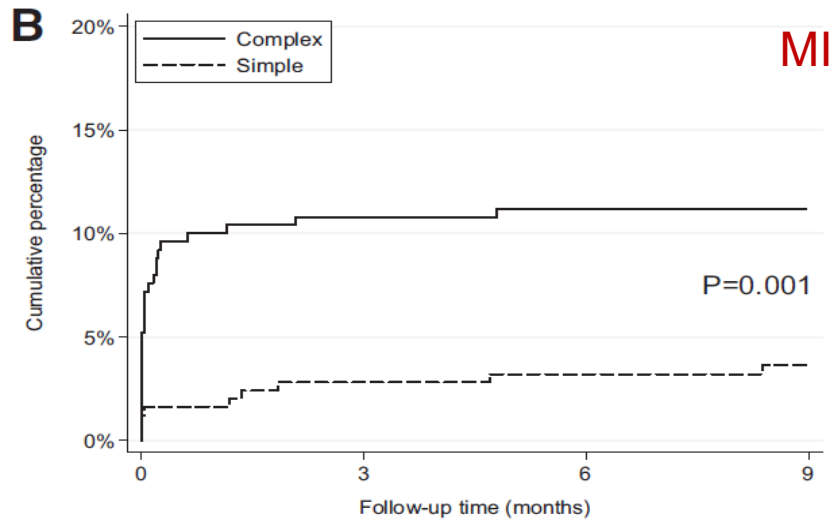
British Bifurcation Study (BBC ONE)

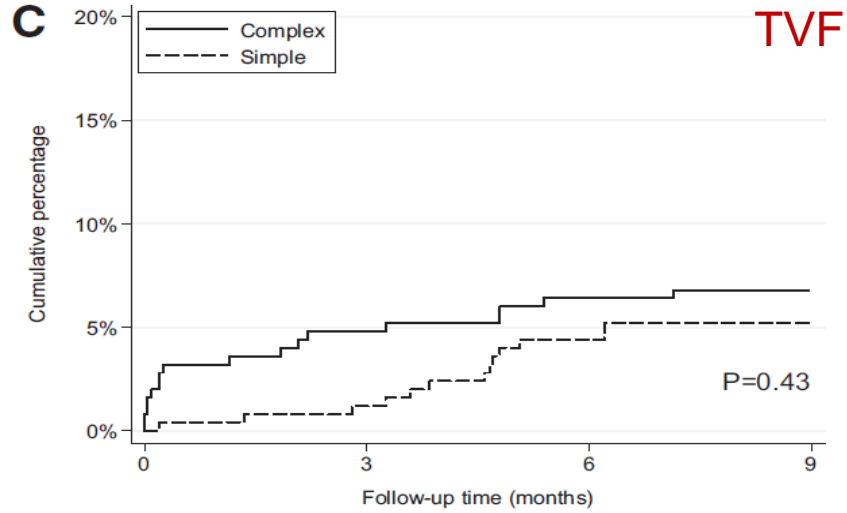
N=500, Simple vs. Complex strategy

82% true bifurcations (>50% narrowing in both vessels).

1º Outcome: Death, MI, TVF







Primary endpoint	38 (15.2%)	20 (8.0%)	HR 2.0 (1.2 to 3.5), p=0.009

Hildick-Smith D, et al. Circulation. 2010;121:1235-1243

CONCLUSIONS

- For unselected bifurcation lesions, a stepwise provisional T stent strategy is superior to a systematic complex strategy in all domains:

  - procedural success
  - procedural complications
  - 9-month MACE

Hildick-Smith D, et al. Circulation. 2010;121:1235-1243

A Flow-guided Concept To Treat Side Branches In True Bifurcation Lesions: THUEBIS Study

Circulation
Cardiovascular Interventions
JOURNAL OF THE AMERICAN HEART ASSOCIATION

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Interventional Therapy of Bifurcation Lesions: A TIMI Flow-Guided Concept to Treat Side Branches in Bifurcation Lesions A Prospective Randomized Clinical Study (Thueringer Bifurcation Study, THUEBIS Study as Pilot Trial)

Hubertus v. Korn, Jiangtao Yu, Marc A. Ohlow, Burkhard Huegl, Walter Schulte, Andreas Wagner, Gernot Wassmer, Stefan Gruene, Oliver Petek and Bernward Lauer

Circ Cardiovasc Interv 2009;2;535-542; originally published online Nov 10, 2009;
DOI: 10.1161/CIRCINTERVENTIONS.108.833046
Circulation: Cardiovascular Interventions is published by the American Heart Association. 7272 Greenville Avenue, Dallas, TX 72514
 Print ISSN: 1941-7640. Online ISSN: 1941-7632

Hubertus v. Korn, et al. Circ Cardiovasc Interv. 2009;2:535-542

Study design

Stenting of the main branch (Taxus-stent) and mandatory side branch percutaneous coronary intervention (PCI; kissing balloons) with provisional SB stenting (Complex strategy, group A), or

Flow-guided treatment: stenting of the MB (Taxus-stent) with provisional SB-PCI only when the SB had a TIMI flow 0 or 1 (Simple strategy, group B).

- Primary endpoint: TLR

Hubertus v. Korn, et al. Circ Cardiovasc Interv. 2009;2:535-542

Study design: flow chart

110 consecutive pts with bifurcations

- Stenting MB (PES)
- „Kissing balloon“-PCI
- Provisional stenting SB

Group A (n=56)

„Complex strategy“

- Stenting MB (PES)
-PCI SB only
@ TIMI 0 or 1

Group B (n=54)

„Simple strategy“

Scheduled angio @ 6 months

Follow-up data @ 6 months

	Complex strategy	Simple strategy	p
Re-PCI MB (%)	5.4	5.6	1.0
(Re)-PCI SB (%)	5.4	0	0.09
Stent thrombosis (%)	3.6	3.7	1.0
CABG related to lesion (%)	3.6	5.6	0.6
TLR (sum, %)	17.9	14.8	0.7
PCI target vessel, non target lesion (%)	5.4	5.6	1.0
TVR (sum, %)	23.2	20.4	0.7
Cardiac death (%)	0	3.7	0.2
ALL MACE (%)	23.2	24.1	0.9

Conclusions

- A simple strategy using PES with only provisional SB-PCI according to the TIMI flow of the SB is not inferior to a more complex strategy with mandatory SB-PCI
- MACE rates are nearly identical for both strategies
- Comparison of the duration of fluoroscopy + the amount of contrast medium favors the simple strategy

Hubertus v. Korn, et al. Circ Cardiovasc Interv. 2009;2:535-542

Double Versus Single Stenting for Coronary Bifurcation Lesions
A Meta-Analysis

Circulation
Cardiovascular Interventions
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Double Versus Single Stenting for Coronary Bifurcation Lesions: A Meta-Analysis

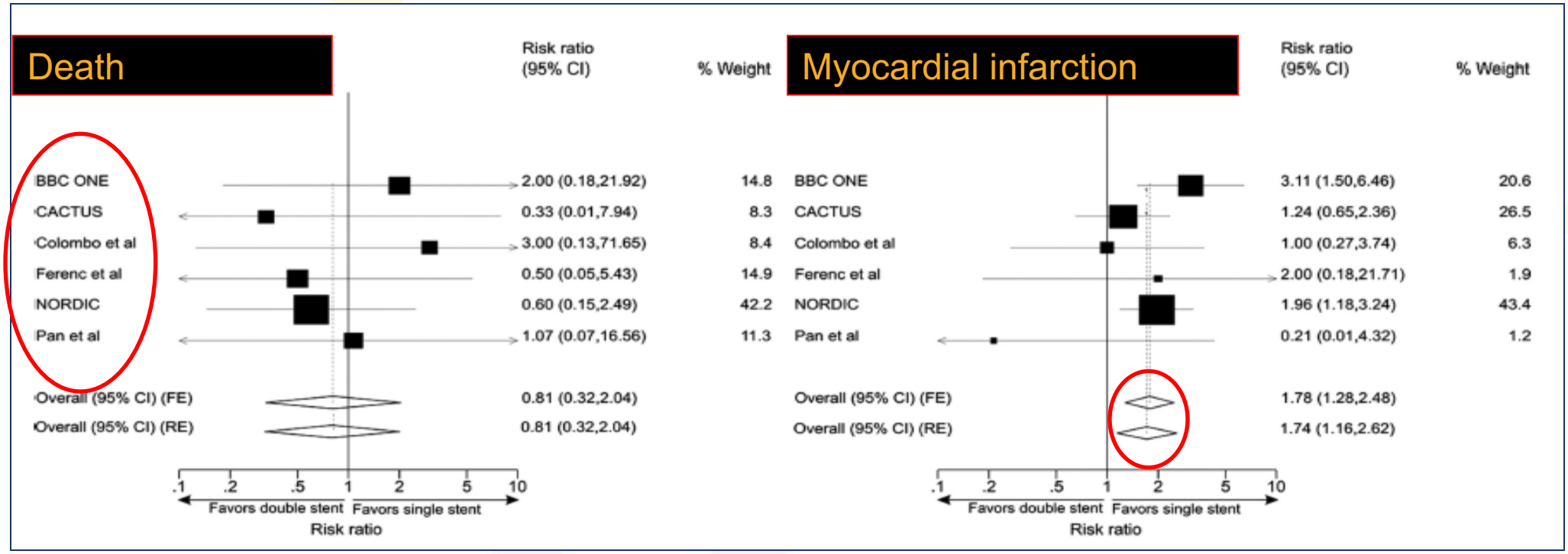
Demosthenes G. Katritsis, George C.M. Siontis and John P.A. Ioannidis

Circ Cardiovasc Interv 2009;2;409-415; originally published online Sep 22, 2009;
DOI: 10.1161/CIRCINTERVENTIONS.109.868091
Circulation: Cardiovascular Interventions is published by the American Heart Association. 7272 Greenville Avenue, Dallas, TX 72514
 Print ISSN: 1941-7640. Online ISSN: 1941-7632

Katritsis D, et al. Circ Cardiovasc Intervent. 2009;2:409-415

Double vs. Single Stenting Meta-Analysis

6 randomized studies: N=1642 patients



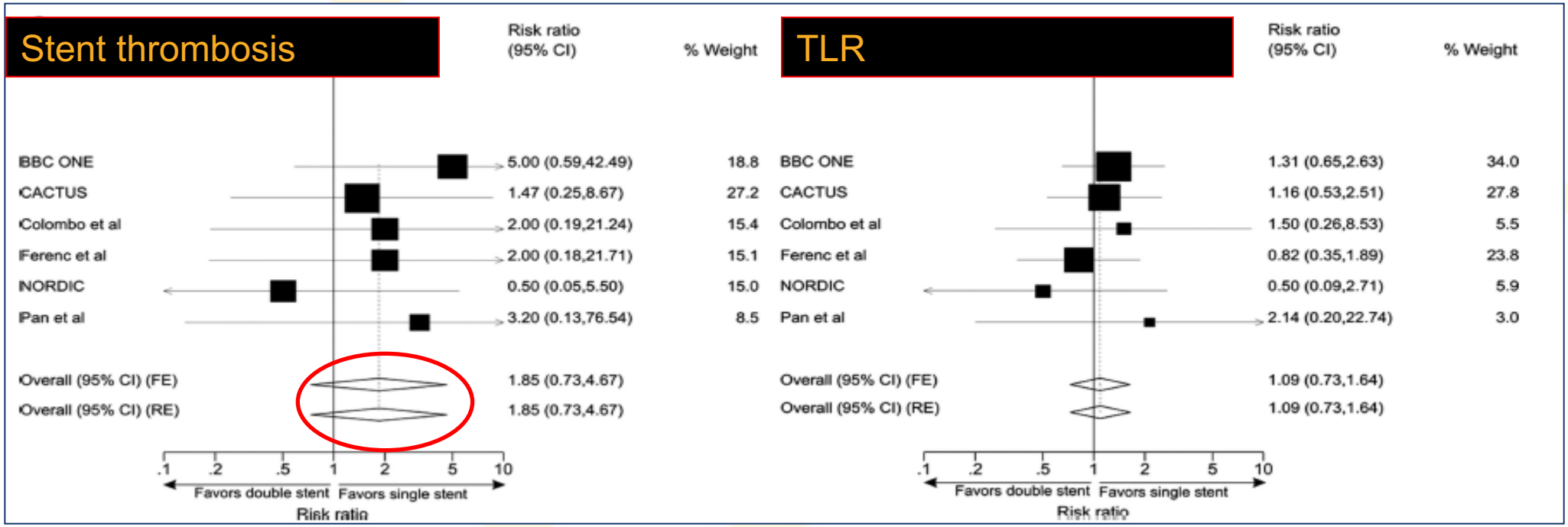
2 stents 1 stent

2 stents 1 stent

Katritsis DG et al. Circ Cardiovasc Intervent. 2009;2:409-415

Double vs. Single Stenting Meta-Analysis

6 randomized studies: N=1642 patients



2 stents 1 stent

2 stents 1 stent

Katritsis DG et al. Circ Cardiovasc Intervent. 2009;2:409-415

COBIS (Coronary Bifurcation Stenting) Registry

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ISSN 0735-1097/10/$36.00
doi:10.1016/j.jacc.2010.02.008

EXPEDITED PUBLICATION

Sirolimus- Versus Paclitaxel-Eluting Stents for the Treatment of Coronary Bifurcations

Results From the COBIS (Coronary Bifurcation Stenting) Registry

Young Bin Song, MD, PHD,* Joo-Yong Hahn, MD, PHD,* Seung-Hyuk Choi, MD, PHD,* Jin-Ho Choi, MD, PHD,* Sang Hoon Lee, MD, PHD,* Myung-Ho Jeong, MD, PHD,† Hyo-Soo Kim, MD, PHD,‡ In-Whan Seong, MD, PHD,§ Ju-Young Yang, MD, PHD,‖ Seung Woon Rha, MD, PHD,¶ Yangsoo Jang, MD, PHD,# Jung Han Yoon, MD, PHD,** Seung-Jea Tahk, MD, PHD,†† Ki Bae Seung, MD, PHD,‡‡ Seung-Jung Park, MD, PHD,§§ Hyeon-Cheol Gwon, MD, PHD*

Seoul, Gwangju, Daejeon, Goyang, Wonju, and Suwon, Korea

Song YB, et al. J Am Coll Cardiol 2010;55:1743–50.

Coronary Bifurcation Stent Registry
The Aim of Study

In Patients undergoing PCI with DES for Bifurcation Lesions

- To compare the long-term clinical outcomes after implantation of SES vs. PES for coronary bifurcation lesions using data from a dedicated, large, multicenter real-world registry in Korea (2004.1 – 2006.6 (2.5 years);

  - Primary outcome : the composite of cardiac death, MI requiring hospitalization, or target lesion revascularization

Song YB, et al. J Am Coll Cardiol 2010;55:1743–50.

Clinical Outcomes

Total population

	SES (N=1033)	PES (N=562)	Adjusted HR* (95% CI)	P Value
Cardiac death	11 (1.1)	2 (0.4)	3.46 (0.75-16.00)	0.12
Cardiac death or MI	18 (1.7)	14 (2.5)	0.86 (0.42-1.78)	0.68
TLR	38 (3.7)	38 (6.8)	0.45 (0.28-0.72)	< 0.01
TVR	50 (4.8)	47 (8.4)	0.51 (0.33-0.78)	< 0.01
MACE	52 (5.0)	49 (8.7)	0.52 (0.34-0.79)	< 0.01

* Adjusted covariates included age, gender, acute coronary syndrome, diabetes mellitus, true bifurcation, stenting techniques, final kissing ballooning, use of intravascular ultrasound, type of stent used, stent diameter, and total stent length.

Median FU 22 months [15-32]

Clinical Outcomes

Propensity-Matched Population

	SES (N=407)	PES (N=407)	Adjusted HR* (95% CI)	P Value
Cardiac death	6 (1.5)	2 (0.5)	2.32 (0.44–12.17)	0.32
Cardiac death or MI	8 (2.0)	8 (2.0)	0.89 (0.33–2.41)	0.82
TLR	14 (3.4)	29 (7.1)	0.48 (0.25–0.91)	0.02
TVR	20 (4.9)	36 (8.8)	0.55 (0.32–0.95)	0.03
MACE	19 (4.7)	35 (8.6)	0.52 (0.30–0.91)	0.02

* Adjusted covariates included age, gender, acute coronary syndrome, diabetes mellitus, true bifurcation, stenting techniques, final kissing ballooning, use of intravascular ultrasound, type of stent used, stent diameter, and total stent length.

Median FU 20 months [14-30]

Summary

- In patients with bifurcation lesions, the use of SES resulted in better long-term outcomes than did the use of PES, primarily by decreasing the rate of repeat revascularization.

Song YB, et al. J Am Coll Cardiol 2010;55:1743–50.

BBK- Registry at Heart Center Bad Krozingen

Long-term outcome of percutaneous catheter intervention for de novo coronary bifurcation lesions with drug-eluting stents or bare-metal stents

Miroslaw Ferenc, MD, Michael Gick, MD, Rolf-Peter Kienzle, MS, Hans-Peter Bestehorn, MD, Klaus-Dieter Werner, MD, Thomas Comberg, MD, Min Zhao, MD, Heinz Joachim Buettner, MD, and Franz-Josef Neumann, MD *Bad Krozingen, Germany*

Background The purpose of this study was to assess the long-term risks and benefits of drug-eluting stents (DESs) compared with bare-metal stents (BMSs) for treatment of coronary bifurcation lesions.

Methods Our registry comprised 1,038 patients treated for coronary bifurcation lesion according to the provisional T-stenting strategy who were followed up for 3 years.

Results Target lesion revascularization rates were 24.3% for BMSs (n = 337), 15.6% for sirolimus-eluting stents (SESs, n = 422), and 17.3% for paclitaxel-eluting stents (PESs, n = 279) (*P* = .003 BMSs vs DESs, *P* = .54 SESs vs PESs). The respective incidences were 11.4%, 9.5%, and 14.8% (*P* = .65, *P* = .13) for death and myocardial infarction and 9.9%, 6.5%, and 10.6% (*P* = .72, *P* = .19) for death. Propensity score adjusted hazard ratios (95% CI) for DESs versus BMSs were 0.49 (0.35-0.68, *P* < .001) for target lesion revascularization, 0.94 (0.64-1.40, *P* = .078) for death and myocardial infarction, and 0.85 (0.55-1.32, *P* = .47) for death. We did not find any significant differences between SESs and PESs, except for an increased risk of death after PESs compared with SESs (but not BMSs) in the subgroup receiving a side-branch stent (adjusted hazard ratio 2.45, 95% CI 1.05-5.73, *P* = .035).

Conclusions Compared with BMSs, both PESs and SESs substantially reduced the long-term need for repeated revascularization but did not increase the risk of death and myocardial infarction. (Am Heart J 2010;159:454-461.)

Ferenc M, et al. Am Heart J 2010;159:454-61

BBK- Registry at Heart Center Bad Krozingen

2002 – 2005 >>> 10 822 PCI

1038 PCI‘s in bifurcation lesions
met selection criteria

T-stenting

n = 382

One stent strategy

n = 656

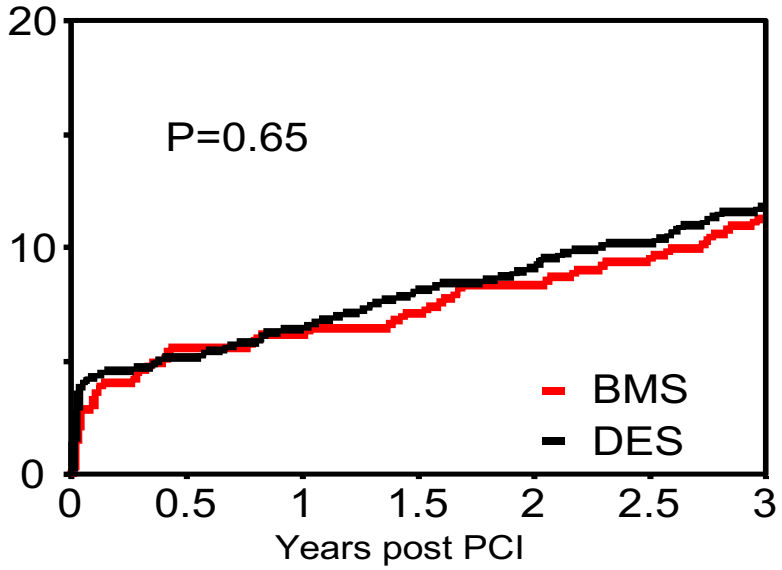
Clinical follow-up at 3 years

TLR ?
Death / Myocardial infarction ?

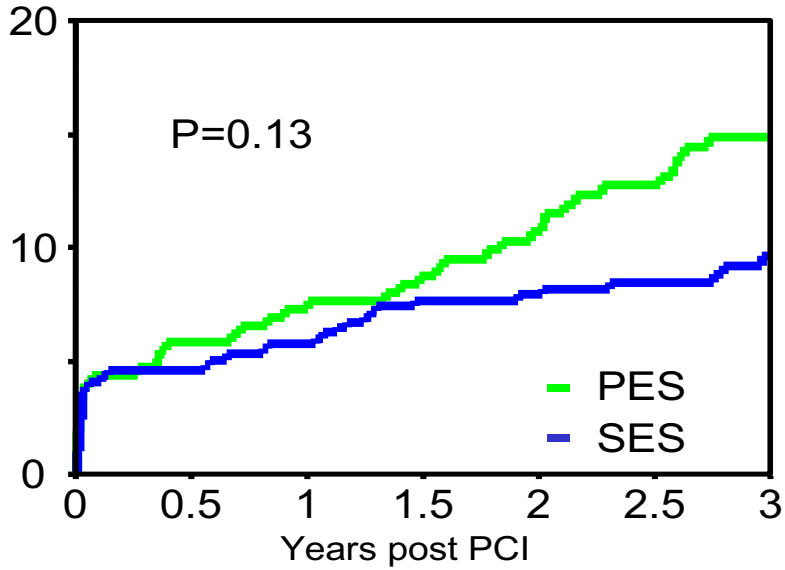
BBK registry: 3 years Follow-up

Death & MI

b) Cumulative incidence of death & MI (%)



e) Cumulative incidence of death & MI (%)



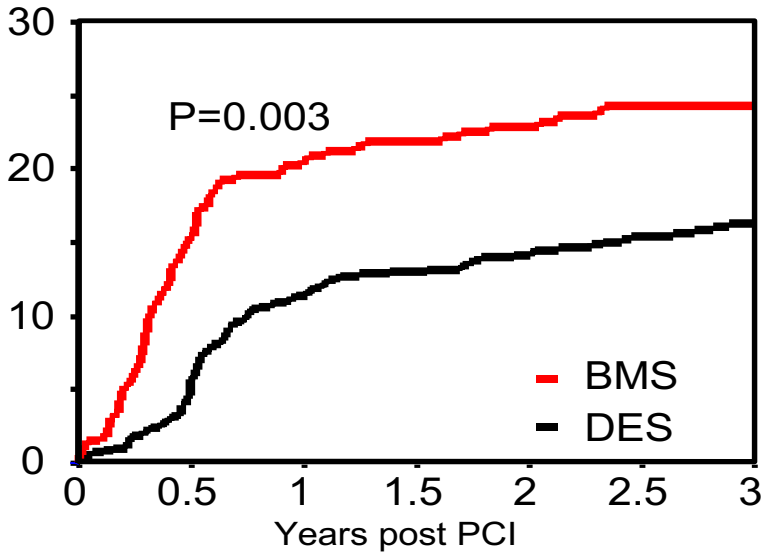
- non adjusted -

Ferenc M, et al. Am Heart J 2010;159:454-61

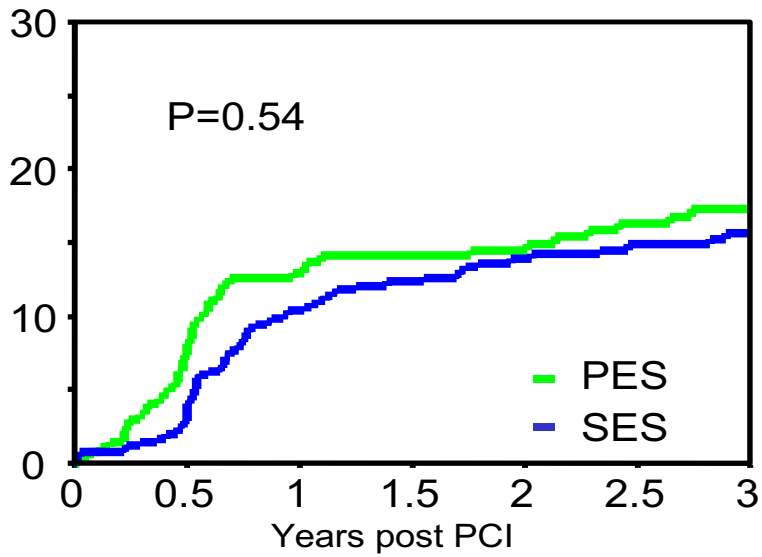
BBK registry: 3 years Follow-up

TLR

a) Cumulative incidence of TLR (%)



d) Cumulative incidence of TLR (%)



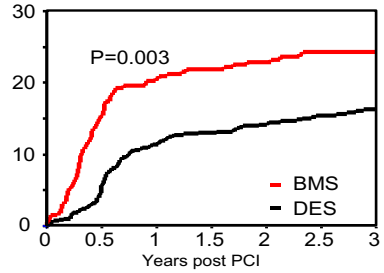
- non adjusted -

Ferenc M, et al. Am Heart J 2010;159:454-61

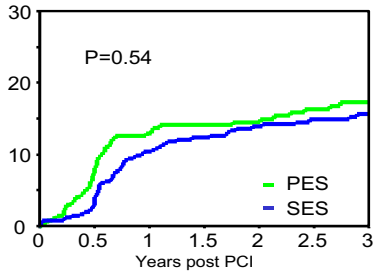
BBK registry: 3 years Follow-up

- non adjusted -

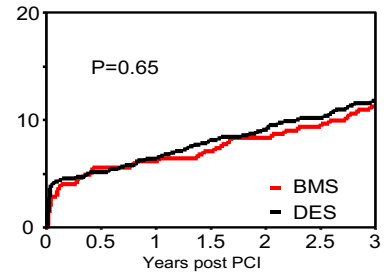
a) Cumulative incidence of TLR (%)



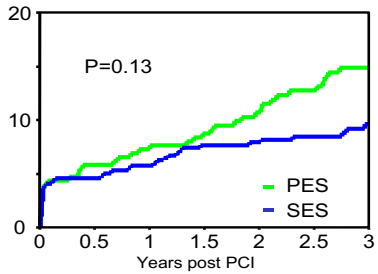
d) Cumulative incidence of TLR (%)



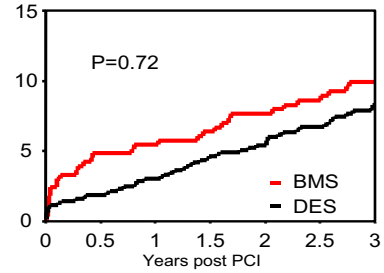
b) Cumulative incidence of death & MI (%)



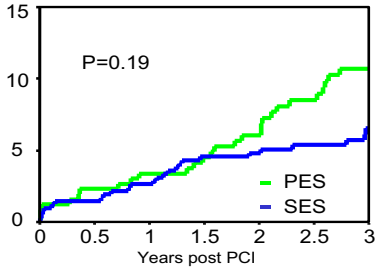
e) Cumulative incidence of death & MI (%)



c) Cumulative incidence of death (%)



f) Cumulative incidence of death (%)



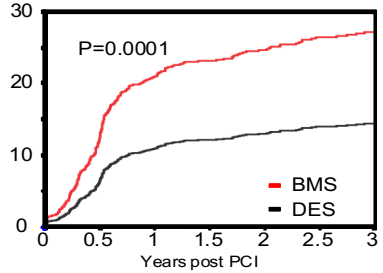
Numbers at risk

BMS	337	316	311	296	288	281	269
DES	701	685	676	653	592	502	406

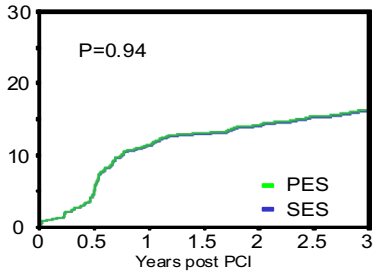
PES	279	270	266	255	231	214	184
SES	422	415	410	398	361	288	222

- Propensity score adjusted -

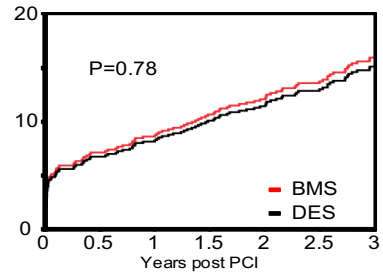
a) Cumulative incidence of TLR (%)



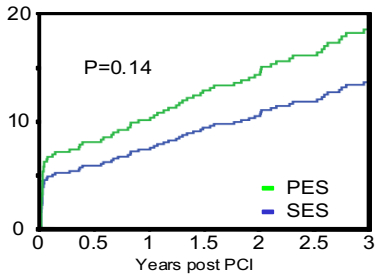
d) Cumulative incidence of TLR (%)



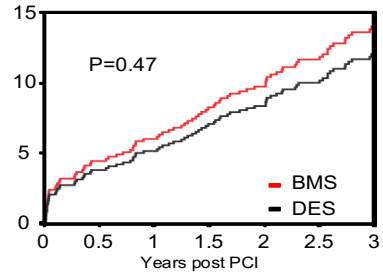
b) Cumulative incidence of death & MI (%)



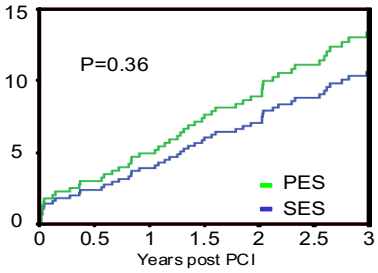
e) Cumulative incidence of death & MI (%)



c) Cumulative incidence of death (%)



f) Cumulative incidence of death (%)



Ferenc M, et al. Am Heart J 2010;159:454-61

Intravascular Ultrasound Classification of Plaque Distribution in Left Main Coronary Artery Bifurcations Where Is the Plaque Really Located?

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Intravascular Ultrasound Classification of Plaque Distribution in Left Main Coronary Artery Bifurcations: Where Is the Plaque Really Located?

Carlos Oviedo, Akiko Maehara, Gary S. Mintz, Hiroshi Araki, So-Yeon Choi, Kenichi Tsujita, Takashi Kubo, Hiroshi Doi, Barry Templin, Alexandra J. Lansky, George Dangas, Martin B. Leon, Roxana Mehran, Seung Jea Tahk, Gregg W. Stone, Masahiko Ochiai and Jeffrey W. Moses

Circ Cardiovasc Interv 2010;3:105-112; originally published online Mar 2, 2010;
DOI: 10.1161/CIRCINTERVENTIONS.109.906016
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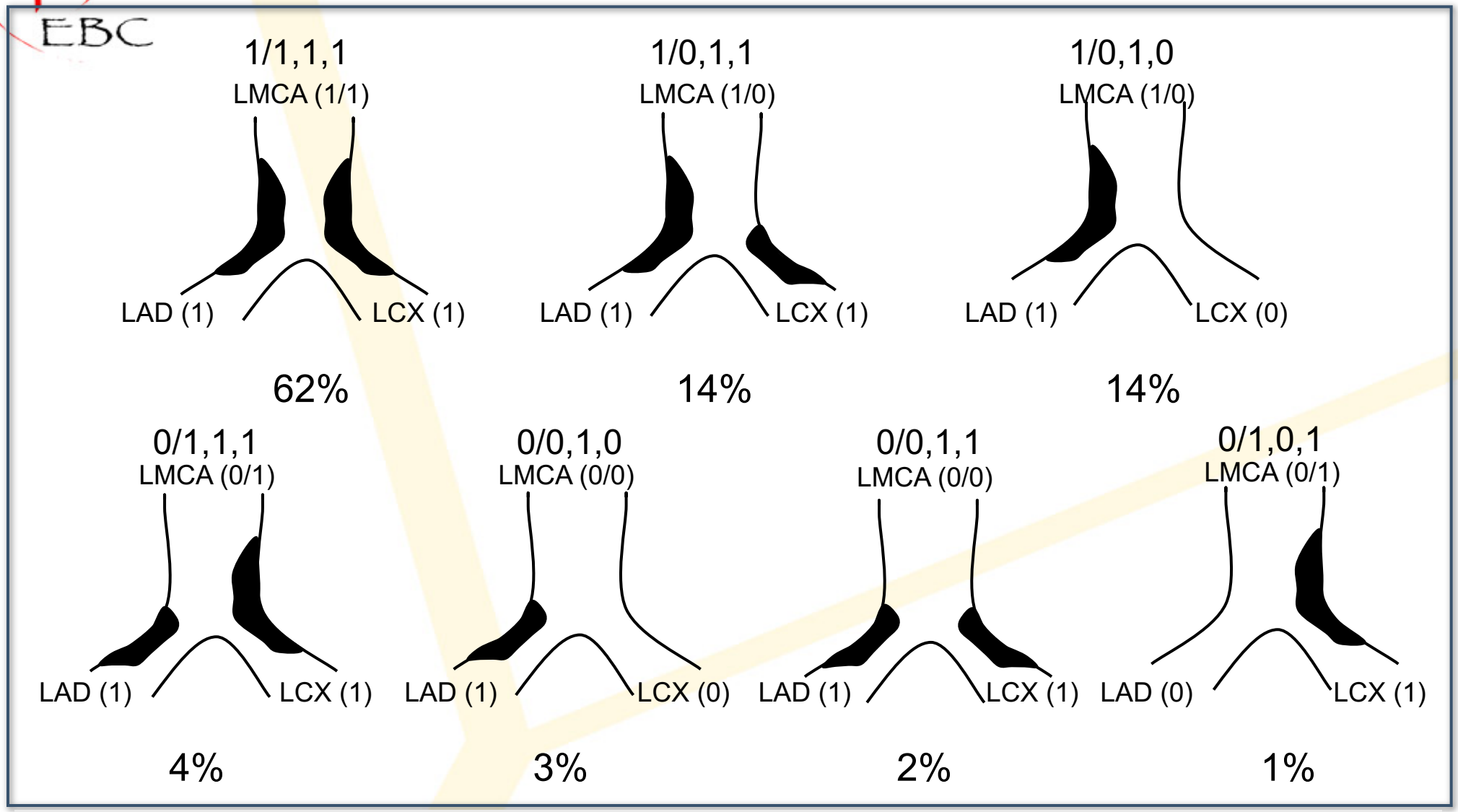
 Print ISSN: 1941-7640. Online ISSN: 1941-7632

Oviedo C, et al. Circ Cardiovasc Interv. 2010;3:105-112

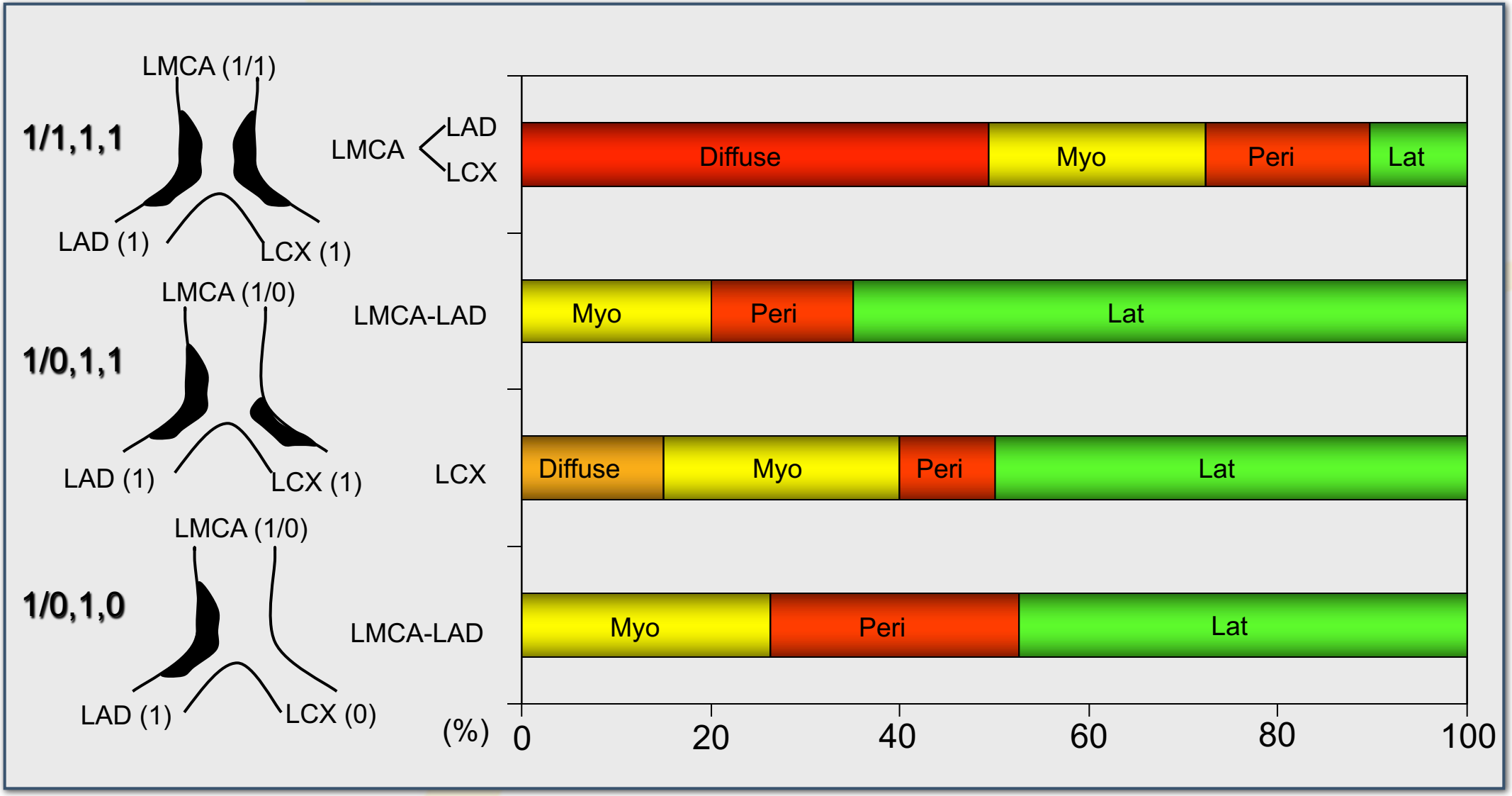
Plaque Distribution by IVUS (n=140)



90% of lesions distribute from LMCA-LAD

Oviedo C et al. Circ Cardiovasc Interv 2010;3:105-12.

Circumferential Plaque Distribution



Summary

- Angiographic classification of LMCA bifurcation lesions is rarely accurate;
- Contrary to angiographic classifications, IVUS showed that bifurcation disease was rarely focal and that both sides of the flow divider were always disease-free.
- Continuous plaque from the LMCA into the proximal LAD artery was seen in 90%, from the LMCA into the LCX artery in 66.4%, and from the LMCA into both the LAD and LCX arteries in 62%.
- Plaque localized to either the LAD or LCX ostium and not involving the distal LMCA was seen in only 9.3% of LAD arteries and 17.1% of LCX arteries.
- Plaque distribution was not influenced by the LAD/LCX angiographic angle, lesion severity, LMCA length, or remodeling

Anatomic and Functional Evaluation of Bifurcation Lesions Undergoing Percutaneous Coronary Intervention

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Anatomic and Functional Evaluation of Bifurcation Lesions Undergoing Percutaneous Coronary Intervention

Bon-Kwon Koo, Katsuhisa Waseda, Hyun-Jae Kang, Hyo-Soo Kim, Chang-Wook Nam, Seung-Ho Hur, Jung-Sun Kim, Donghoon Choi, Yangsoo Jang, Joo-Yong Hahn, Hyeon-Cheol Gwon, Myeong-Ho Yoon, Seung-Jea Tahk, Woo-Young Chung, Young-Seok Cho, Dong-Ju Choi, Takao Hasegawa, Toru Kataoka, Sung Jin Oh, Yasuhiro Honda, Peter J. Fitzgerald and William F. Fearon

Circ Cardiovasc Interv 2010;3;113-119
DOI: 10.1161/CIRCINTERVENTIONS.109.887406
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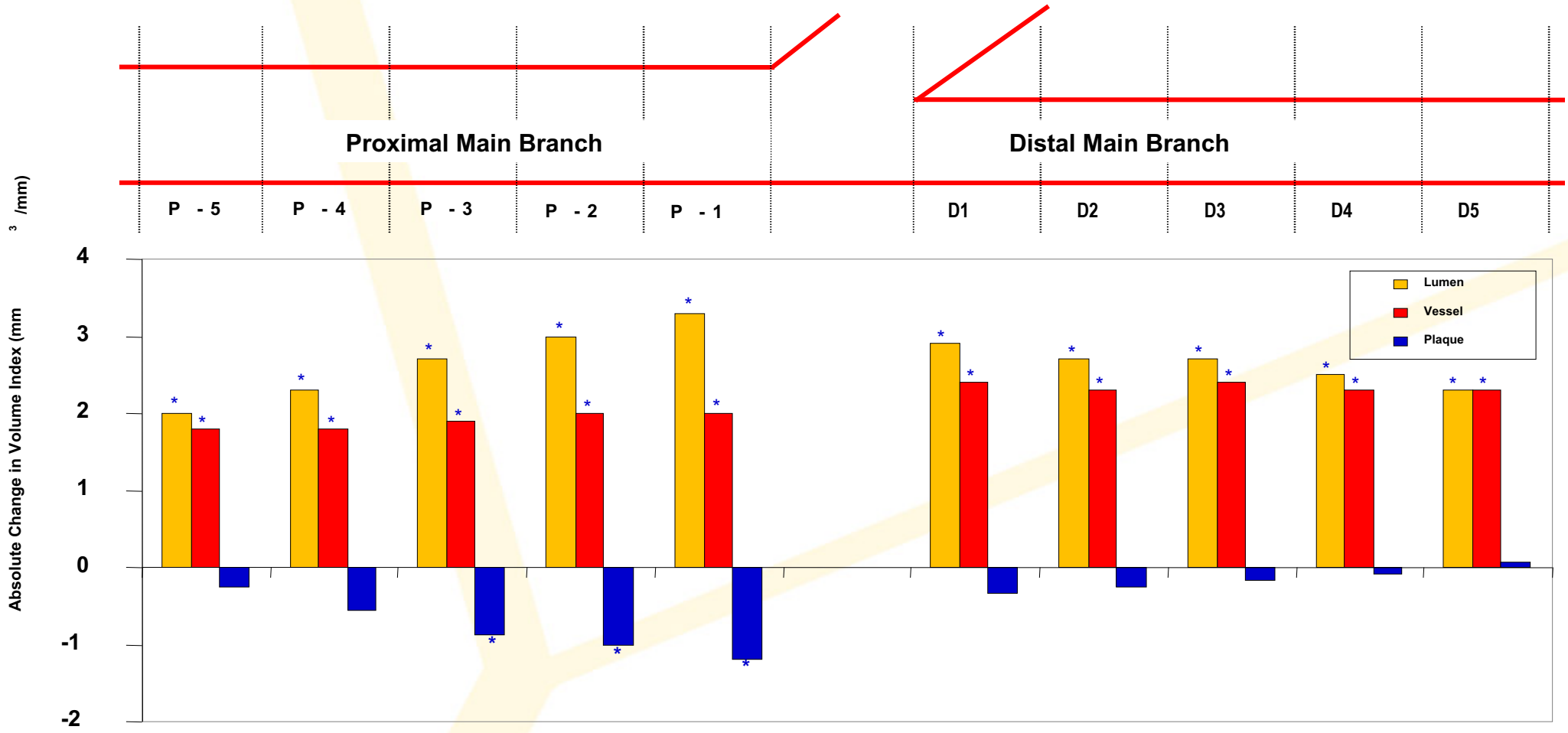
 Print ISSN: 1941-7640. Online ISSN: 1941-7632

Bon-Kwon Koo et al. Circ Cardiovasc Interv. 2010;3:113-119.

Absolute changes in volume indices

All patients underwent MB IVUS before and after MB stent implantation
FFR of the jailed SB lesions

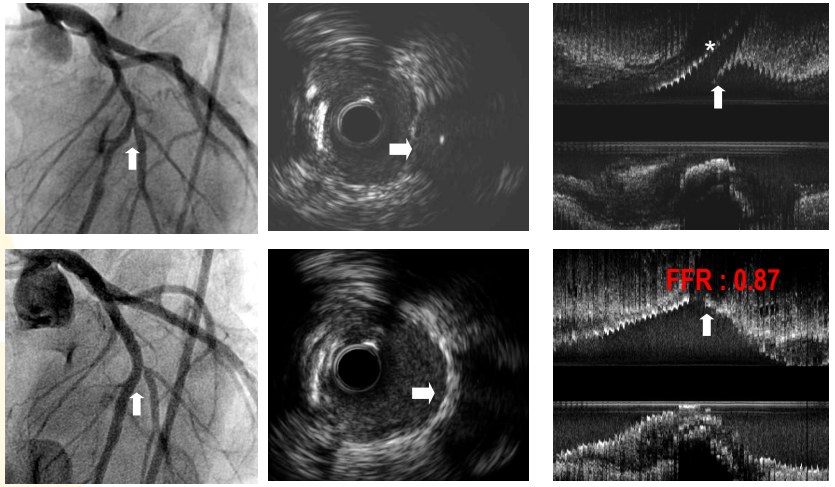


* P<0.005; comparison between pre- and post-stent implantation indices by RM ANOVA and post hoc analysis

Prospective multicenter trial (8 centers, US, Japan and Korea)

IVUS findings of Carina shift vs. Plaque shift

carina shift



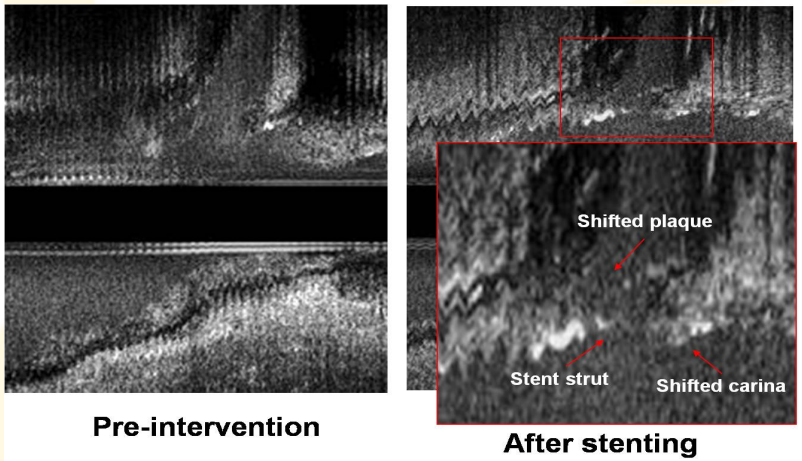
Angiogram | Cross-sectional IVUS | Longitudinal IVUS

Before MB stent

After MB stent

* : A 0.014 inch coronary wire

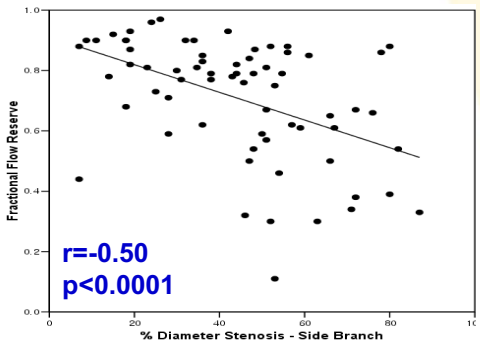
Both plaque shift and carina shift ➔ Aggravation of SB luminal narrowing after MB stent implantation

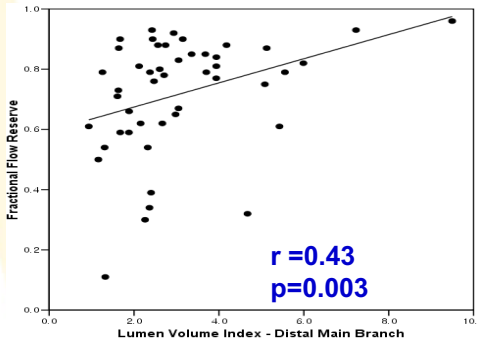


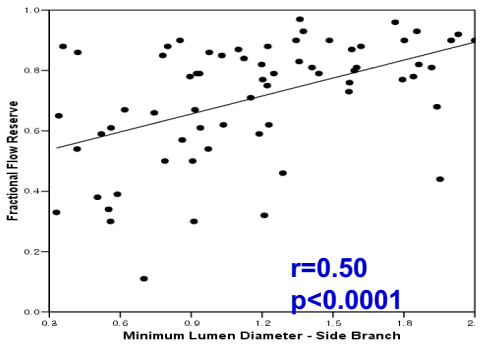
Pre-intervention

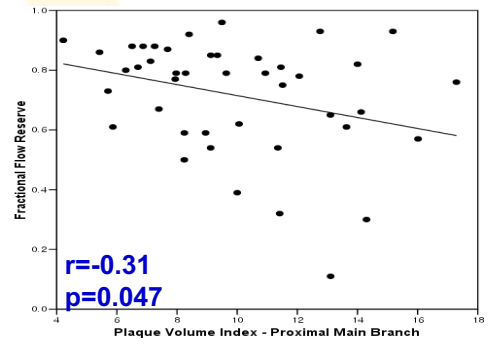
After stenting

Correlation between FFR of jailed SB lesion and pre-intervention angiographic and IVUS parameters









Predictor of jailed SB	OR	95% CI	P value
Main branch			
Reference diameter	1.10	0.29 – 4.23	0.89
% diameter stenosis	1.00	0.95 – 1.05	0.99
MB lesion length	1.02	0.96 – 1.08	0.50
Side branch			
Reference diameter	0.27	0.06 – 1.31	0.11
% diameter stenosis	**1.05**	1.01 – 1.09	**0.01**
SB lesion length	1.06	0.89 – 1.25	0.53
Y angle (≥ 70°)	3.62	0.23 – 58.14	0.37
MLD lo		3	**0.05**

Binary logistic regression analysis

Pre- % diameter stenosis of SB & type B lesion : independent angiographic predictors of functionally significant SB jailing
Post-stent SB-MLD & post-stent SB % diameter stenosis → correlated with SB FFR

Conclusion

- Aggravation of SB luminal narrowing after MB stent implantation results from both plaque shift and carina shift.
- Anatomic evaluation does not reliably predict the *functional significance of each jailed SB lesion* due to the complex mechanism of luminal narrowing and its individual variability