

# ***Bifurcation Stenting in the setting of Acute Myocardial Infarction: New Data***

*European Bifurcation Club*



***Dr. Stephane Noble***  
***University Hospital of Geneva***  
***Switzerland***



**UNIVERSITÉ  
DE GENÈVE**

**FACULTÉ DE MÉDECINE**



**HUG**    
Hôpitaux Universitaires de Genève





# Literature review (PubMed)

- Bifurcation and acute myocardial infarction (1/134)

## Impact of bifurcation lesions on clinical outcome and prognosis of primary angioplasty in acute myocardial infarction

Diaa-Eldin Abdel Hakim<sup>1,4</sup>, MD; Philippe Garot<sup>2</sup>, MD; Stéphane Champagne<sup>3</sup>, MD; Fathi Maklady<sup>4</sup>, MD; Ahmed El Hawary<sup>4</sup>, MD, PhD; Jean-Luc Dubois-Randé<sup>3</sup>, MD, PhD; Pierre-François Lesault<sup>3</sup>, MD; Emmanuel Teiger<sup>3\*</sup>, MD, PhD

EuroInterv.2008;4:93-98

- Bifurcation and STEMI (1/14)

## Impact of bifurcation lesions on angiographic characteristics and procedural success in primary percutaneous coronary intervention for ST-segment elevation myocardial infarction

Caroline Frangos<sup>1</sup>, Stéphane Noble<sup>1,\*</sup>, Nicolo Piazza, Anita Asgar, Annik Fortier, Quoc Hung Ly, Raoul Bonan

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# Impact of bifurcation lesions on clinical outcome and prognosis of primary angioplasty in acute myocardial infarction

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- 646 consecutive pts eligible for primary PCI
- 150 (23%) had a BF as the culprit lesion
- Single center (Henri Mondor, Paris)
- No precise definition for BF lesion
- Procedural and 1-year outcome (BF vs non BF)
- Only BMS
- 6-F guiding catheters



## Impact of bifurcation lesions on clinical outcome and prognosis of primary angioplasty in acute myocardial infarction

Table 1. Characteristics of the study patients.

	Bifurcation (n=150)	Non-bifurcation (n=496)	P value
Age, years	59±14	59±13	0.41
Male, % (n)	86 (129)	82.25 (408)	0.29
Diabetes mellitus, % (n)	24 (36)	22.1 (110)	0.46
Hypertension, % (n)	32.7 (49)	30.2 (150)	0.46
Current smoking, % (n)	38.7 (58)	36.3 (180)	0.24
Hypercholesterolaemia, % (n)	35.3 (53)	33.1 (164)	0.39
Previous MI, % (n)	13 (20)	12 (60)	0.47
Previous revascularisation	8 (12)	6.1 (30)	0.42
Use of glycoprotein IIb/IIIa inhibitor, % (n)	30 (45)	26 (129)	0.28
LVEF, %	53±12	56±10	0.35
Time from pain onset to PCI, min	180±25	195±30	0.52

MI: myocardial infarction; LVEF: left ventricular ejection fraction;  
PCI: percutaneous intervention



**Table 2. Characteristics of the bifurcation lesions.**

**Infarct related artery**

LM	2.6%
<u>LAD/Diag</u>	<u>65.4%</u>
LCX/Mg	16.5%
RCA/PDA-RVB	15.5%

*(Types of bifurcation lesions according to the Medina classification)*

<u>Type (1,1,1)</u>	<u>58%</u>
<u>Type (1,0,1)</u>	<u>10%</u>
Type (1,1,0)	16.7%
Type (1,0,0)	8%
<u>Type (0,1,1)</u>	<u>2%</u>
Type (0,1,0)	3%
Type (0,0,1)	2.3%

True BF  
70%

LM: Left Main; LAD: Left Anterior Descending; Diag: Diagonal; LCX: Left Circumflex; Mg: Marginal; RCA: Right Coronary Artery; PDA: Posterior Descending Branch; RVG: Retro-Ventricular Branch



**Table 3. Procedural characteristics in the patients with bifurcation lesions.**

<u>Double guidewires, % (n)</u>	54.6 (82)
Stenting of both branches, % (n)	7.3 (11)
Stenting only in main branch, % (n)	82 (123)
Provisional (T) stenting, % (n)	89.3 (134)
Balloon dilatation only, % (n)	10.7 (16)
Stent diameter, main branch (mm)	3.17±0.3
Stent length, main branch (mm)	16.2±4.6
Stent diameter, side branch (mm)	2.64±0.2
Stent length, side branch (mm)	11.5±4.1
<u>Kissing balloon inflation, % (n)</u>	33 (49)
Angiographic success, main branch, % (n)	92 (138)
Angiographic success, both branches, % (n)	87 (130)

< 30% RS  
TIMI III



**Table 5. Immediate and mid-term outcomes.**

Endpoints	Bifurcation (n= 150)	Non-bifurcation (n= 496)	P value
Angiographic success %(n)	92% (138)	93% (462)	0.65
In-hospital, % (n)			
Death	3,3 (5)	2 (10)	0.35
AMI	4 (6)	4.4 (22)	0.81
Acute and sub-acute stent thrombosis	<u>3.3 (5)</u>	<u>2 (10)</u>	0.41
Revascularisation	6 (9)	5 (25)	0.96
CABG	3.3 (5)	2.2 (11)	0.95
PCI	2.7 (4)	2.8 (14)	0.88
MACE	13.3 (20)	11.4 (57)	0.72
1-year outcomes % (n)			
Death	4.6 (7)	3 (15)	0.15
AMI	6.6 (10)	6 (30)	0.91
Revascularisation	11.3 (17)	10.5 (52)	0.74
CABG	4 (6)	3.8 (19)	0.81
PCI	7.3 (11)	6.7 (33)	0.76
MACE	22.6 (34)	19.5 (97)	0.56



## Author's conclusions

EuroInterv.2008;4:93-98

- The culprit lesion on a BF had no significant impact on immediate or mid-term outcomes (death, AMI and need for repeat revascularisation)
- High rate of provisional T-stenting
- The prognostic impact of BF lesions is probably small compared to other factors (size of MI and time to reperfusion)



# Impact of bifurcation lesions on angiographic characteristics and procedural success in primary PCI for STEMI



- 1070 primary PCI
- Over 26 months at the Montreal Heart Institute
- 114 pts (11%) had a BF lesion as the culprit lesion
- BF definition = SB  $\geq$  2.0mm
- Angiographic characteristics and procedural outcome (BF vs a matched group - age, gender, culprit vessel - of non-BF)
- Mainly BMS (94%)
- 6-F guiding catheters (60% of radial approach)



# No differences in baseline characteristics

Table 1 Baseline characteristics.

	BFL group (n = 114)	Non-BFL group (n = 114)	p
Mean age (years)	57.7 ± 11.1 (32–87)	57.7 ± 11.0 (34–89)	0.995
Men	92 (80.7)	92 (80.7)	1.0
Diabetes mellitus	17 (14.9)	11 (9.7)	0.23
Hypertension	41 (36.0)	39 (34.2)	0.78
Hypercholesterolaemia	62 (54.4)	58 (50.9)	0.60
Smoking history	59 (51.8)	63 (55.3)	0.60
Previous	10 (8.8)	16 (14.0)	0.21
Current	49 (43.0)	47 (41.2)	0.79
Obesity <sup>a</sup>	29 (27.9)	36 (33.0)	0.42
Previous MI	1 (0.9)	2 (1.8)	0.56
Previous PCI	6 (5.3)	2 (1.8)	0.15
CAD			0.012
One VD	67 (58.8)	88 (77.2)	
Two VD	33 (29.0)	18 (15.8)	
Three VD	14 (12.3)	8 (7.0)	

BFL: bifurcation lesion; CAD: coronary artery disease; MI: myocardial infarction; PCI: percutaneous coronary intervention; VD: vessel disease. Data are mean ± standard deviation (range) or number (%).

<sup>a</sup> Body mass index greater or equal to 30 kg/m<sup>2</sup>.



**Table 2** Infarct-related artery and bifurcation lesion subtypes.

Infarct-related artery/BFL subtype	Number of patients (%)
LAD/diagonal branch	72 (65.0)
LCX/OM	20 (17.5)
RCA/PDA-PL	20 (17.5)
<i>Types of BFL according to the Medina classification</i>	
Type (1,1,1)	33 (29.0)
Type (1,1,0)	6 (5.3)
Type (1,0,1)	8 (7.0)
Type (0,1,1)	12 (10.5)
Type (1,0,0)	21 (18.4)
Type (0,1,0)	26 (22.8)
Type (0,0,1)	8 (7.0)
True BFLs (1,1,1; 1,0,1; 0,1,1)	53 (46.5)
False BFLs (1,1,0; 1,0,0; 0,1,0; 0,0,1)	61 (53.5)

70% in the previous study



**Table 2** Infarct-related artery and bifurcation lesion subtypes.

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Type (1,0,0)	21 (18.4)
Type (0,1,0)	26 (22.8)
Type (0,0,1)	8 (7.0)
True BFLs (1,1,1; 1,0,1; 0,1,1)	53 (46.5)
False BFLs (1,1,0; 1,0,0; 0,1,0; 0,0,1)	61 (53.5)

59.7 %  
92.7% in previous study

**Table 3** Pre-intervention TIMI flow and thrombus grade in bifurcation lesion and non-bifurcation lesion groups.

Variables	BFL group (n = 114)		Non-BFL group (n = 114)	p <sup>a</sup>
	MB	SB		
<i>Pre-PCI TIMI flow grade</i>				0.83
0	51 (44.7)	33 (29.0)	53 (46.5)	
1	7 (6.1)	4 (3.5)	8 (7.0)	
2	24 (21.1)	15 (13.1)	27 (23.7)	
3	32 (28.1)	62 (54.4)	26 (22.8)	
<i>Pre-PCI TIMI thrombus grade</i>				0.083
0	29 (25.5)	65 (57.0)	18 (15.8)	
1	0	5 (4.4)	5 (4.4)	
2	4 (3.5)	3 (2.6)	9 (7.9)	
3	17 (14.9)	5 (4.4)	18 (15.8)	
4	13 (11.4)	3 (2.6)	11 (9.6)	
5	51 (44.7)	33 (29.0)	53 (46.5)	

BFL: bifurcation lesion; MB: main branch; SB: side branch; PCI: percutaneous coronary intervention; TIMI: thrombolysis in myocardial infarction.

<sup>a</sup> The p values refer to the comparison between MB bifurcation and non-bifurcation data.

- Higher TIMI III flow pre-intervention (compared to the previous study)
- MB **28.1%** vs 16%; SB: **54.4%** vs 29.3%; Non BF **22.8%** vs 11.3%
- Higher rate of Abciximab administration 85% vs 30% (often up front)



**Table 5** Procedural data for patients with bifurcation lesions.

<u>Double guidewire</u>	<u>57 (50.0)</u>
<i>Pre-dilatation</i>	
MB only	69 (60.5)
SB only	12 (10.5)
Sequential	26 (22.8)
Kissing balloon	1 (0.9)
None	6 (5.3)
<u>Provisional SB stenting</u>	<u>106 (93)</u>
Stenting of both branches <sup>a</sup>	10 (8.8)
Stenting only in MB	96 (84.2)
Stenting only in SB	8 (7.0)
Stent length, MB (mm)	20.8 ± 6.2
Stent diameter, MB (mm)	3.14 ± 0.4
Stent length, SB (mm)	17.5 ± 6.2
Stent diameter, SB (mm)	2.80 ± 0.4
<u>Final kissing balloon inflation</u>	<u>50 (43.9)</u>
Angiographic success, MB ≤ 30% RS, TIMI III	110 (96.5)
Angiographic success, SB ≤ 50% RS, TIMI III	103 (90.4)

**A: all but two were T-stenting**



- **Time to reperfusion** (needle-to-balloon/thrombectomy/direct stenting) was not different between BF and Non BF **13.7±7.9 min and 12.1±5.7 min, p=0.087**
- No difference between true and false BF (p=0.23)

**Table 6A** Mean fluoroscopy time, mean contrast volume and mean procedural time.

	BFL group (n = 114)	Non-BFL group (n = 114)	p	True BFL group (n = 53)	False BFL group (n = 61)	p
Fluoroscopy time (min)	16.2 ± 11.2	9.8 ± 5.1	< 0.0001	21.2 ± 12.9	11.9 ± 7.1	< 0.0001
Contrast volume (mL)	265 ± 91	207 ± 68	< 0.0001	298 ± 90	236 ± 83	0.0003
Procedural time (min)	51.0 ± 26.6	35.3 ± 11.5	< 0.0001	58.7 ± 29.5	44.4 ± 22.2	0.0050

BFL: bifurcation lesion. Data are mean ± standard deviation.

**Table 6B** Mean fluoroscopy time, mean contrast volume and mean procedural time.

	True BFL group (n = 53)	Non-BFL group (n = 114)	p	False BFL group (n = 61)	Non-BFL group (n = 114)	p
Fluoroscopy time (min)	21.2 ± 12.9	9.8 ± 5.1	< 0.0001	11.9 ± 7.1	9.8 ± 5.1	0.058
Contrast volume (mL)	298 ± 90	207 ± 68	< 0.0001	236 ± 83	207 ± 68	0.016
Procedural time (min)	58.7 ± 29.5	35.3 ± 11.5	< 0.0001	44.4 ± 22.2	35.3 ± 11.5	0.0035

BFL: bifurcation lesion. Data are mean ± standard deviation.



# Impact of bifurcation lesions on angiographic characteristics and procedural success in primary PCI for STEMI

## Conclusions

- BF in STEMI were associated with similar time to reperfusion and procedural success but did lead to significantly greater contrast use and prolonged procedural time compared with non-BF
- Medina classification is more difficult to use in STEMI patients when thrombus burden is important and sometimes difficult to differentiate from atherosclerosis



# What about DES in AMI with BF ?

- **One year outcome after implantation of drug-eluting stents in bifurcation lesions in STEMI patients undergoing primary PCI**

J. Mehilli; S. Schulz; S. Kufner; M. Seyfarth; S. Maßberg; J. Dirschinger, A. Schömig, A. Kastrati

Deutsches Herzzentrum, Technische Universität , Munich,  
Germany



Poster presented at ESC 2010



# One year outcome after implantation of drug-eluting Stents in bifurcation lesions in STEMI patients undergoing primary PCI

J. Mehilli; S. Schulz; S. Kufner; M. Seyfarth; S. Maßberg; J. Dirschinger, A. Schömig, A. Kastrati  
Deutsches Herzzentrum, Technische Universität , Munich, Germany

- 873 pts with STEMI treated with DES implantation
- 196 pts (22%) had a BF as the culprit lesion
- Single center (Munich Heart center)
- Definition of BF not described
- One-year outcome after DES implantation in BF lesions in STEMI patients



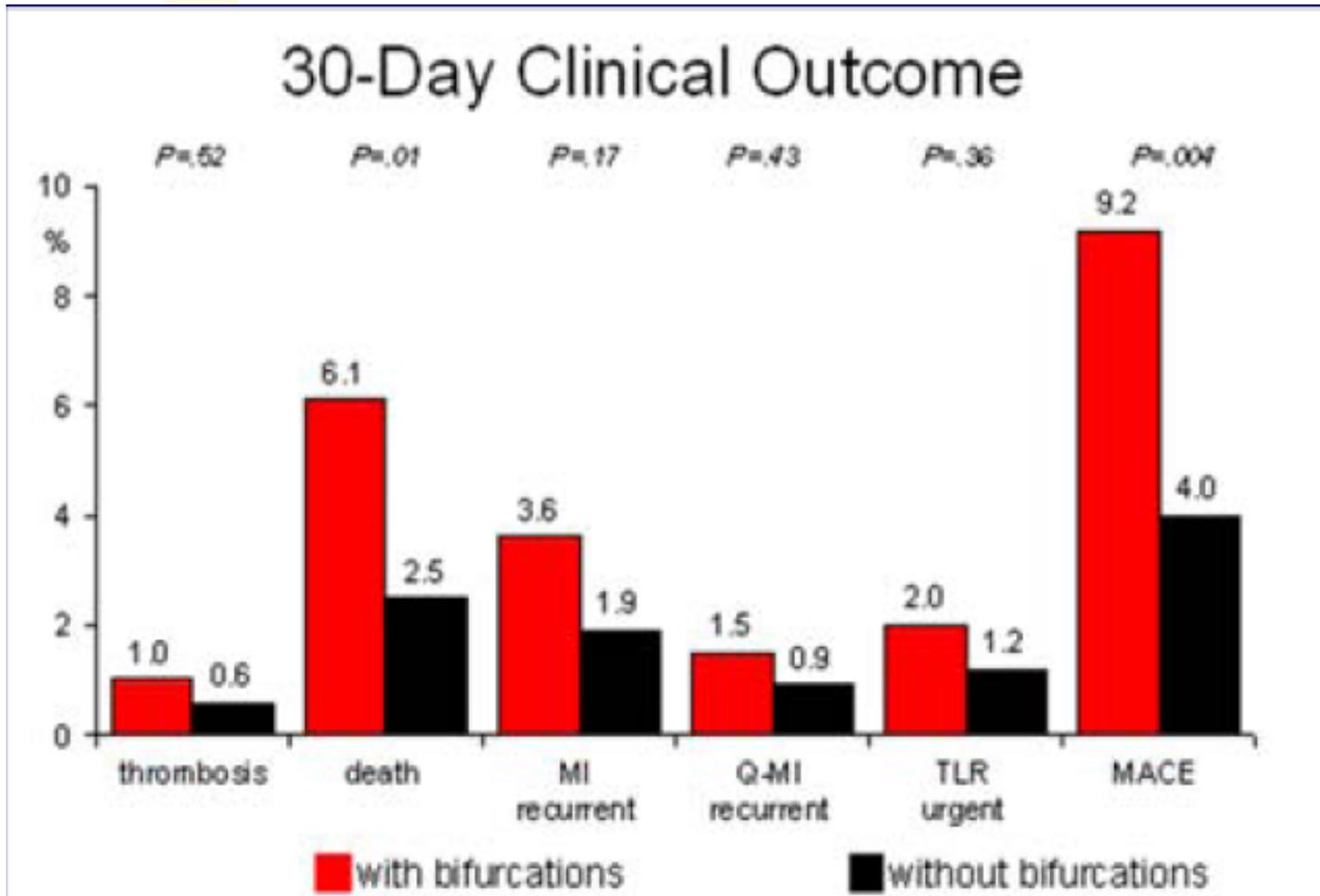
# One year outcome after implantation of drug-eluting Stents in bifurcation lesions in STEMI patients undergoing primary PCI

## Angiographic Characteristics

	With bifurcation n=196	Without bifurcation n=677	P
LV-EF, %	46.2±11.2	47.8±10.2	.08
Multivessel disease, %	72.4	69.7	.46
# of lesions >1, %	73.5	29.5	<.001
Treated vessel			<.001
LAD, %	54.1	37.4	
LCx, %	28.6	21.3	
RCA, %	17.8	41.4	
Occlusion, %	37.8	52.7	<.001



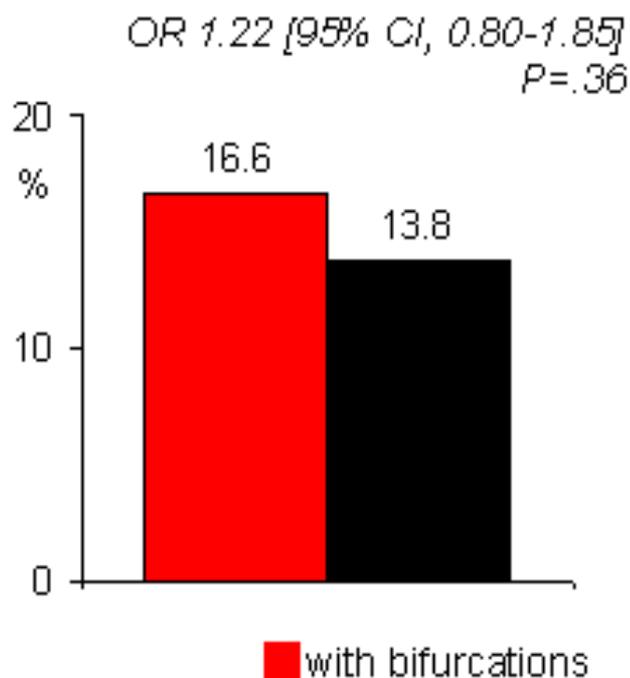
# One year outcome after implantation of drug-eluting Stents in bifurcation lesions in STEMI patients undergoing primary PCI



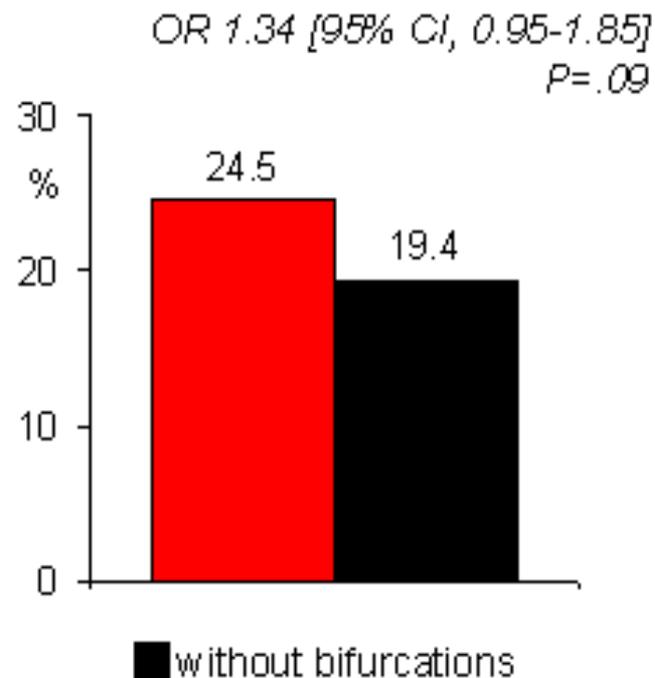


# One year outcome after implantation of drug-eluting Stents in bifurcation lesions in STEMI patients undergoing primary PCI

Target Lesion Revascularization  
- at one-year follow-up -



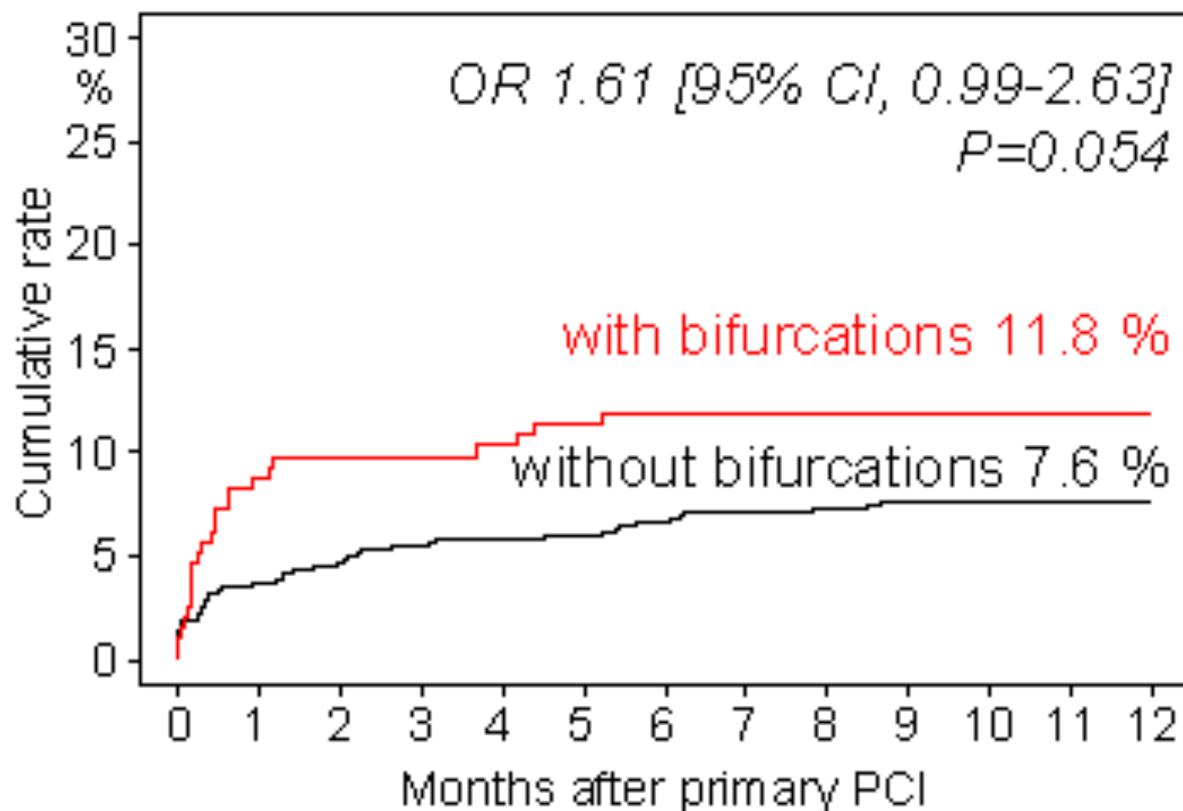
Major Adverse Cardiac Events  
- at one-year follow-up -





# One year outcome after implantation of drug-eluting Stents in bifurcation lesions in STEMI patients undergoing primary PCI

Death or Recurrent MI  
- at 1-year follow-up -





## One year outcome after implantation of drug-eluting Stents in bifurcation lesions in STEMI patients undergoing primary PCI

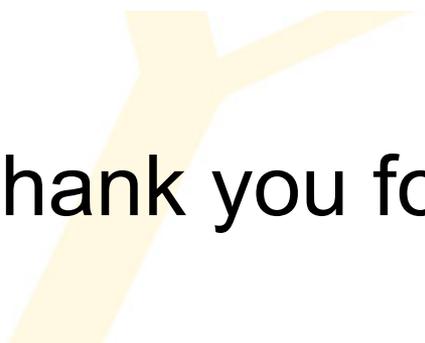
### Conclusions

- In acute STEMI, implantation of DES in BF is associated with numerically higher thrombotic complications and repeat revascularizations compared with non BF (not significant)
- These data suggest that DES in STEMI have attenuated the negative impact of BF lesions



# Final Conclusions

- Very few studies focusing on BF in STEMI
- Prevalence between 11% and 23%
- Predominantly LAD/diag.
- Procedural success rate not significantly different between BF and non BF groups
- Provisional T-stenting was the most common technique used
- Time to reperfusion similar, but longer procedural time
- DES to treat BF in STEMI seem to be safe

A large, stylized yellow arrow graphic pointing upwards and to the right, located behind the text.

Thank you for your attention





Table 4 Procedural characteristics.

	BFL group (n = 114)	Non-BFL group (n = 114)	p
<i>Vascular access</i>			0.85
Radial	70 (61.4)	71 (62.3)	
Femoral	44 (38.9)	43 (37.7)	
Glycoprotein IIb/IIIa inhibitors	97 (85.1)	96 (84.2)	0.85
Thrombectomy	36 (31.6)	39 (34.2)	0.85
Pre-dilatation	108 (94.7)	74 (64.9)	< 0.0001
Stent length (mm)	20.8 ± 6.2	20.0 ± 5.7	0.32
Stent diameter (mm)	3.14 ± 0.4	3.22 ± 0.4	0.14

BFL: bifurcation lesion. Data are mean ± standard deviation or number (%).



- Time to reperfusion (needle-to-balloon/thrombectomy/direct stenting) was not different between BF and Non BF

13.7±7.9 min vs 12.1±5.7 min, p=0.087

- No difference between true and false BF (p=0.23)

Table 6A Mean fluoroscopy time, mean contrast volume and mean procedural time.

	BFL group (n=114)	Non-BFL group (n=114)	p	True BFL group (n=53)	False BFL group (n=61)	p
Fluoroscopy time (min)	16.2 ± 11.2	9.8 ± 5.1	<0.0001	21.2 ± 12.9	11.9 ± 7.1	<0.0001
Contrast volume (mL)	265 ± 91	207 ± 68	<0.0001	298 ± 90	236 ± 83	0.0003
Procedural time (min)	51.0 ± 26.6	35.3 ± 11.5	<0.0001	58.7 ± 29.5	44.4 ± 22.2	0.0050

BFL: bifurcation lesion. Data are mean ± standard deviation.