



SCA ET PATIENTS PONTÉS

Le pontage : un vaisseau comme un autre

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GRCI 7 décembre 2018





DISCLOSURE STATEMENT OF FINANCIAL INTEREST
Anne BELLEMAIN-APPAIX, MD

- **Research Grants to Institution** from Daiichi-Sankyo, Fondation pour la Recherche Médicale, Fédération Française de Cardiologie and Société Française de Cardiologie
- **Consulting Fees** from Daiichi-Sankyo, Eli Lilly, Astra Zeneca, Biotronik, Novartis
- **Lecture Fees** from Daiichi Sankyo, Eli Lilly and Servier, Astra Zeneca, Biotronik, Novartis

SCA ET CABG

FREQUENCE

MECANISME

PREVENTION

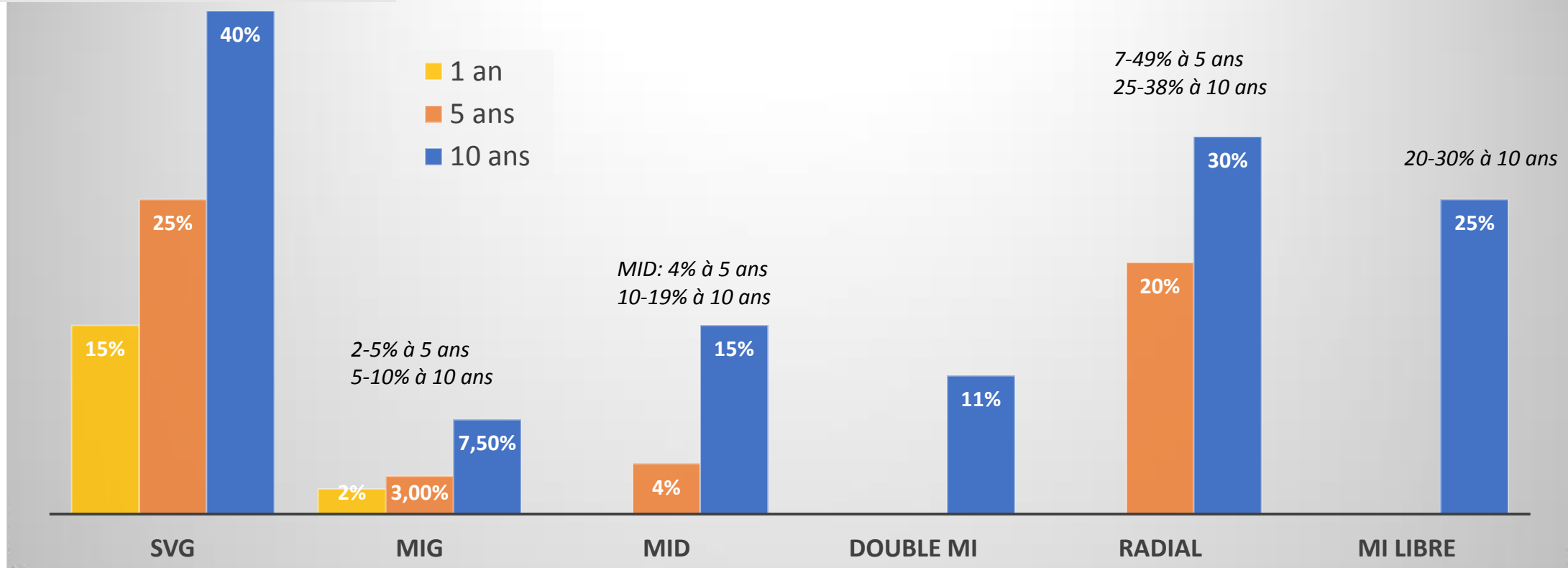
PERMÉABILITÉ DES PONTAGES MECANISME D'OCCLUSION

1° PONTAGE SAPHÈNE 1967

Hyperplasie néointimale / régimes de pressions + shear stress artériel
Prolifération et migration des cellules musculaires vasculaires; libération de cytokines, dégradation MEC
Contexte proinflammatoire + Athéromatose

1-6 ans: 1-2% / an
6-10 ans: 4% / an
50% des SVG perméables sont sténosés

TAUX D'OCCLUSION DES PONTAGES



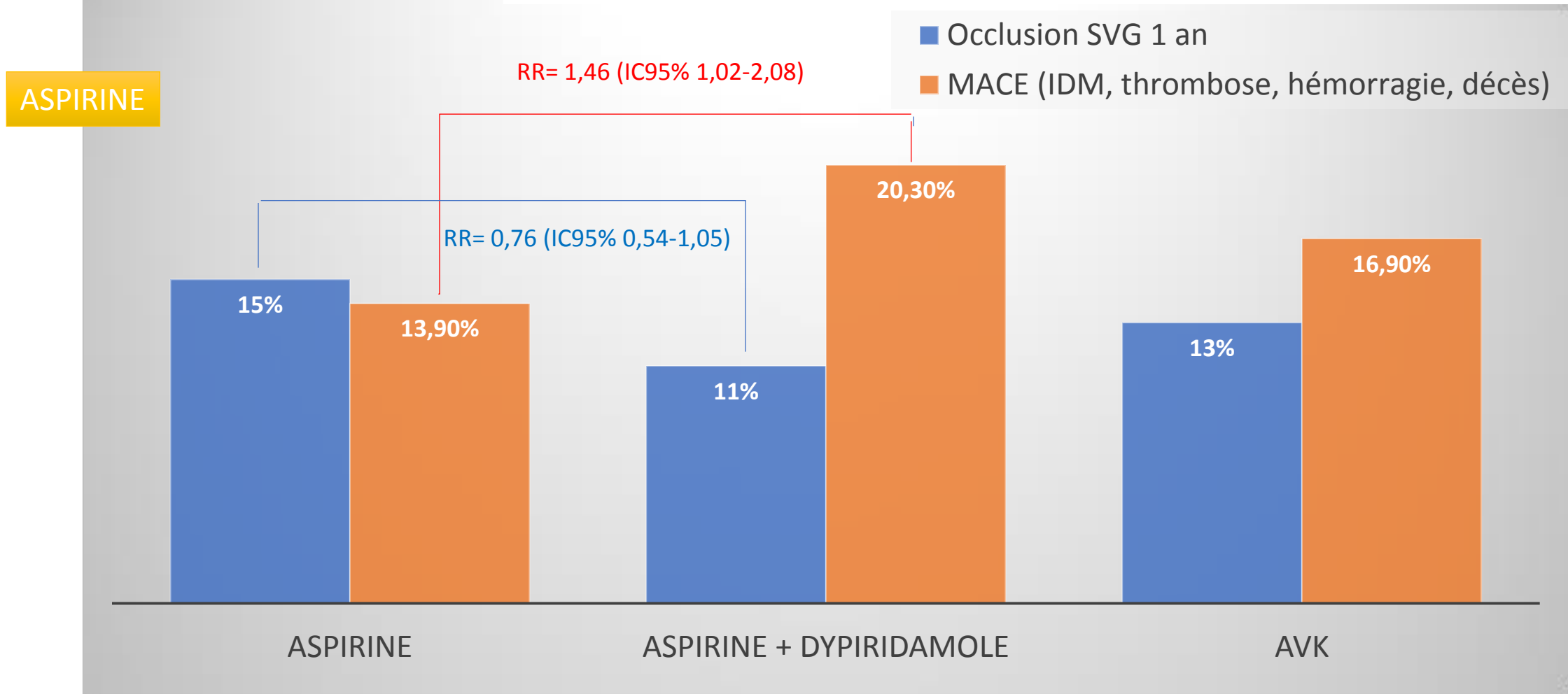
Prolifération des **ARTÈRES NATIVES**: 5% / an

Motwani et al; *Circulation*. 1998;97:916-931.

PERMÉABILITÉ DES PONTAGES: prévention

RCT 948 CABG; Aspirine vs ASA+ DPR vs AVK

Aspirine: 50mg/j; DPR: perfusion 5mg/kg/j 28h puis 200mg*2/J; AVK INR=2,8-4,8



Mammaire: occlusion 4,6% anastomose, aspirine, reste NS

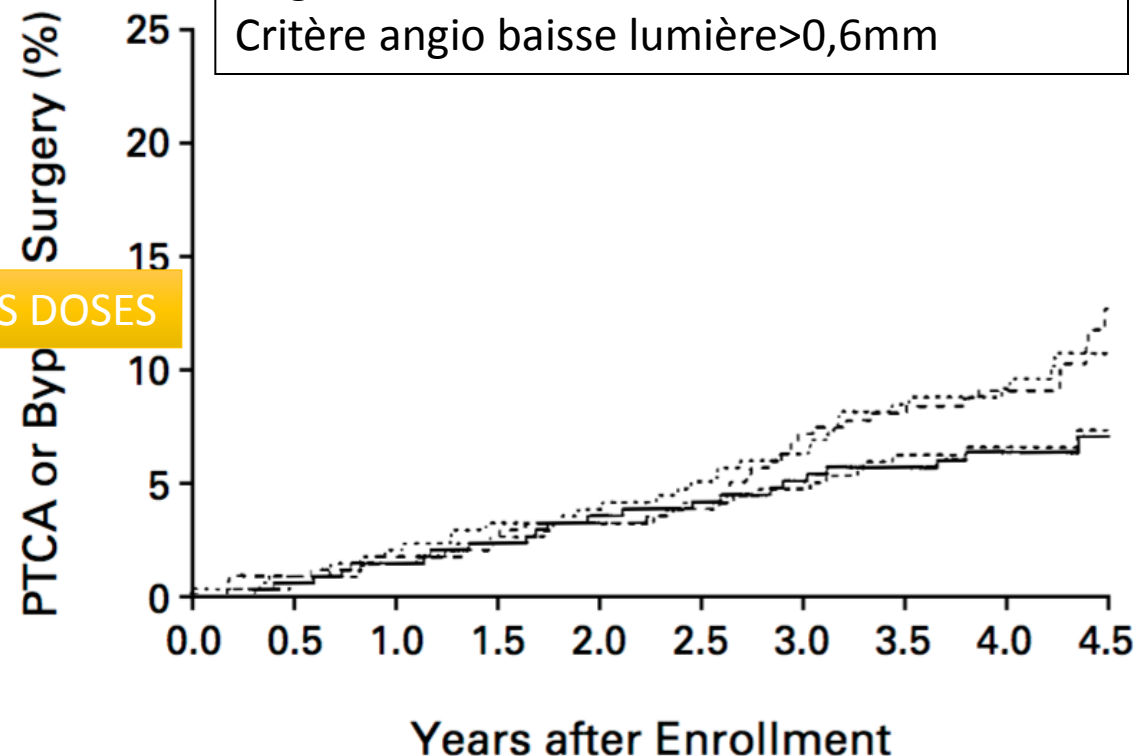
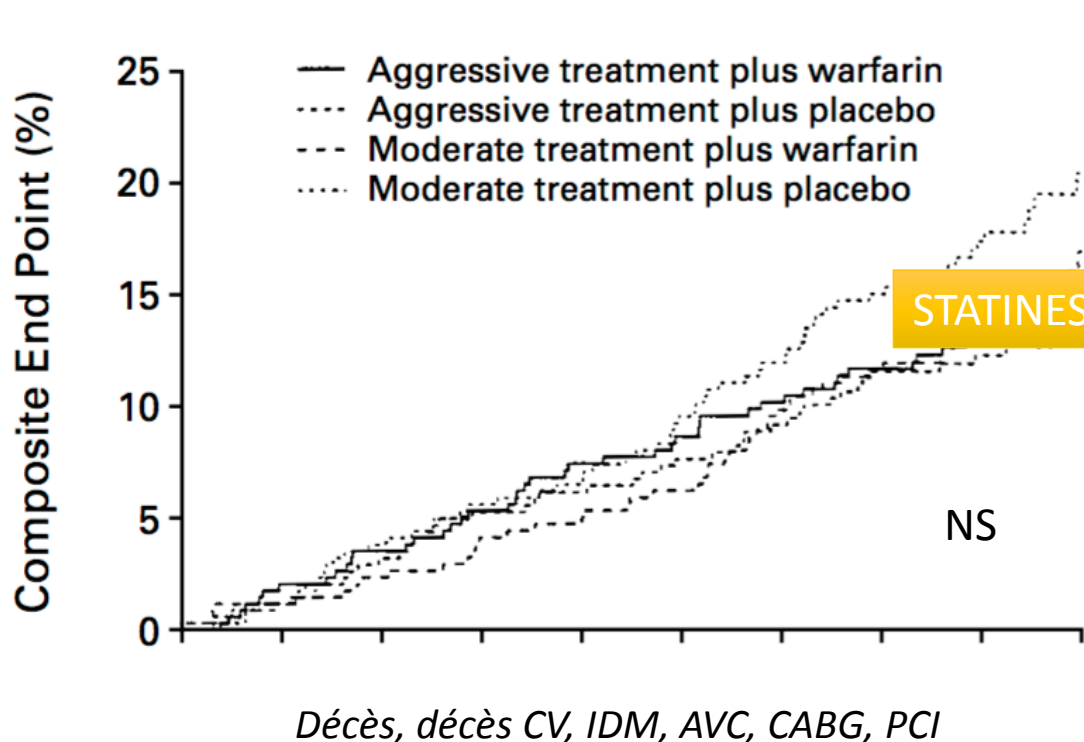
Van der Meer et al; [Lancet](#). 1993 Jul 31;342(8866):257-64.

PERMÉABILITÉ DES PONTAGES: prévention

Lovastatine +/-cholestyramine
LDL 0,6-0,85g/dl groupe agressif
LDL 1,3-1,4g/dl groupe modéré

Warfarine pour INR<2 (moy 1,4)

STATINES FORTES vs FAIBLES DOSES
ANTICOAGULANTS FAIBLE DOSE



1351 CABG 1-11 ans avec >1 SVG perméable
Angio 4,3 ans
Critère angio baisse lumière >0,6mm

STATINES FORTES DOSES

Lipides+: critère angio progression 27% vs 39% (p<0,001) avec **réduction de 29% des revascularisations** (6,5% vs 9,2% à 4 an)

[Post Coronary Artery Bypass Graft Trial Investigators. N Engl J Med. 1997 Jan 16;336\(3\):153-62.](#)

FRÉQUENCE des PONTAGES si SCA

FAST-MI

STEMI 1995-2015

=212 / 7 043: **3% des STEMI**

	USIK 1995* (n=1536)	USIC 2000* (n=1844)	FAST-MI 2005 (n=1611)	FAST-MI 2010 (n=1716)	FAST-MI 2015 (n=1872)	P Value
Myocardial infarction	225 (15)	276 (15)	180 (11)	187 (11)	231 (12)	<0.001
PCI	–	139 (7.5)	140 (9)	175 (10)	236 (13)	<0.001
CABG	–	50 (3)	34 (2)	96 (6)	32 (2)	<0.001

NSTEMI 1995-2015

=420 / 5 228: **8% des NSTEMI**

	USIK 1995* (n=616)	USIC 2000* (n=476)	FAST-MI 2005 (n=1448)	FAST-MI 2010 (n=1363)	FAST-MI 2015 (n=1941)	P for Trend
Myocardial infarction	169 (27)	135 (28)	345 (24)	311 (23)	469 (24)	0.055
PCI	–	77 (16)	260 (18)	314 (23)	462 (24)	<0.001
CABG	–	48 (10)	132 (9)	116 (8.5)	124 (6)	0.006

Puymirat et al [Circulation](#). 2017 Nov 14;136(20):1908-1919

ANGIOPLASTIE des patients pontés: fréquence des SCA

Registre US 2004-2009: 1 721 046 patients + PCI
 Angioplastie des pontages: **17.5%** : 300 902

SCA = 60%

Artère native 62.5%
PONTAGE: 37.5%
 -saphène (SVG) 34.9%(93%)
 -artériel 2.5%
 -les 2: 0.2%

Table 2. Comparison of Baseline Patient Characteristics in CathPCI Registry Patients With Prior CABG Undergoing PCI Classified According to the Treated Vessel

Variable	Native Only (n = 187,989)	SVGs (n = 104,678)	Arterial Grafts (n = 7,517)	SVGs and Arterial Grafts (n = 718)	p Value
Presentation					
Symptoms					<0.001
No angina	14%	11%	15%	12%	
Atypical chest pain	7%	6%	8%	7%	
Stable angina	21%	16%	20%	19%	
ACS: unstable angina	42%	40%	39%	40%	
ACS: NSTEMI	12%	20%	13%	19%	
ACS: STEMI	4%	7%	4%	3%	
Congestive heart failure	12%	14%	15%	17%	<0.001
Cardiogenic shock	1.3%	1.8%	1.9%	2.0%	<0.001
Days from CABG to PCI, median	2,859 (1,431–4,539)	3,949 (2,492–5,501)	2,572 (941–4,395)	2,998 (602–4,672)	<0.001

68 ans
 Hommes 73%
 Diabète 45-50%, IR 20%
 ATCD IDM 45%
 AOMI 25%
 IR 10%
 AVK 5%

PCI pontage: +mortalité hosp (odds ratio: 1.22, 95% CI: 1.12 to 1.32)

Brilakis et al; JACC Cardiovasc Interv. 2011 Aug;4(8):844-50

SCA ET CABG
THROMBOLYSE ?
PCI ?
REDO-CABG ?

Mécanisme d'occlusion / STEMI + CABG: thrombolyse ?

Thrombolyse IC

TIMI 2-3 après thrombolyse IV STEMI

- **+ CABG: 47%**
- Sans CABG: 65%

Reiner (abstr). Circulation 1996;94 Suppl I:I-570.

50 STEMI + ATCD CABG > 1 an
Angio H1-J7

Artère coupable:
-SVG 76%: thrombus 82%
(>2 cm 50% des cas)
-artère native 16%
- ? : 8%

Thrombolyse IV: reperfusion 25% SVG
Thrombolyse intra SVG +/- ATC: 80%

Grines et al [Am J Cardiol.](#) 1990 Jun 1;65(20):1292-6.

OCCLUSION DES PONTAGES: redo-CABG



Table 3. Predictors of Early Mortality

Variable	OR (95% CI)	p Value
Status		
Elective	1.00	...
Urgent	1.89 (1.32–2.71)	<0.001
Emergency/salvage	4.93 (2.97–8.90)	<0.001

Table 4. Predictors of Midterm Mortality

Variable	OR (95% CI)	p Value
Status		
Elective	1.00	...
Urgent	1.17 (1.02–1.35)	0.03
Emergency/salvage	1.80 (1.38–2.34)	<0.001

Yap et al; Ann Thorac Surg 2009;87:1386–1391.

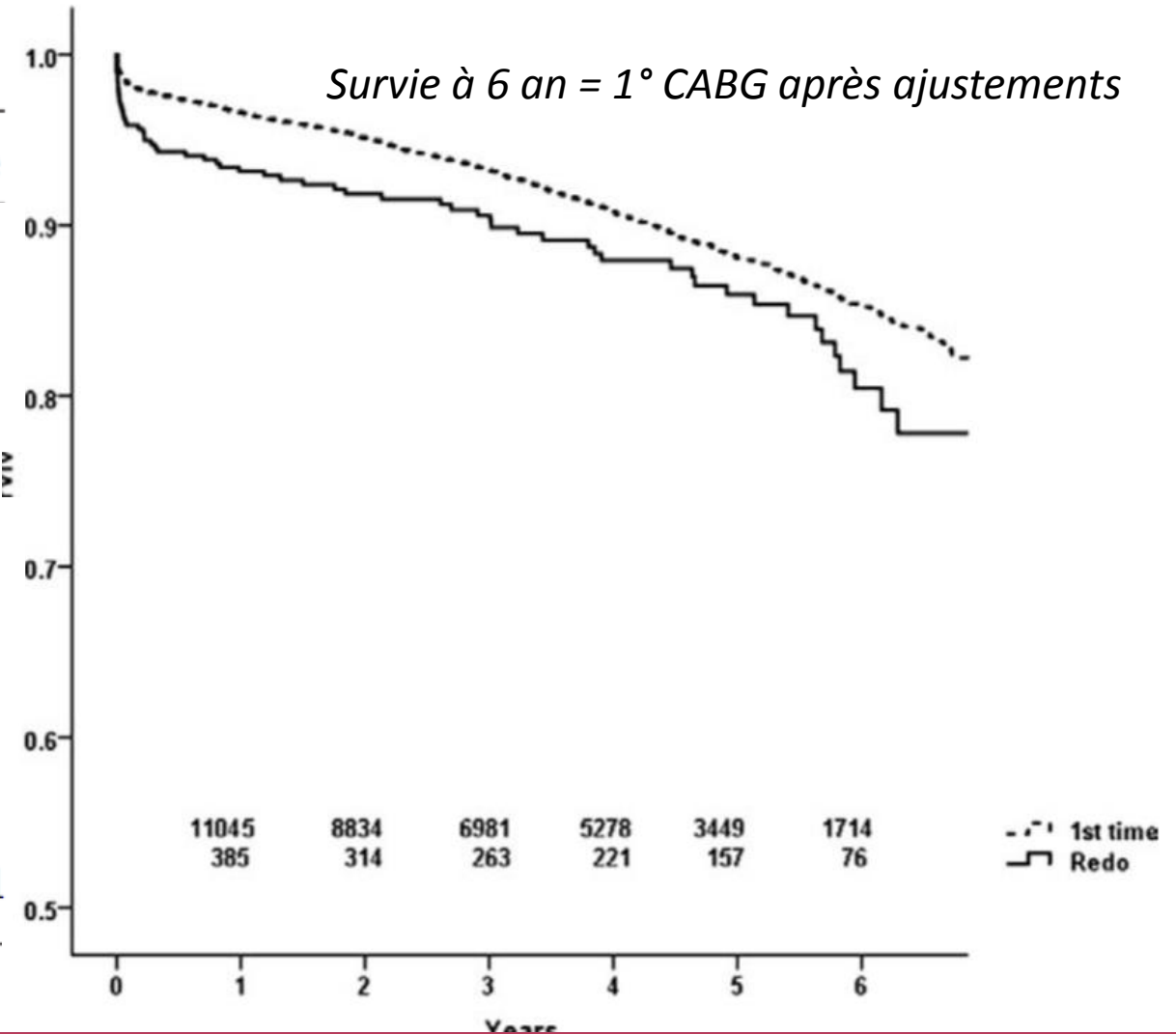


Table 3. Early Coronary Angioplasty Outcomes Stratified by Infarct-related Vessel Type (Core Laboratory Analysis)

	Bypass graft (n = 32)	Native Artery (n = 1,068)	p Value
PTCA performed	71.9%	89.8%	0.001
Diameter stenosis after PTCA	35 ± 22%	26 ± 35%	0.25
Maximal balloon size (mm)	3.6 ± 1.3	3.1 ± 0.5	<0.0001
Maximal balloon pressure (atm)	8.0 ± 3.8	7.9 ± 2.7	0.89
TIMI flow grade after PTCA			
0/1	4.3%	1.9%	
2	25.5%	3.8%	<0.0001
3	70.2%	94.3%	
Type ≥B dissection present after PTCA	30.4%	25.5%	0.62
Thrombus present after PTCA	30.4%	9.4%	<0.0001
Adjunctive intravessel urokinase	17.4%	9.7%	0.22

OCCLUSION DES PONTAGES: traitement: PCI

Registre 140 CABG + SCA ST+

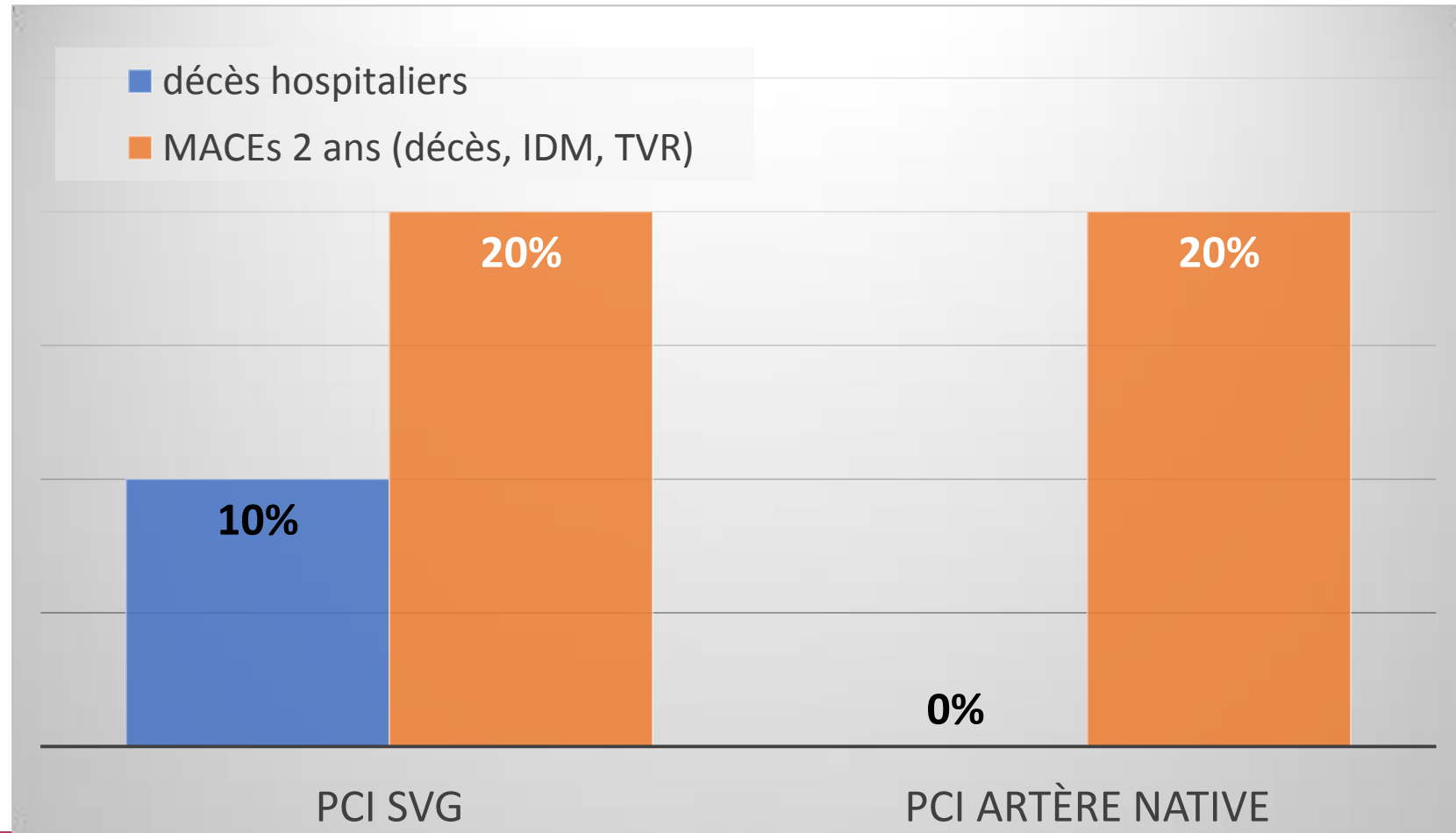
Ancienneté des pontages 5,6 +/- 4,2 ans

Angioplastie SVG : 21%

DES

ANGIOPLASTIE **ARTERE NATIVE (IIaC)** > PONTAGE ?

Liu et al; [Chin Med J \(Engl\)](#). 2013 Jun;126(12):2281-5.

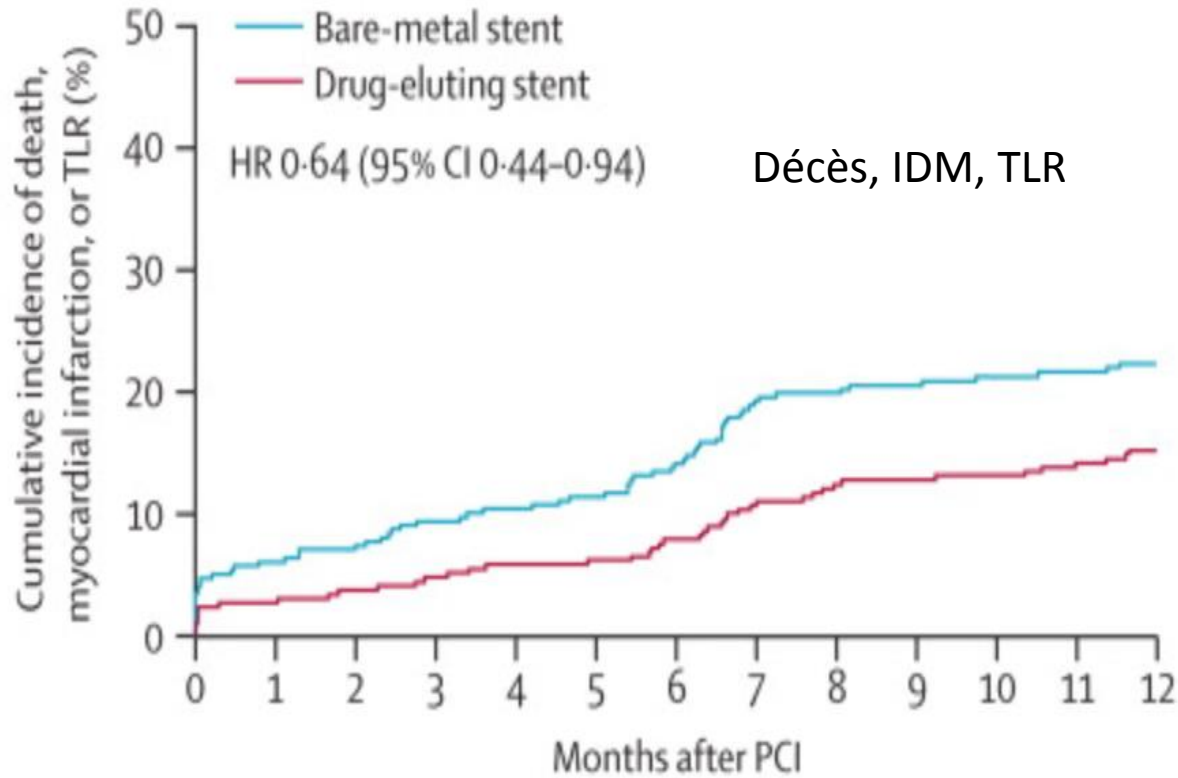


OCCLUSION DES PONTAGES: traitement: PCI

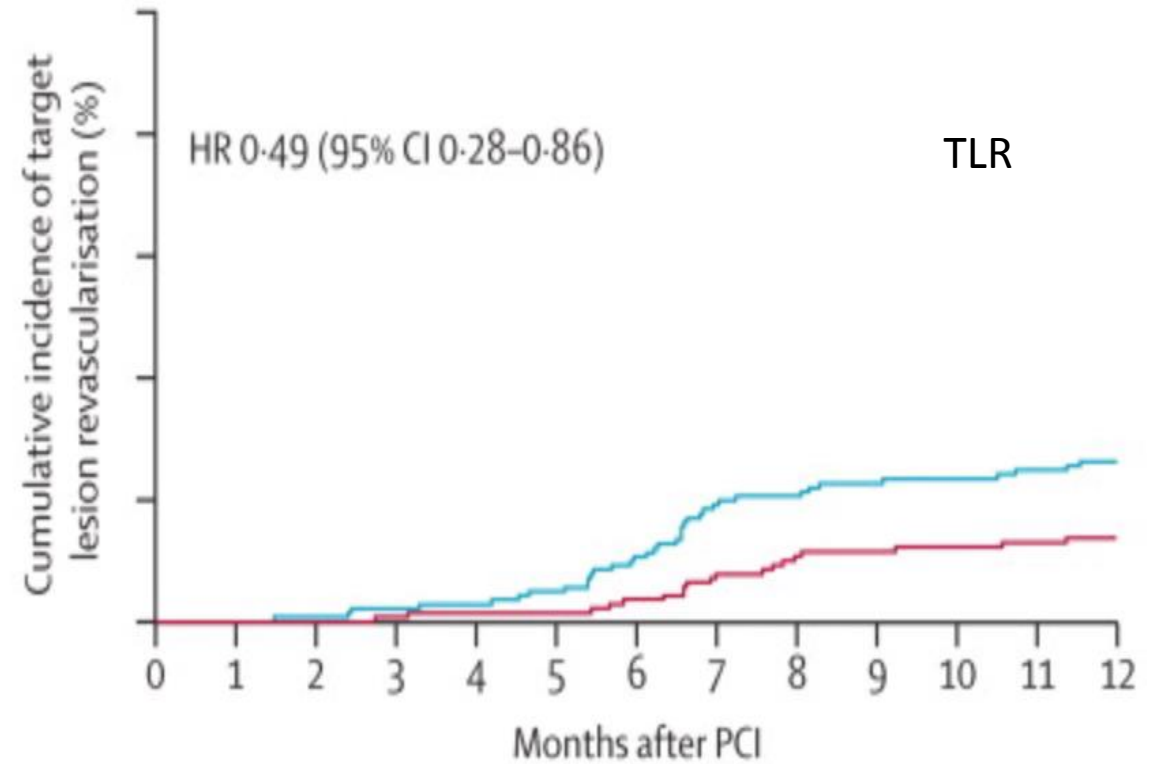
DES ou BMS ?

Age des pontages: 5,3 ans
Aspirine 200mg+clopidogrel >6 mois, +/- GI
Coro 6-8 mois: RIS 15% DES vs 29% BMS (<0,0001); 9% occlusion

610 SVG, suivi à 1 an
SCA 40%
DES vs BMS 1:1:1:3
PES vs SES +/- BD vs BMS



Décès, IDM, ST: NS



Mehili et al; [Lancet](#). 2011 Sep 17;378(9796):1071-8

OCCLUSION DES PONTAGES: traitement: PCI

PCI +Protection SVG: IIaB, emploi -

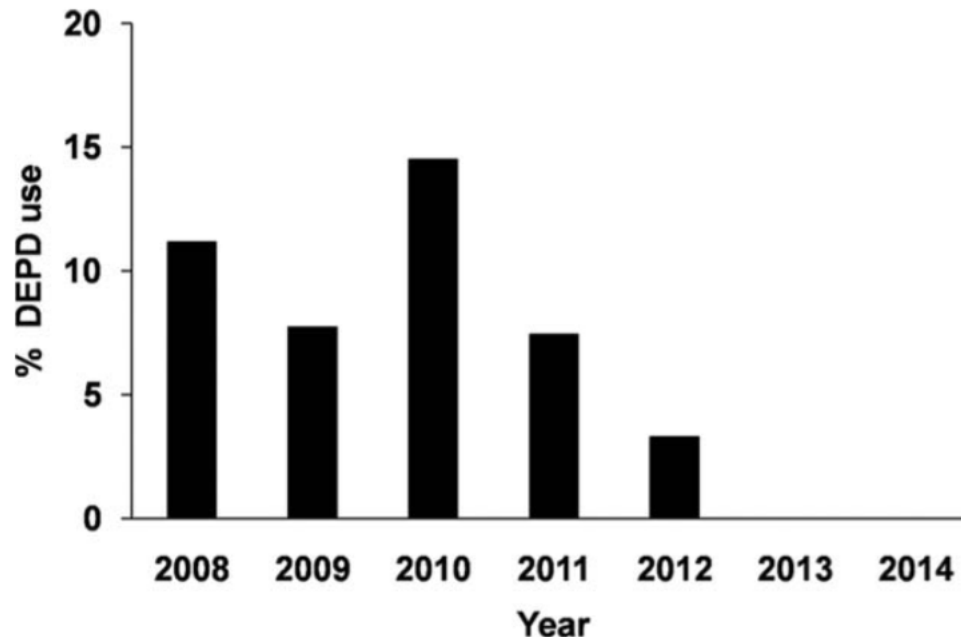
SYSTÈME DE PROTECTION ?

Registre britannique
ATC SVG seul
DES 65%
GI 4,6%
STEMI 11,8%, NSTEMI 59,4%
TIMI flow pré 0-1: 78

TIMI 2/3 POST PCI

TVR 1 AN

DÉCÈS 1 AN



Embolisation d'athérome riche en lipide et friable
Cascade: obstruction microvasculaire, spasme distal, oedème, thrombose
REDUCTION / ABSENCE DE FLUX MICROVASCULAIRE

Marqueurs du risque de MACEs J30 post PCI SVG: (étude SAFER)
-étendue dégénérescence du SVG
-volume de plaque

À 2 ans: décès et TVR: NS

OR=2,38 IC95%(1,51-3,74), p<0,001

HR=0,35 IC95%(0,14-0,85), p=0,021

HR=0,45 IC95%(0,18-1,10), p=0,082

Iqbal et al; CCI 88:73-83 (2016)

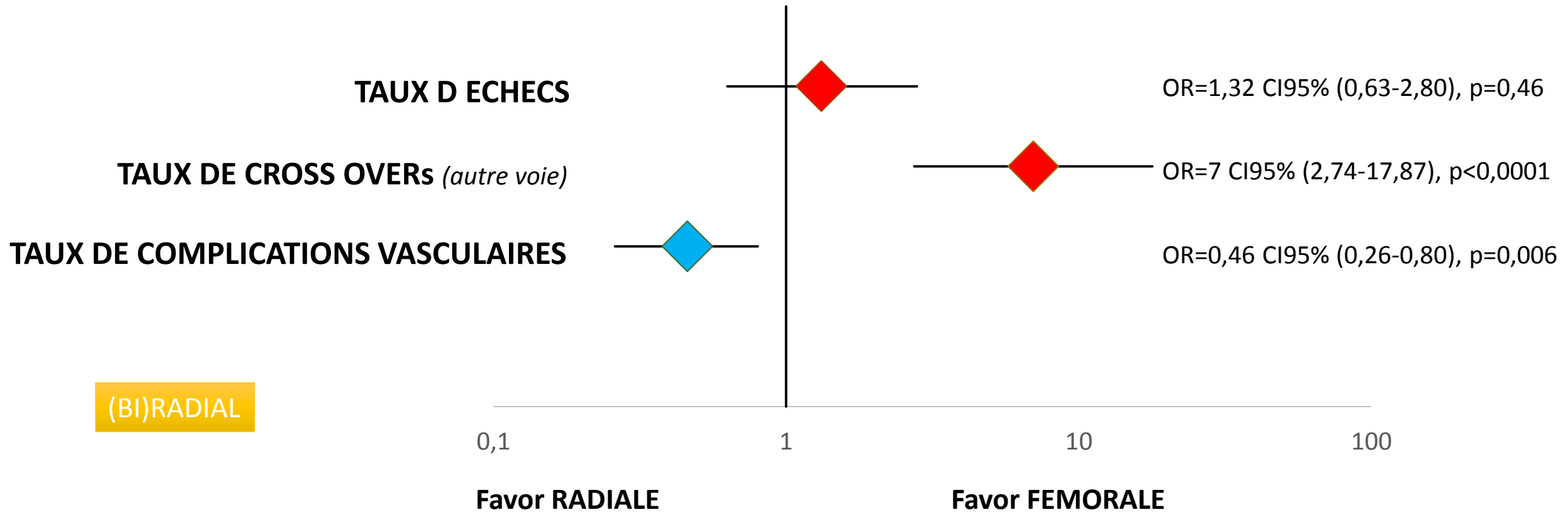
QUEL ABORD ?

Méta-analyse abord RADIAL vs FEMORAL CABG

Rigattieri et al; [Am J Cardiol.](#) 2016 Apr 15;117(8):1248-55

Temps de procédure: NS (delta 3,24 min, p=0,2)
Temps de fluoroscopie : NS (delta 0,62 min, p=0,4)
Quantité de PCI: NS (delta -2,58ml, p=0,75)

1 RCT + 8 NR studies
2 763 patients



Redo CABG vs PCI CABG ?

PCI > redo CABG : IIaC

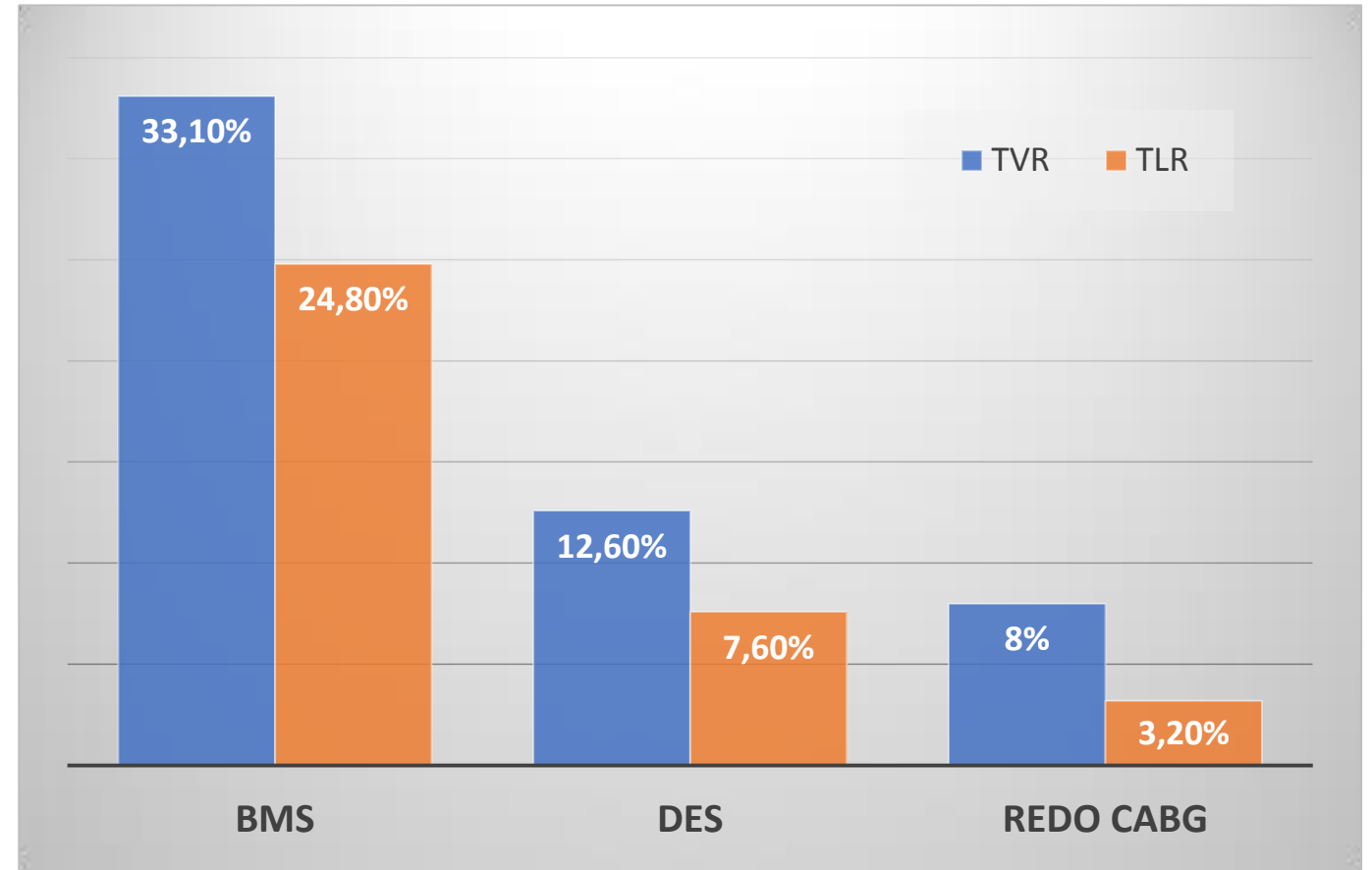
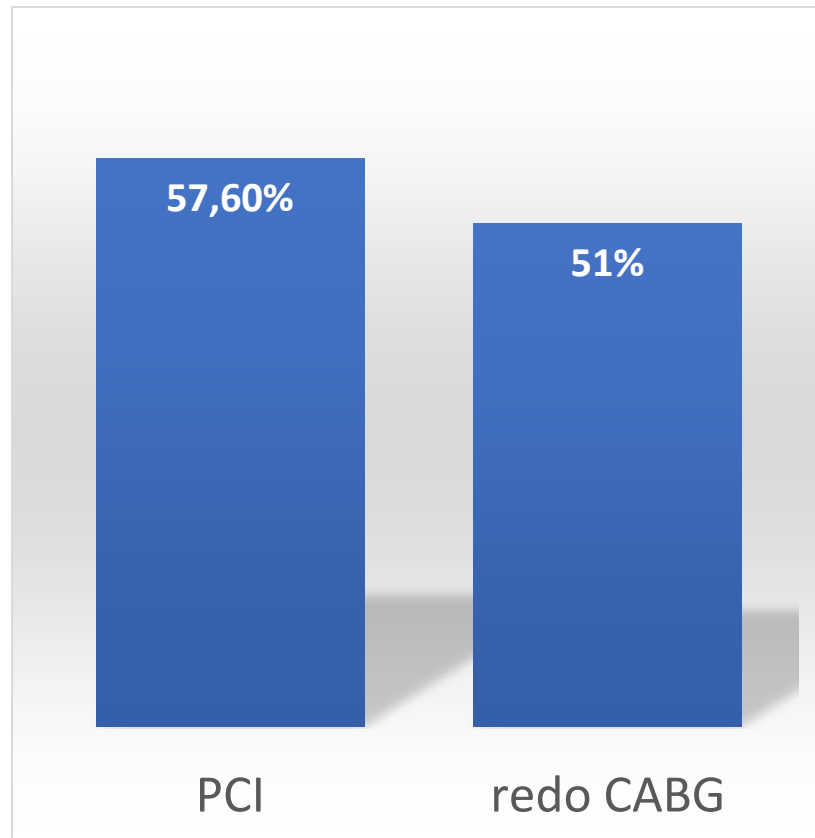
Registre rétrospectif

287 patients

243 PCI: + STEMI, MVD, SVG, ATCD IDM

BMS 81,3%, DES 18,7%, suivi 3,9 ans

Décès IDM TVR à 5 ans



[Harskamp, J Cardiovasc Med \(Hagerstown\). 2013 Jun;14\(6\):438-45](#)

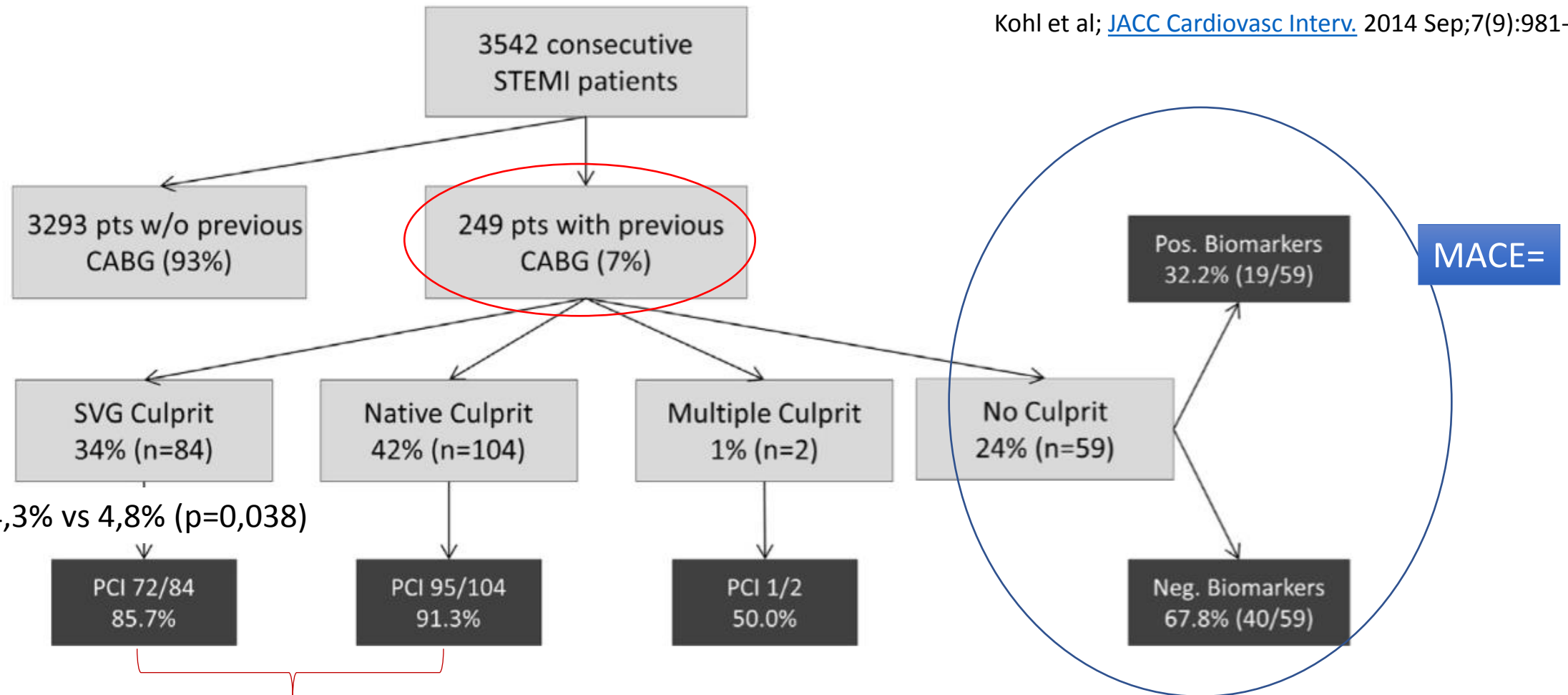
SCA ET CABG
STEMI

STEMI PATIENTS PONTÉS

Cohorte prospective, NR
MIG=0

Si pontages: STEMI = FDR indépendant plus fort taux de MACEs

Kohl et al; [JACC Cardiovasc Interv.](#) 2014 Sep;7(9):981-7.



SVG: + choc 14,3% vs 4,8% (p=0,038)

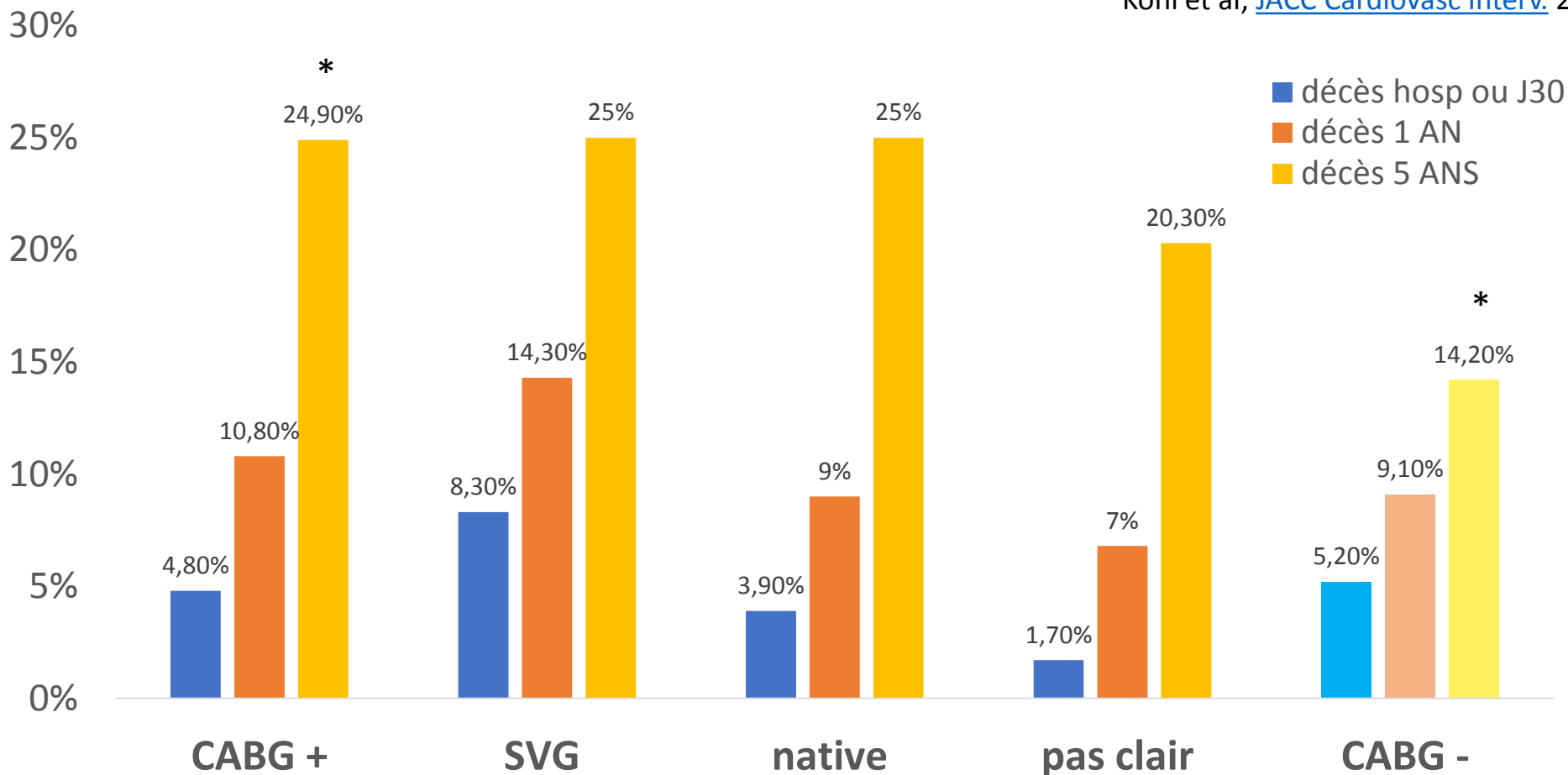
NS

STEMI PATIENTS PONTÉS

Cohorte 3 542 STEMI; **PAC: 7%**

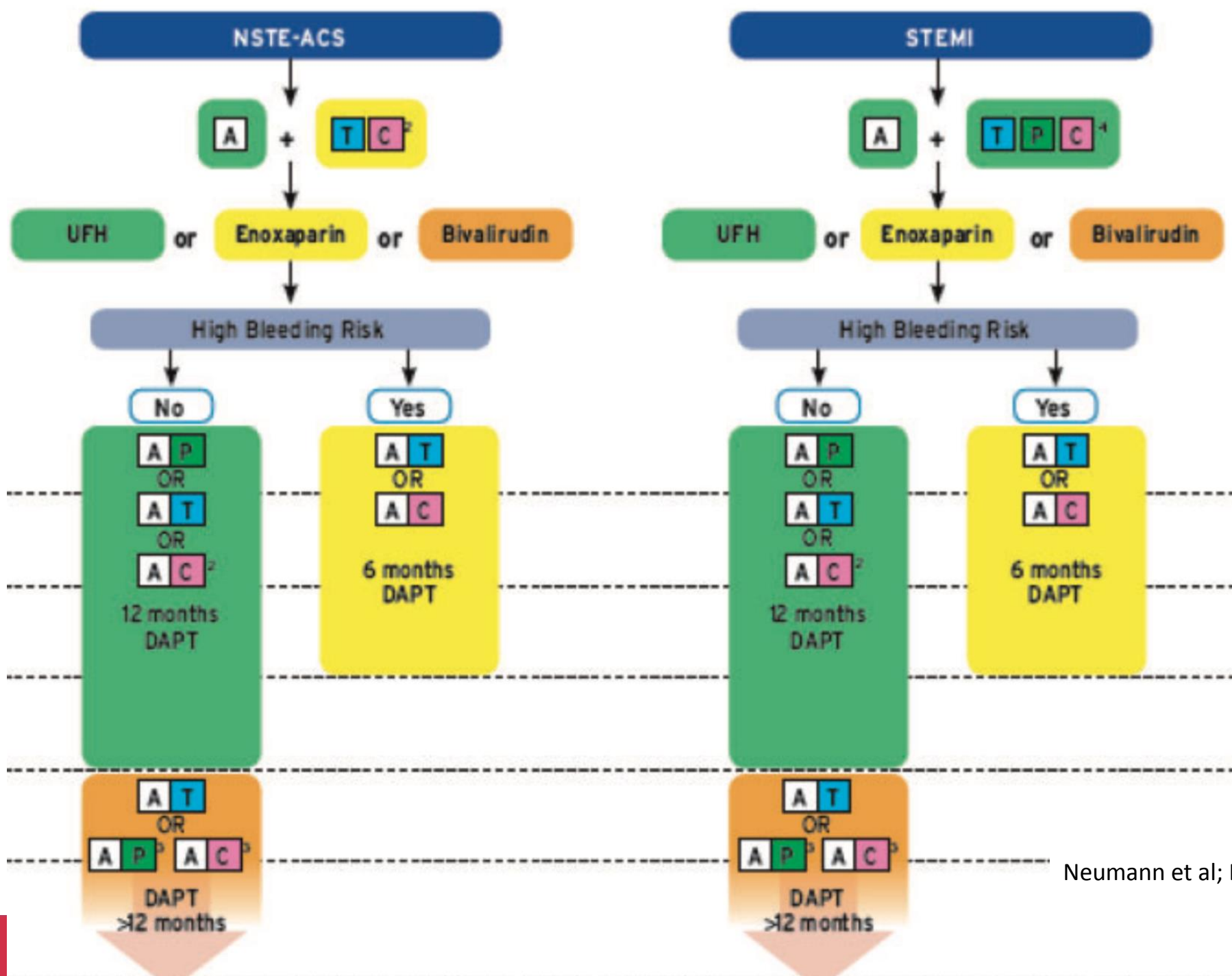
Coupable: SVG 34%; **native 42%**, pas clair 24%, MIG=0

Kohl et al; [JACC Cardiovasc Interv.](#) 2014 Sep;7(9):981-7.



Réhospit, AVC, reMI, décès, MACE J30 et 1 an: NS; CABG vs non et si CABG selon artère coupable

SCA ET CABG
MEDICAMENTS



Neumann et al; Eur Heart J. 2018 Aug 25.

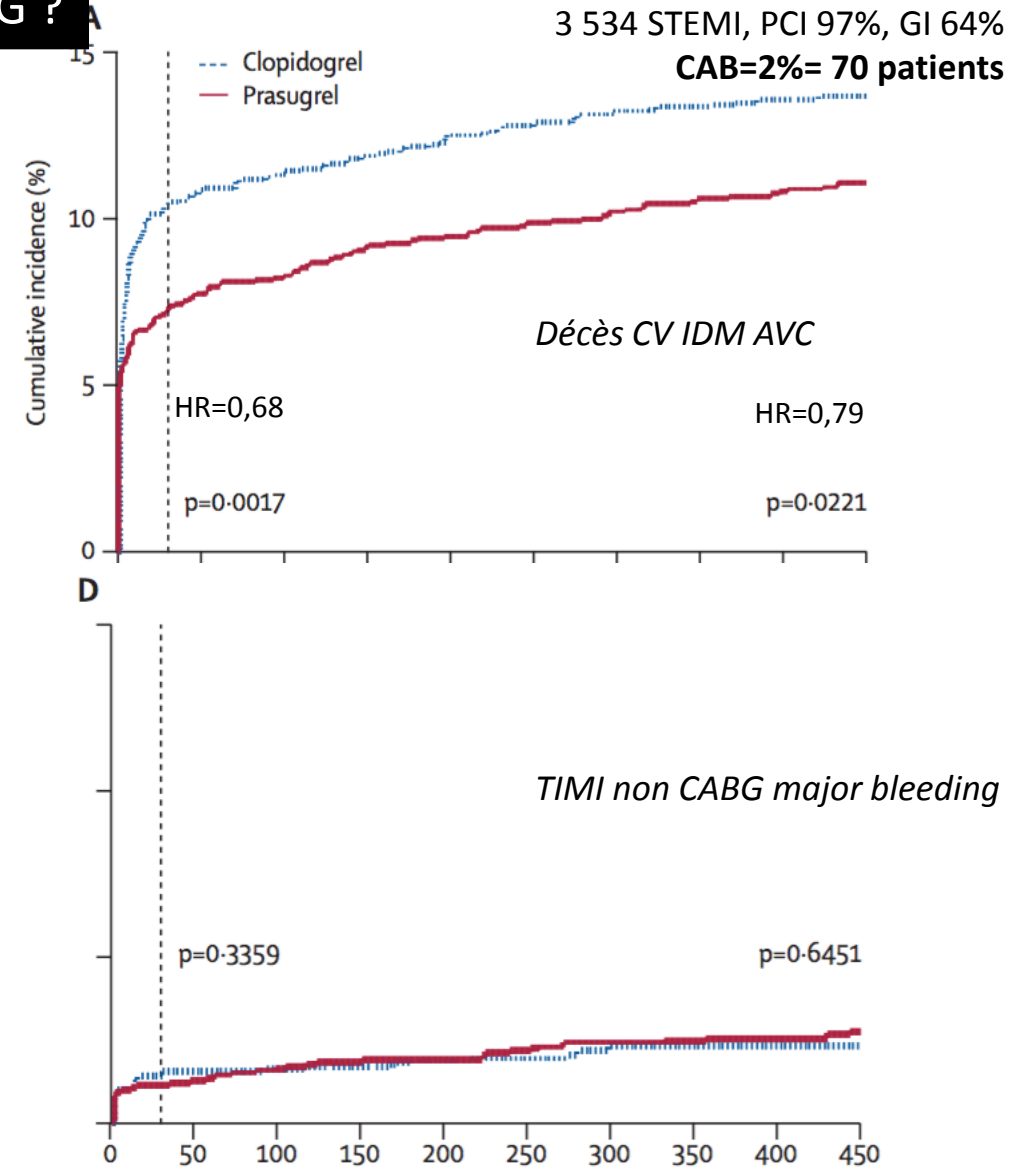
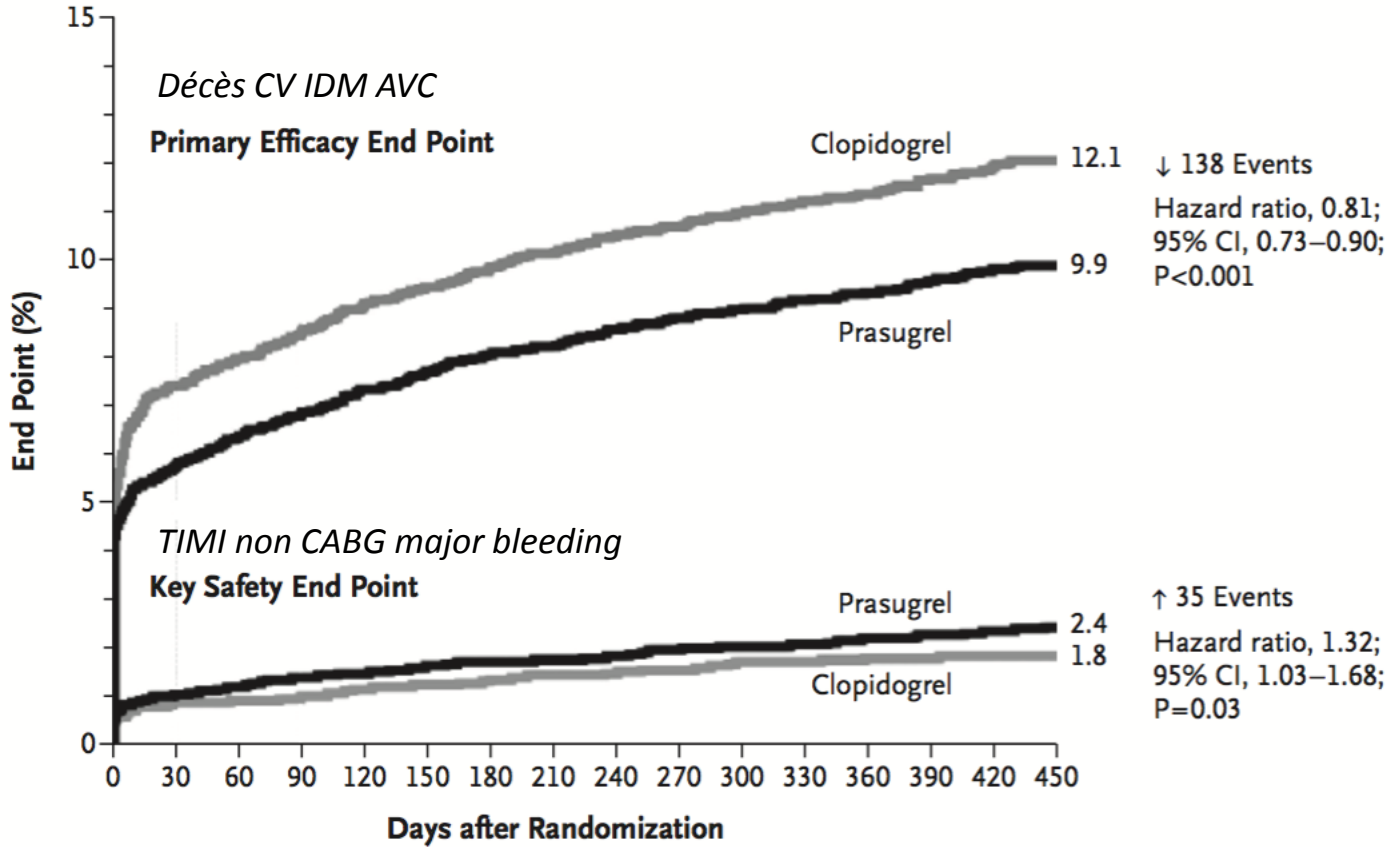
PRASUGREL

TRITON

TRITON - STEMI

13 608 SCA + PCI (99%) RCT prasugrel vs clopidogrel
CABG = 8% = 1 021

Sous groupe CABG ?



Wiviott et al; N Engl J Med 2007;357:2001-15.

TICAGRELOR

18 613 SCA RCT 1:1 ticagrelor vs clopidogrel

PLATO CABG

PCI 49,4% (vs 62%); GI= 26,7% (NS)

CABG= 6,1% = 1 133 pts

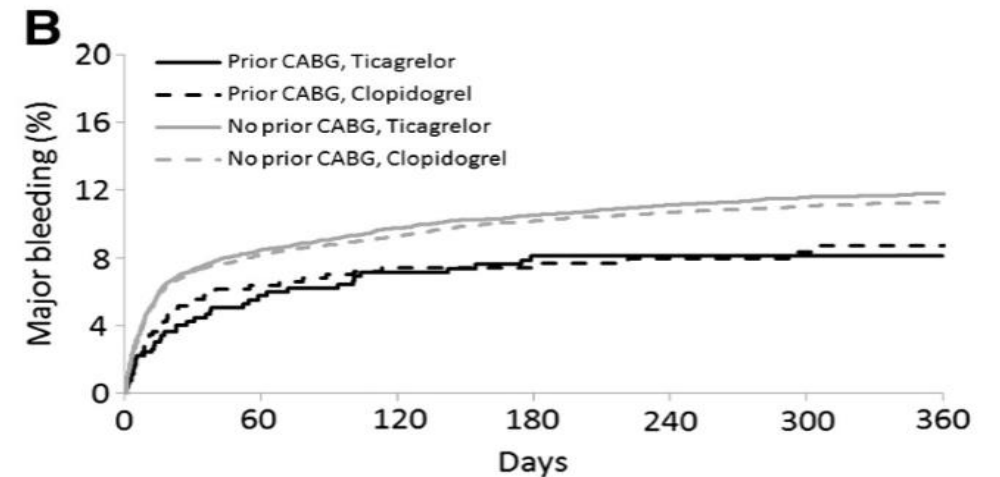
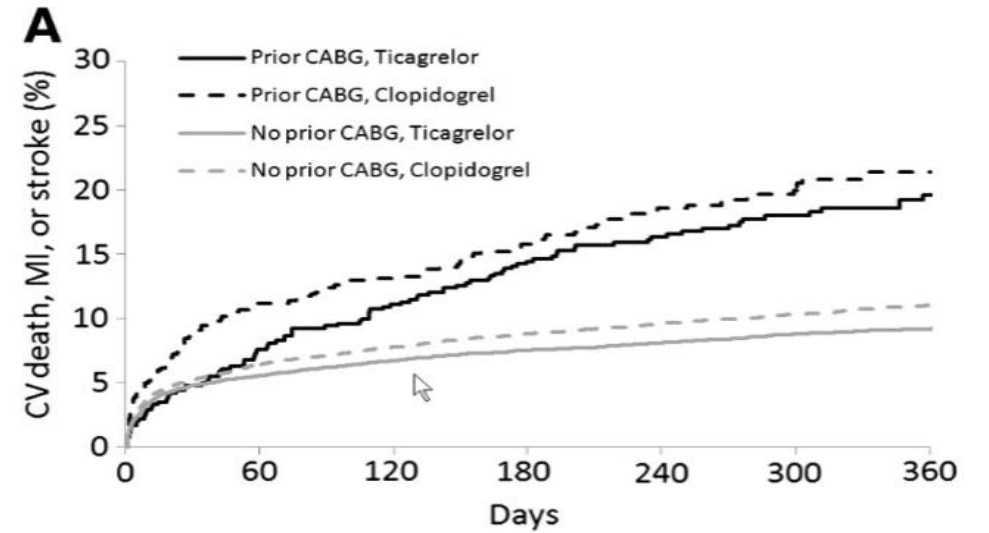
STEMI 11,5% NSTEMI 60,8%, UA 24,2%

CABG vs non CABG

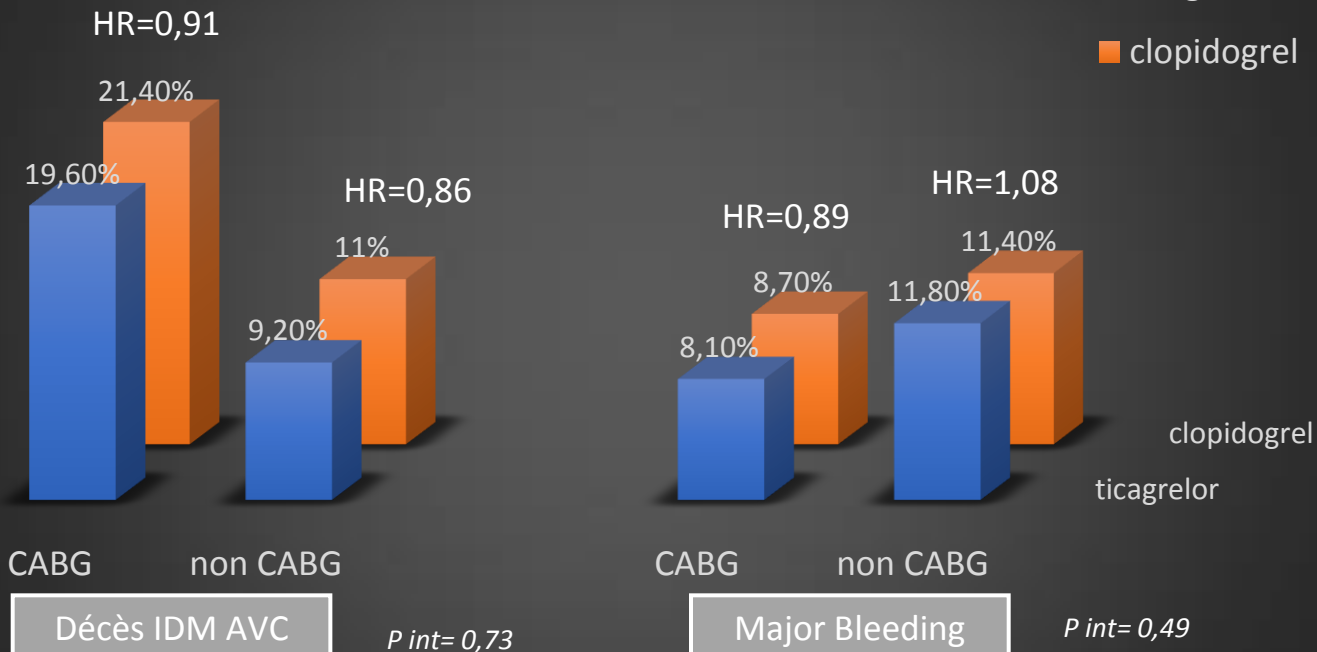
- MACEs *2 : 20,5% vs 10,1%
- décès : 8,2% vs 5%
- hémorragies <: 8,4% vs 11,6%

Effet Ticagrelor SCA + ATCD CABG

- réduction 1° EP (décès IDM AVC): idem
- Major bleeding: NS



Brilakis et al; Am Heart J 2013;166:474-80



TICAGRELOR

Résolution du ST, TIMI 3 préangio: NS
 MACEs: NS
 Major bleeding: ns

ATLANTIC

1 862 STEMI <H6
 RCT ticagrelor préhospitalier vs intra

Characteristic	Odds ratio (95% CI)	Total patients	Endpoint rate		OR (95% CI)	P-value (Int.)
			Pre-h	In-h		
Age						
<65 years		1014	85.9%	87.3%	0.887 (0.618, 1.272)	0.6207
≥65 years		584	88.6%	88.2%	1.037 (0.625, 1.724)	
<75 years		1348	86.7%	86.8%	0.994 (0.726, 1.362)	0.2940
≥75 years		250	87.6%	92.0%	0.617 (0.269, 1.418)	
Sex						
Male		1288	87.0%	87.7%	0.945 (0.680, 1.312)	0.8292
Female		310	85.9%	87.5%	0.871 (0.451, 1.684)	
Diabetes						
Yes		212	88.3%	88.1%	1.015 (0.438, 2.353)	0.8319
No		1386	86.6%	87.5%	0.922 (0.673, 1.261)	
Previous MI						
Yes		124	84.9%	84.5%	1.031 (0.383, 2.770)	0.8240
No		1474	87.0%	87.9%	0.917 (0.674, 1.248)	
Prior PCI						
Yes		107	85.0%	77.6%	1.634 (0.577, 4.630)	0.2489
No		1491	86.9%	88.5%	0.863 (0.633, 1.176)	
Prior CABG						
Yes		8	50.0%	75.0%	0.333 (0.017, 6.667)	0.4989
No		1590	87.0%	87.7%	0.941 (0.700, 1.266)	

TICAGRELOR

EN PREVENTION ??

461 patients CABG

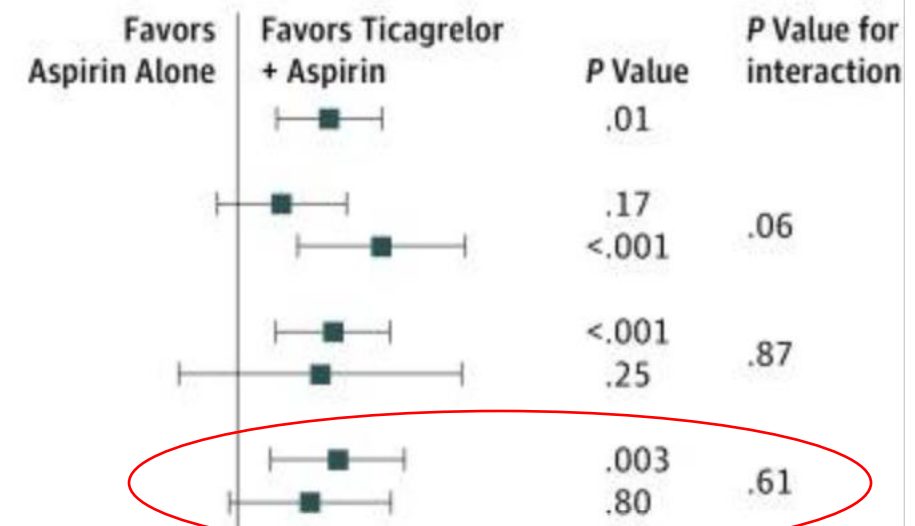
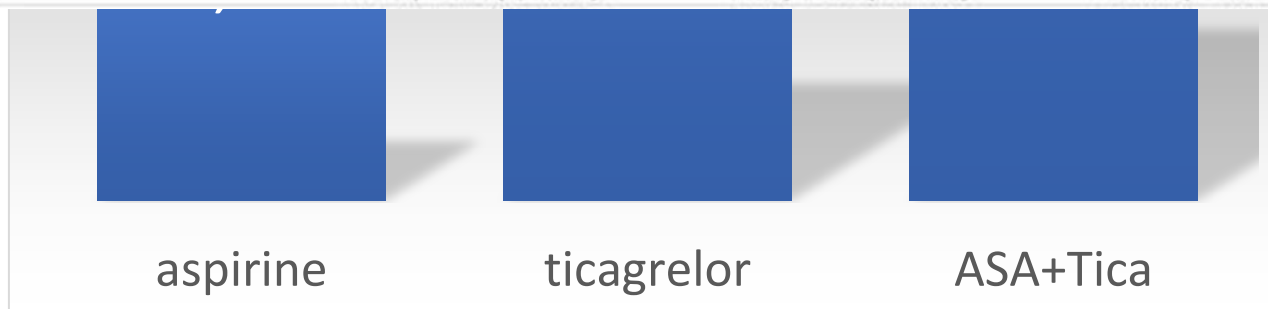
RCT ouvert 1:1:1

Aspirine (100mg) vs ticagrelor vs ASA+tica

SCAD 33% UA 64% NSTEMI 33%

Perméabilité des Pontages SVG à 1 an Coro ou coroTDM

	Aspirin Alone No. of Patent SV Grafts/Total No. of SV Grafts (%)	Ticagrelor + Aspirin No. of Patent SV Grafts/Total No. of SV Grafts (%)	Difference (95% CI), %
All SV grafts	371/485 (76.49)	432/487 (88.71)	12.21 (5.24 to 19.19)
Age, y			
≤65	212/255 (83.14)	236/265 (89.06)	5.92 (-2.61 to 14.44)
>65	159/230 (69.13)	196/222 (88.29)	19.16 (8.08 to 30.24)
Sex			
Men	315/410 (76.83)	342/382 (89.53)	12.70 (5.22 to 20.18)
Women	56/75 (74.67)	90/105 (85.71)	11.05 (-7.62 to 29.72)
Baseline ACS			
Yes	251/336 (74.70)	294/334 (88.02)	13.32 (4.47 to 22.17)
No	120/149 (80.54)	138/153 (90.20)	9.66 (-1.07 to 20.39)



Major bleeding: 3 tica+asa, 2 ticagrelor

Zhao et al; [JAMA](#). 2018 Apr 24;319(16):1677-1686

CANGRELOR

CHAMPION-PHOENIX

n=10 942 mITT
Stable angina/NSTE-ACS/STEMI
P2Y₁₂ naïve
Placebo or clopidogrel at the start or end of PCI

CHAMPION-PCI

n=8667 mITT
Stable angina/NSTE-ACS/STEMI
Placebo or clopidogrel at the start of PCI

CHAMPION-PLATFORM

n=5301 mITT
Stable angina/NSTE-ACS
P2Y₁₂ naïve
Placebo or clopidogrel at the end of PCI

Subgroups	Total number of patients	Subgroups		OR (95% CI)	p (Int)
		Cangrelor	Clopidogrel		
Age ≥75 years	4222	89/2124 (4.2)	125/2098 (6.0)	0.69 (0.52-0.91)	0.219
Age <75 years	20659	384/10335 (3.7)	454/10324 (4.4)	0.84 (0.73-0.96)	
Men	17976	342/9024 (3.8)	395/8952 (4.4)	0.85 (0.74-0.99)	0.18
Women	6905	131/3435 (3.8)	184/3470 (5.3)	0.71 (0.56-0.89)	
Ethnicity: white	21357	422/10725 (3.9)	516/10632 (4.9)	0.80 (0.70-0.92)	0.683
Ethnicity: non-white	3490	51/1718 (3.0)	60/1772 (3.4)	0.87 (0.60-1.28)	
USA	10820	223/5415 (4.1)	269/5405 (5.0)	0.82 (0.68-0.98)	0.816
Rest of the world	14061	250/7044 (3.5)	310/7017 (4.4)	0.80 (0.67-0.94)	
Stable angina	7715	225/3915 (5.7)	278/3800 (7.3)	0.77 (0.64-0.93)	0.866
NSTE-ACS	14282	207/7137 (2.9)	250/7145 (3.5)	0.82 (0.68-0.99)	
STEMI	2884	41/1407 (2.9)	51/1477 (3.5)	0.84 (0.55-1.27)	
Weight ≥60 kg	23325	436/11649 (3.7)	538/11676 (4.6)	0.80 (0.71-0.92)	0.927
Weight <60 kg	1556	37/810 (4.6)	41/746 (5.5)	0.82 (0.52-1.30)	
Biomarker: positive	12279	111/6077 (1.8)	142/6202 (2.3)	0.79 (0.62-1.02)	0.962
Biomarker: negative	12230	348/6192 (5.6)	424/6038 (7.0)	0.79 (0.68-0.91)	
Diabetic: yes	7362	147/3655 (4.0)	171/3707 (4.6)	0.87 (0.69-1.09)	0.446
Diabetic: no	17494	325/8793 (3.7)	408/8701 (4.7)	0.78 (0.67-0.91)	
Insulin-dependent diabetes: yes	2019	35/1043 (3.4)	51/976 (5.2)	0.63 (0.41-0.98)	0.247
Insulin-dependent diabetes: no	22862	438/11416 (3.8)	528/11446 (4.6)	0.83 (0.72-0.94)	
Previous myocardial infarction	5696	116/2788 (4.2)	142/2788 (5.1)	0.72 (0.57-0.92)	0.250
No previous myocardial infarction	18966	353/9558 (3.7)	416/9558 (4.3)	0.85 (0.74-0.99)	
Previous TIA/stroke	1270	28/650 (4.3)	31/650 (4.8)	0.80 (0.48-1.34)	0.972
No previous TIA/stroke	23518	444/11763 (3.8)	521/11763 (4.4)	0.81 (0.71-0.92)	
History of PAD	1719	42/889 (4.7)	66/830 (8.0)	0.57 (0.39-0.86)	0.082
No history of PAD	22775	423/11369 (3.7)	506/11406 (4.4)	0.83 (0.73-0.95)	
History of CHF	2179	43/1079 (4.0)	63/1100 (5.7)	0.68 (0.46-1.02)	0.375
No history of CHF	22580	428/11316 (3.8)	512/11264 (4.5)	0.83 (0.72-0.94)	
Clopidogrel 300 mg	2806	81/1405 (5.8)	95/1401 (6.8)	0.84 (0.62-1.14)	0.772
Clopidogrel 600 mg	22075	392/11054 (3.5)	484/11021 (4.4)	0.80 (0.70-0.92)	
Bivalirudin only	5375	120/2661 (4.5)	146/2714 (5.4)	0.83 (0.65-1.06)	0.622
Heparin only	16417	300/8225 (3.6)	383/8192 (4.7)	0.77 (0.66-0.90)	
Vessels 1	21134	366/10567 (3.5)	435/10567 (4.1)	0.84 (0.73-0.96)	0.214
Vessels ≥2	3632	101/1833 (5.5)	140/1799 (7.8)	0.69 (0.53-0.90)	
Drug-eluting stent	13236	279/6657 (4.2)	323/6579 (4.9)	0.85 (0.72-1.00)	0.231
Bare-metal stent	10239	162/5083 (3.2)	225/5156 (4.4)	0.72 (0.59-0.89)	
Aspirin ≤100 mg	7818	145/3920 (3.7)	172/3898 (4.4)	0.83 (0.66-1.04)	0.689
Aspirin >100 mg	15129	290/7595 (3.8)	362/7534 (4.8)	0.79 (0.67-0.92)	
Clopidogrel load before PCI start	13766	281/6904 (4.1)	335/6862 (4.9)	0.83 (0.70-0.97)	0.735
Clopidogrel load after PCI start	10960	180/5476 (3.3)	226/5484 (4.1)	0.79 (0.65-0.97)	
Cangrelor infusion ≤129 min	14743	285/7426 (3.8)	339/7317 (4.6)	0.82 (0.70-0.96)	0.753
Cangrelor infusion >129 min	10074	187/5002 (3.7)	238/5072 (4.7)	0.79 (0.65-0.96)	
Previous thienopyridine use	2965	51/1487 (3.4)	63/1478 (4.3)	0.80 (0.55-1.16)	0.948
No previous thienopyridine use	21916	422/10972 (3.8)	516/10944 (4.7)	0.81 (0.71-0.92)	
Periprocedural GP IIb/IIIa use	3159	75/1534 (4.9)	105/1625 (6.5)	0.74 (0.55-1.01)	0.552
No periprocedural GP IIb/IIIa use	21714	398/10921 (3.6)	474/10793 (4.4)	0.82 (0.72-0.94)	
Overall	24 881	473/12459 (3.8)	579/12422 (4.7)	0.81 (0.71-0.91)	

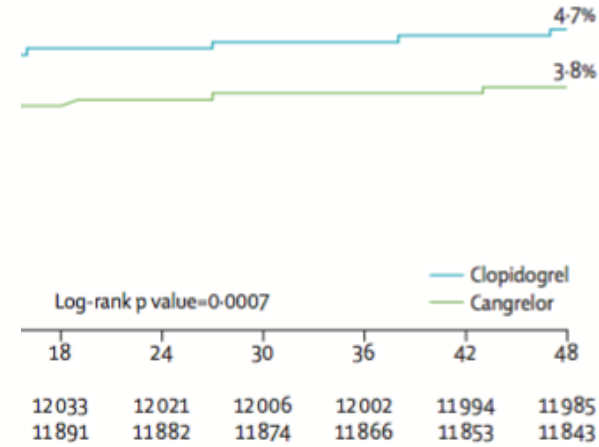
CABG ?

Steg et al; Lancet 2013; 382: 1981-92

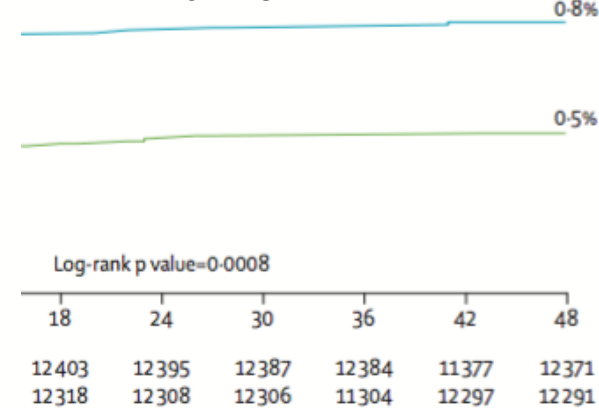
ures (GUSTO) et transfusions: NS
s 13%, p<0,0001

Idem J30

Décès, IDM, IDR, ST JH48

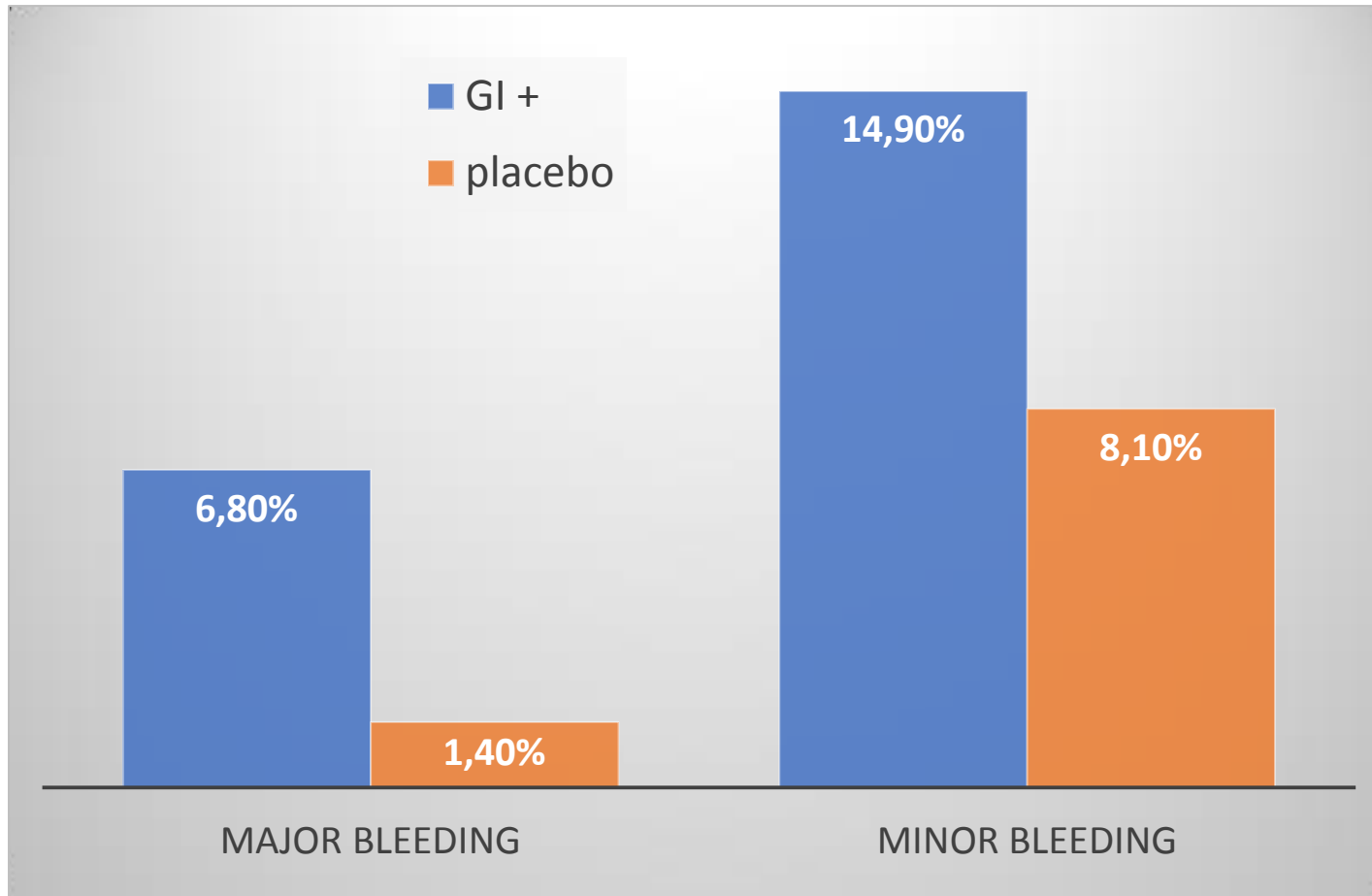


ST H48



ANTIGPIIBIIIA

13 158 patients, **627 pontages**, 389 GI+, 216 placebo
SVG 93%



Toutes différences <0,05

Meta-analyse 5 RCT:

-EPIC (SCA+) EPILOG EPISTENT: abciximab

-IMPACT II (SCA+) PURSUIT (que SCA): eptifibatide

	GP IIb/IIIa (n=389)	Placebo (n=216)	P
30-Day events, %			
Death	2.6	1.4	0.34
MI	14.7	9.7	0.08
Urgent revascularization	2.9	2.4	0.69
Death/MI	15.7	10.7	0.08
Death/MI/ urgent revascularization	16.5	12.6	0.18
6-Month events, %			
Death	5.9	2.9	0.08
MI	19.6	15.0	0.14
Revascularization	26.0	21.9	0.23
Death/MI	22.3	16.3	0.07
Death/MI/revascularization	39.4	32.7	0.07

Pas d'interaction avec stenting

Roffi et al; *Circulation*. 2002;106:3063-3067

GPIIBIIIA + SYSTÈME DE PROTECTION ?

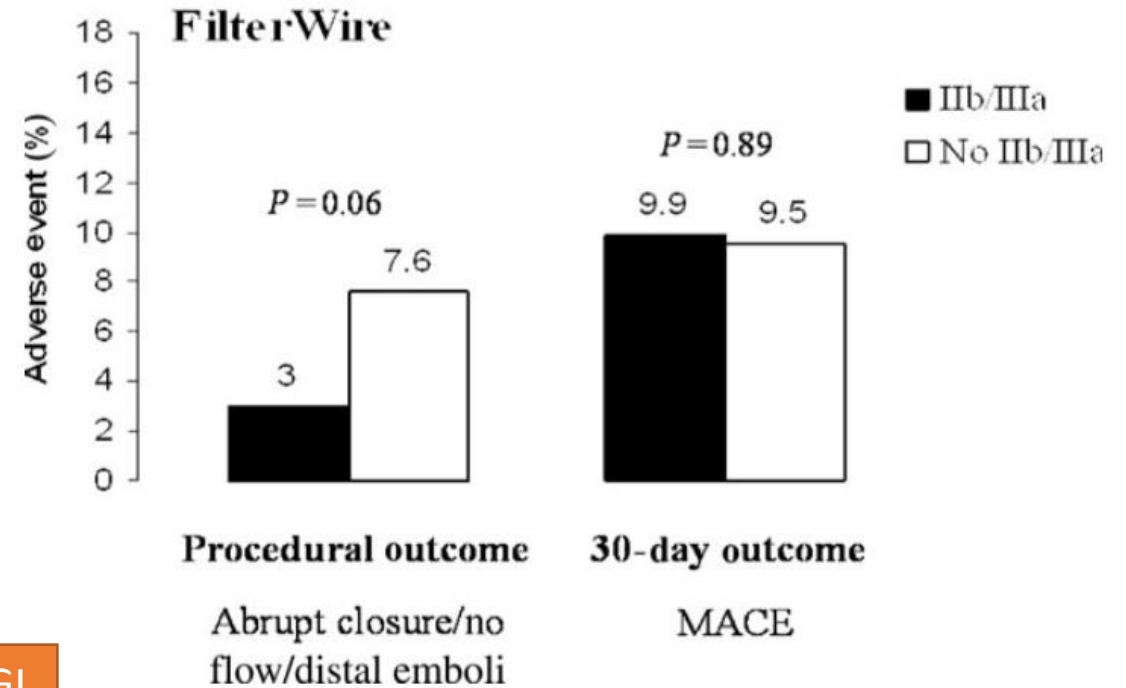
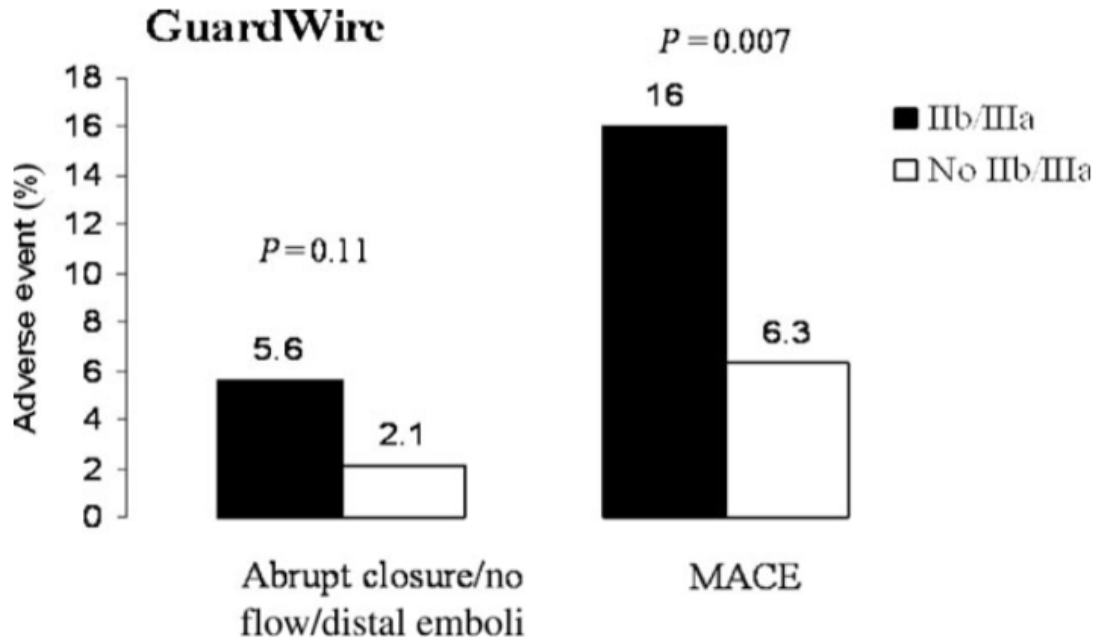
Hypothèse: éviter l'occlusion du filtre (ischémie + complications)

Pré-selection des patients pour GI: plus haut risque de complications ischémiques

-+ d'angine et d'IDM récent (94%)

- - TIMI 3 basal, lésions plus complexes

Randomisation FilterWire X vs Guardwire (ballon d'occlusion/aspiration)



Interaction significative + faible taux de MACE – Filtre + GI

Transfusion J30: GI 7,5% vs 3,7%, p=0,02

Jonas et al; European Heart Journal (2006) 27, 920–928

CONCLUSION

SCA chez les patients pontés

UN PATIENT COMME UN AUTRE ?

NON

+ vieux, + hommes, + comorbidités
+ état de choc si SVG
MACEs et décès * 2-3
Biradiale
+ de faux positifs si STEMI
- d'artère coupable identifiée: 25% !



UN VAISSEAU / TRAITEMENT COMME UN AUTRE ?

OUI

On évite de traiter les SVG...
PCI artère native
DES
biAAP
Statines
Prévention secondaire: durée ?