When we plan to open a strut toward a large SB (> 2.5 mm) we should perform a POT Side rePOT

AMINIAN ADEL,MD
CHU Charleroi

On behalf of Gérard FINET and Francois DERIMAY

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INSERM Research Unit 1060 CarMeN
Claude Bernard University Lyon 1
Lyon - France

What do we want to achieve during provisional stenting?

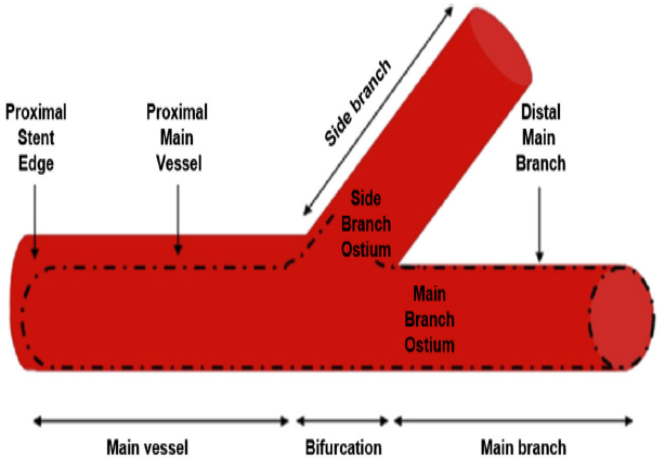
Goals

- Optimal proximal and distal stent apposition
- Minimize ostial SB obstruction
- No residual significant SB stenosis

Methods

1) Stent size based on distal MB diameter
2) Initial POT (balloon diameter based on fractal law)
3) Opening of stent strut towards the SB (which technique?)
4) Correct MV stent deformation due to SB balloon dilation (which technique and sequence?)

Finet's Law: Diam MoV= 0.678x (Diam SB+ Diam MB)

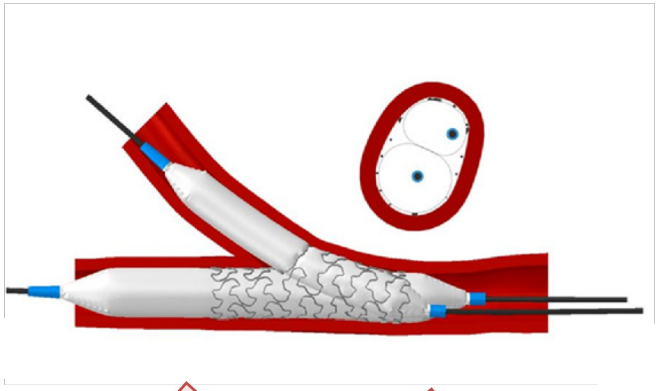


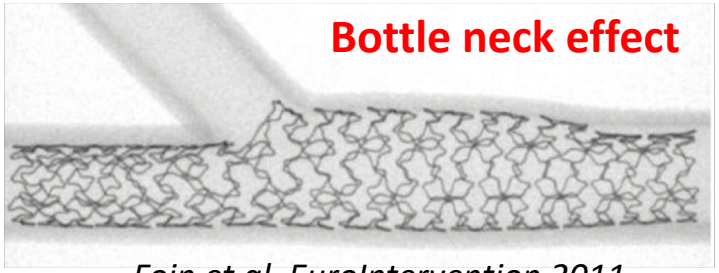
Consensus

KBI? Asym KBI? KBI+final POT? SBI+POT (rePOT)? No clear Consensus!

Finet G. et al. EuroIntervention 2007;3:1-9.

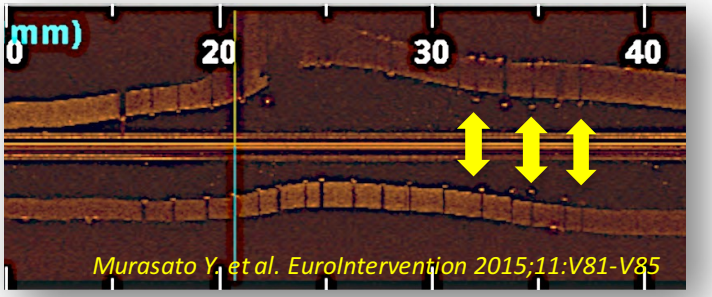
Detrimental mechanical effect after KBI demonstrated in vitro!



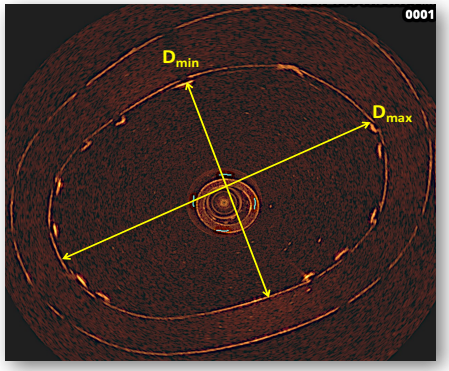


Foin et al. EuroIntervention 2011.

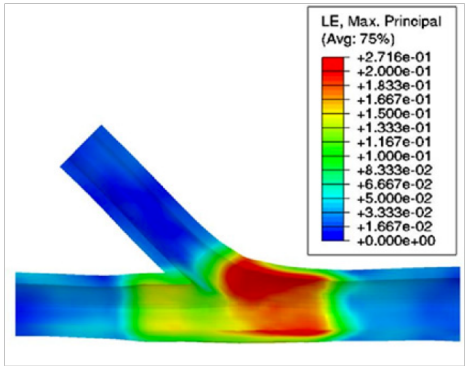
Proximal elliptic deformation
High stress concentration
(arterial + plaque overstretch)



MV Proximal edge malapposition



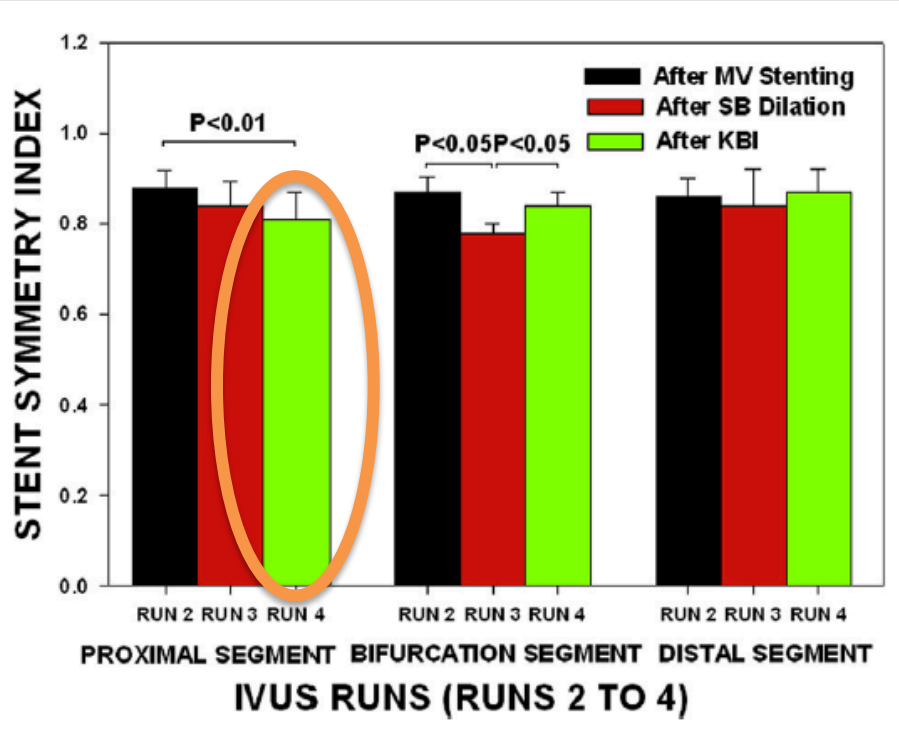
Mortier P et al. JACC CI 2014

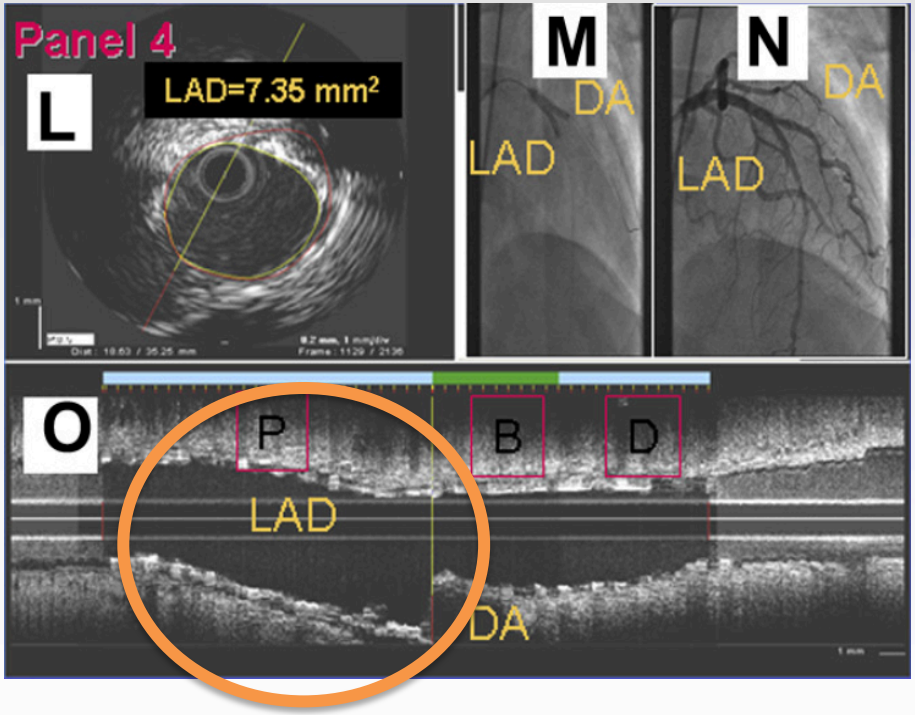


Foin et al. JACC CI 2012

Kissing balloon inflation: in vivo analysis!

N=22 patients, serial IVUS volumetric analysis

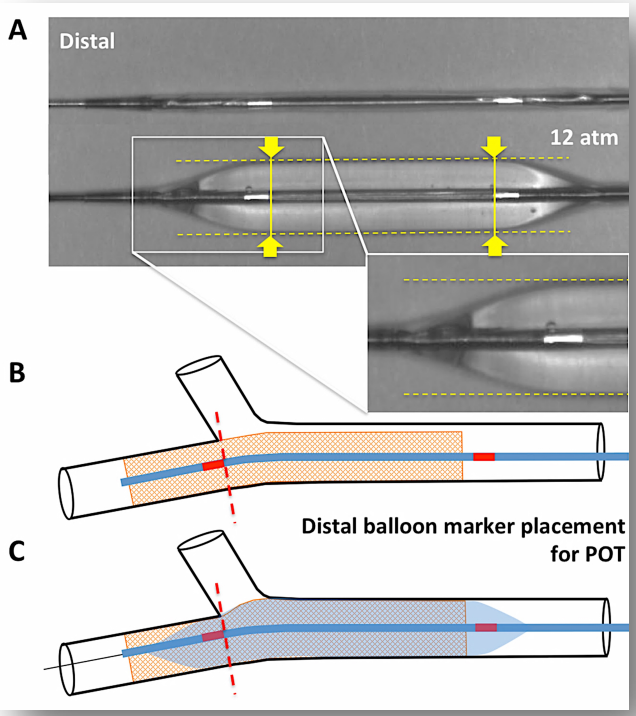




*« KBI restores the MV stent volume, area, and symmetry loss after SB dilation in the bifurcation segment, and **induces asymmetric stent expansion** in the proximal segment »*

Rahman S et al, JACC CI 2013

rePOT sequence
5 simple steps!



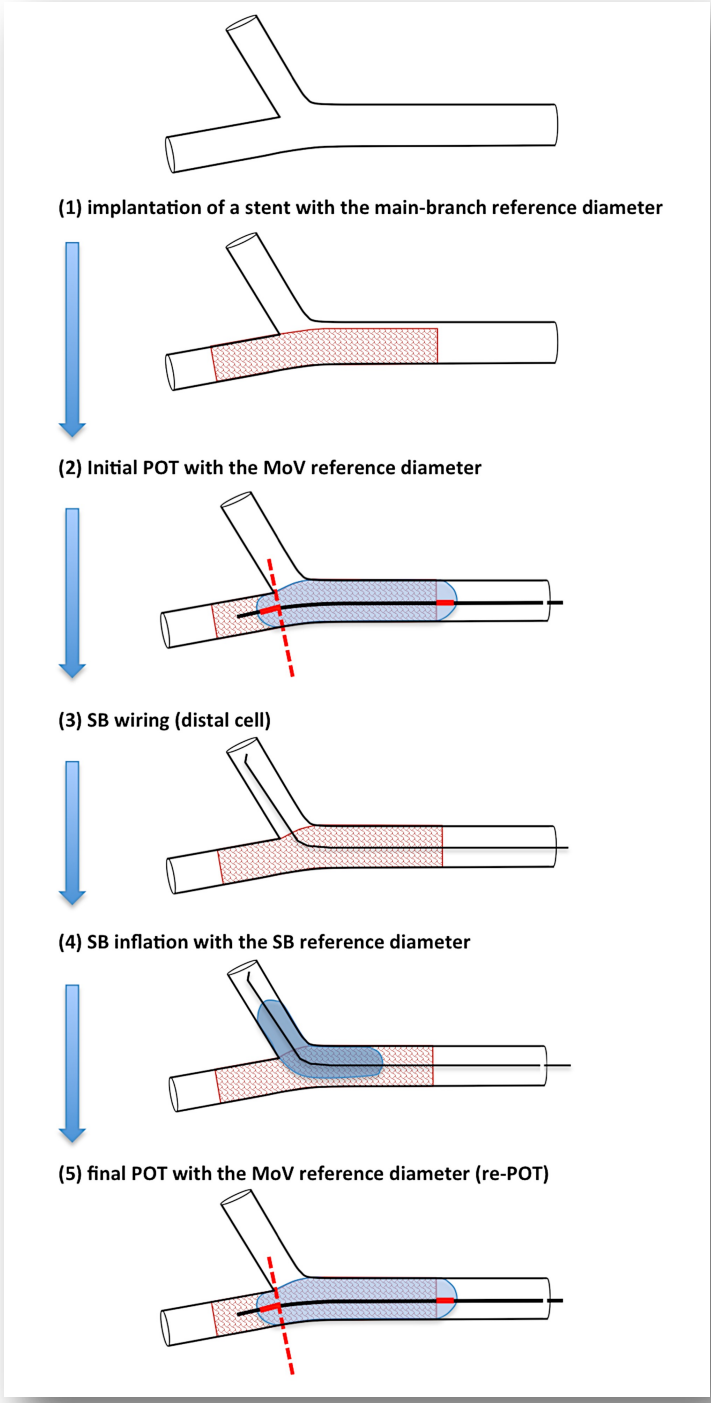
Balloon positioning
for the POT

rePOT

initial POT

SBI

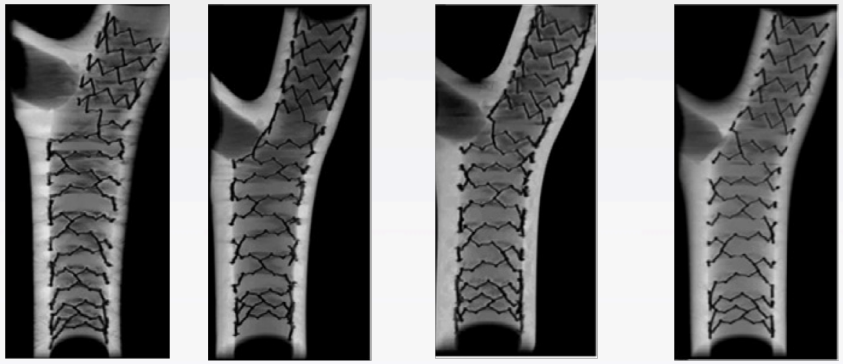
final POT

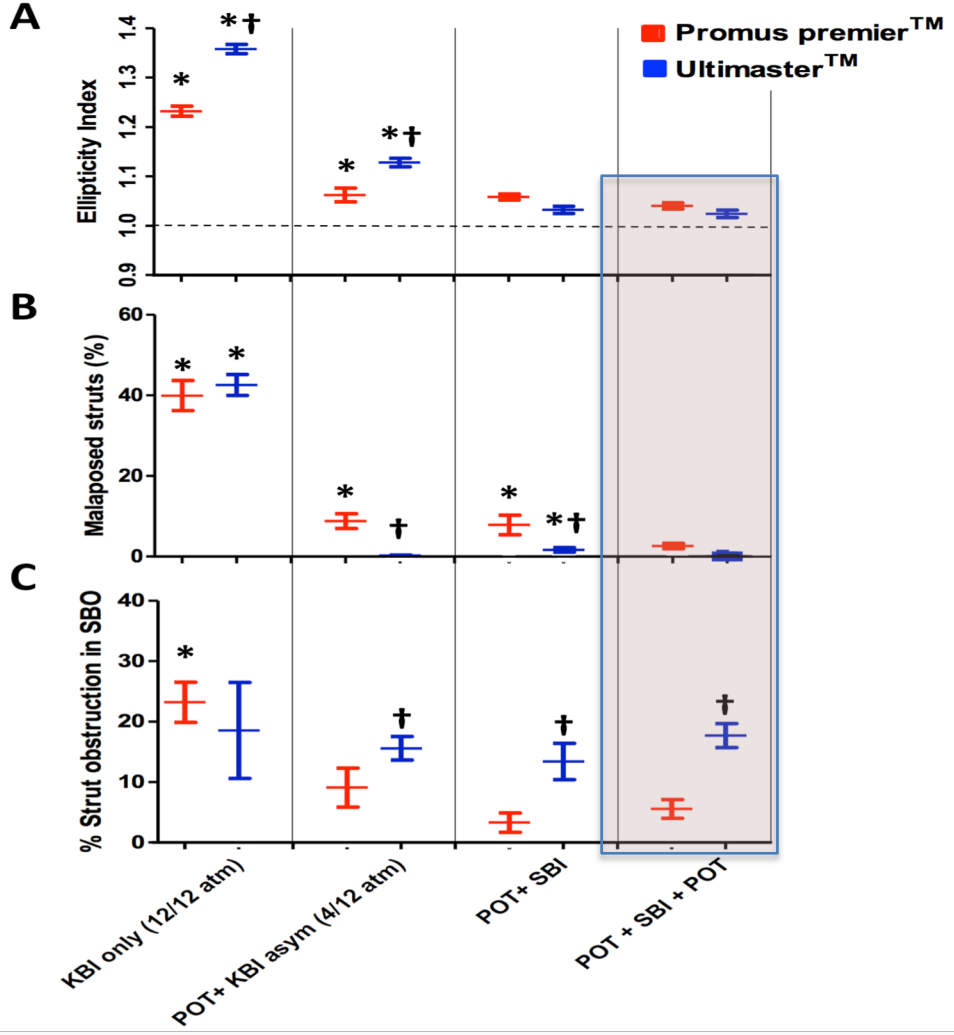


RePOT (POT-SBI-POT): in vitro validation

Head to head comparison of provisional techniques
Assessment of:
1) ellipticity index,
2) global malapposed strut ratio (%),
3) strut obstruction ratio in SBO (%)

KBI | POT+ Asym KBI | POT+ SBI | rePOT





G Finet, F Derimay, et al. J Am Coll Cardiol Intv 2015;8:1308–17.

Immediate in vivo assessment of the rePOT sequence by *serial OCT analysis*

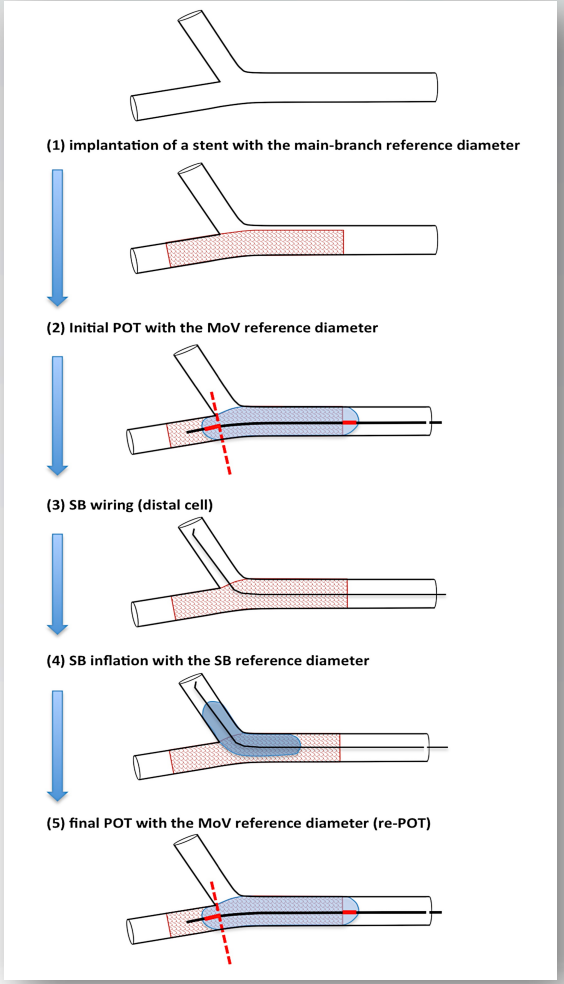
The REPOT clinical study

106 patients with Bifurcation lesions (including LM) with intended provisional strategy
with
MB≥2.5 mm
SB≥2.0 mm
Stable patients or NSTEMI

OCT run 1 →

OCT run 2 →

OCT run 3 →



Derimay F et al. Eurointervention 2018

Immediate in vivo assessment of the rePOT sequence by *serial OCT analysis*

The REPOT clinical study

Baseline patient characteristics

	n =106
Age (years)	65.2±11
Male gender	80 (75.5%)
Diabetes mellitus	30 (28.3%)
Hypertension	57 (53.8%)
Dyslipidaemia	50 (47.2%)
Current smoker	30 (28.3%)
ACS	45 (42.4%)
LVEF (%)	56±9%
Radial approach	**83 (78.3%)**
6F	**101 (95.3%)**
Contrast medium w/o OCT	**152±69 ml**
Fluoroscopy time	14.9±6.6 min

	n =106
LM	**43 (40.6%)**
LAD/DIAG	50 (47.2%)
Others	13 (12.2%)
%DS	80.6 ± 11.9%
"True bifurcation lesion"	**42 (39.6%)**
Medina 111	31 (29.2%)
Bif angle < 70°	51 (48.1)

Derimay F et al. Eurointervention 2018

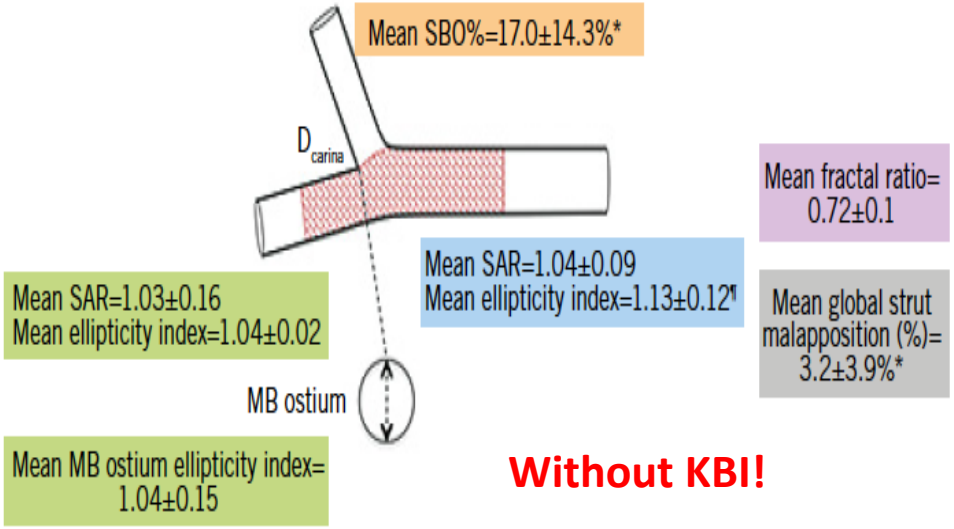
Immediate in vivo assessment of the rePOT sequence by *serial OCT analysis*

The REPOT clinical study

Procedural results

	N= 106
Complete rePOT successfull	106 (100%)
MV stented	106 (100%)
SB Slow flow (TIMI 2)	2 (3.2%)
SB dissection	1 (1.6%)
SB stented (TAP technique)	1 (1.6%)
Residual SB stenosis	22.4± 13.0%

OCT analysis after full rePOT sequence



Without KBI!

Clinical FU at 6 months: 1 TLR (Mo vessel), no stent thrombosis, no CV death

In vivo replication of the excellent results obtained on bench test!!

Derimay F et al. Eurointervention 2018

Clinical rePOT study
Results in LM bifurcation!

	n=63 (59.4%)	n=43 (40.6%)
	Others bifurcations	**LM bifurcations**
Baseline		
mean D_{MoV}	3.44 ± 0.46 mm	**4.25 ± 0.57 mm ***
mean D_{MB}	2.69 ± 0.05 mm	3.17 ± 0.46 mm *
mean D_{SB}	1.97 ± 0.44 mm	**2.69 ± 0.60 mm ***
After stent implantation		
mean D MoV	3.39 ± 0.51 mm	4.31 ± 0.43 mm *
mean stent D	2.89 ± 0.39 mm	3.44 ± 0.51 mm *
ΔD (proximal stent underexpansion)	0.50 ± 0.36 mm	**0.87 ± 0.41 mm ***
SBO obstruction %	45.1 ± 10.2%	46.7 ± 13.5% *
Global strut malpposition (%)	15.1 ± 11.5 %	**25.0 ± 13.9 % ***
After rePOT sequence		
mean D_{MoV} / Elipticity ratio $_{MoV}$	3.54 ± 0.53 mm / 1.12 ± 0.08	**4.42 ± 0.46 mm * / 1.13 ± 0.16**
mean D_{MB} / Ellipticipty ratio $_{MB}$	2.86 ± 0.41 mm / 1.11 ± 0.08	**3.37 ± 0.5 mm * / 1.11 ± 0.08**
SBO obtruction %	15.8 ± 16.8 %	**14.9 ± 10.7 % ***
Global strut malapposition (%)	3.02 ± 3.4 %	**3.09 ± 3.9 % ***

** $p<0.05$*

Derimay F et al. Eurointervention 2018

Coronary Artery Bifurcation Revascularisation without kIssing ballOon infLation by rEpot Technique.

The CABRIOLET study.

CABRIOLET recruiting centers

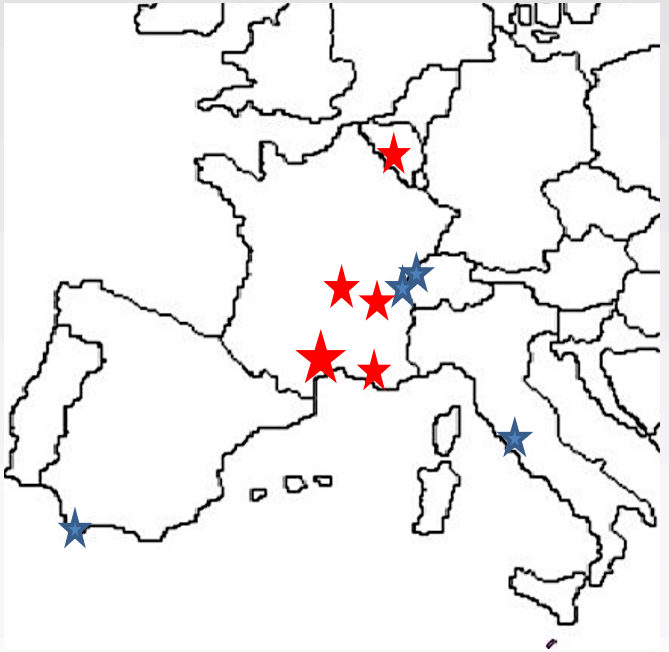
France:
- Hôpital cardiologique Louis Pradel, Lyon (Pr Finet)
- Hôpital Gabriel Montpied, Clermont Ferrand (Pr Souteyrand)
- Clinique Axium, Aix en Provence (Dr Maillard)
- CHU Caremeau, Nîmes (Dr Lattuca)

Switzerland:
- CHU Vaudois, Lausanne (Dr Adjedj)
- Hôpitaux Universitaires, Genève (Dr Iglesias)

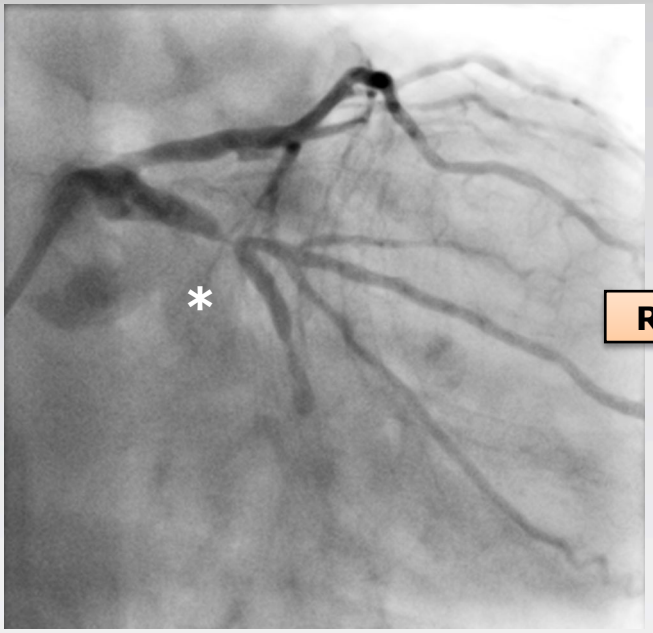
Belgium:
- CHU Marie Curie, Charleroi (Dr Aminian)

Spain:
- Punta de Europa University Hospital, Algecirias (Pr Gutierrez-Chico)

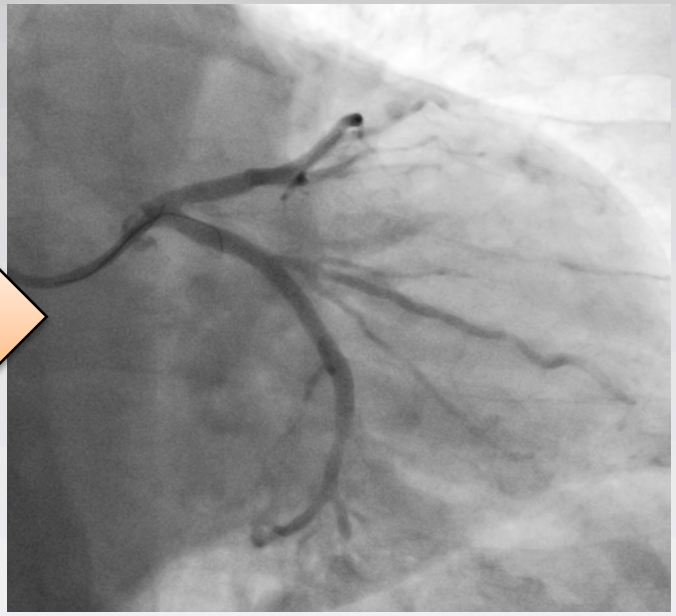
Italy:
- Ospedale S. Eugenio, Rome (Dr Sgueglia)

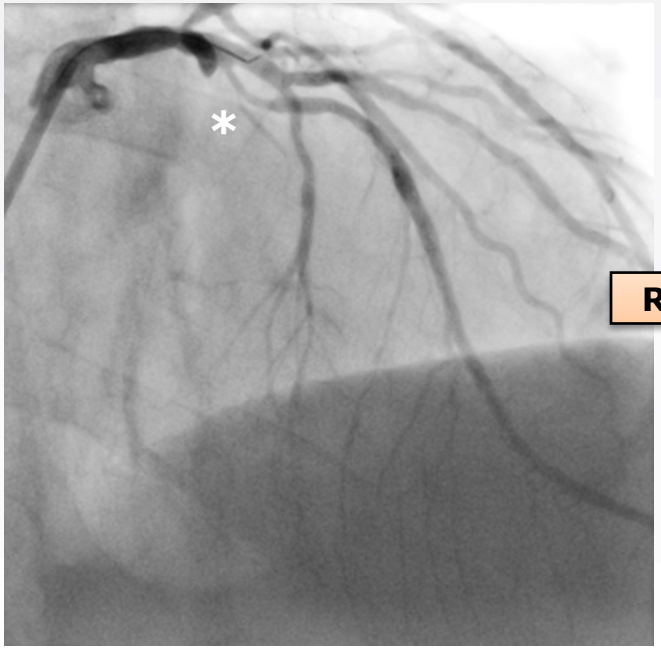


Multicenter Prospective Registry (goal= minimum of 500 patients, more?)
Patients with bifurcation lesions and intended PS treated by rePOT technique
Few exclusion criteria (ACS < 12h, HD instability, intracoronary thrombus,…)
Procedural outcome and clinical FU (MACE) at 1 year (min) and up to 5 years
October 2018: inclusion of 326 patients (LM 31.8%, true bif 35%)

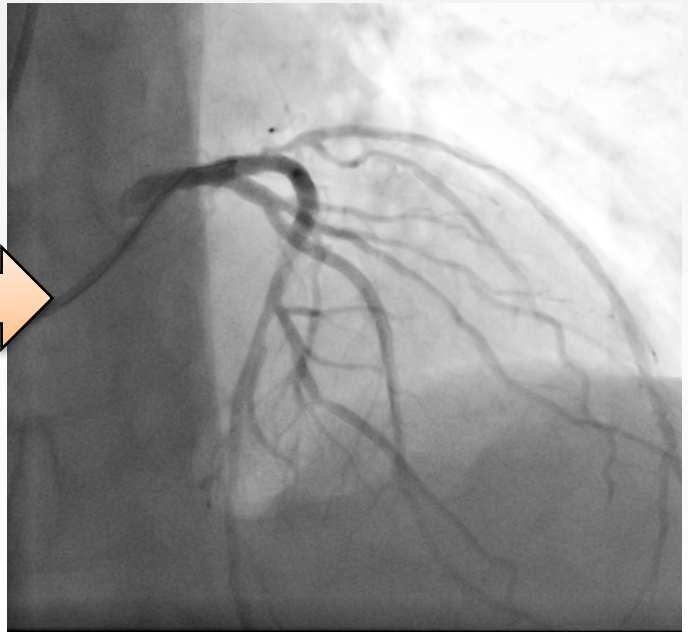


RePOT





RePOT

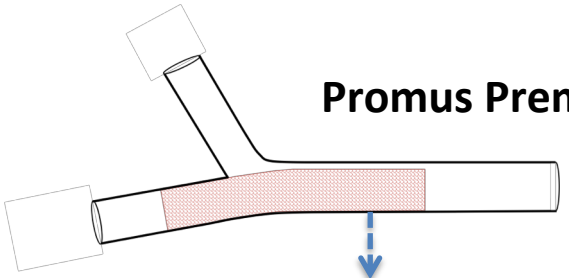


Question ?

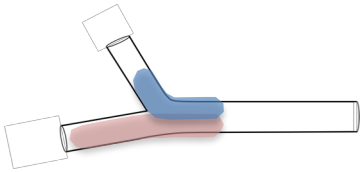
May final POT be sufficent to correct the detrimental effects of FKB?

BENCH STUDY!

Promus Premier™ stent (Boston) N=5



POT



KBI
Complete balloon juxtaposition
symmetric BIP
(12/12 atm)

SB inflation
SB @ 12 atm

Final POT (post KBI)

Final POT (rePOT)

Final 2D-3D OCT run

Derimay et al. Int J Cardio 2018

Mechanical results POT-KBI-POT vs rePOT

	KBI technique ($n = 5$)		rePOT technique ($n = 5$)	
	Before final POT	After final POT	Before final POT	After final POT
Proximal mother vessel				
D_{mean} (mm)	4.19 ± 0.09	4.27 ± 0.04*	4.18 ± 0.06	4.18 ± 0.05
D_{max} (mm)	4.35 ± 0.18	4.47 ± 0.11*	4.25 ± 0.05	4.25 ± 0.05
D_{min} (mm)	4.02 ± 0.02	4.10 ± 0.06	4.09 ± 0.09	4.10 ± 0.07
Area	13.78 ± 0.58	14.33 ± 0.46	13.70 ± 0.35	13.70 ± 0.36
Ellipticity ratio	1.08 ± 0.05	1.09 ± 0.03*	1.04 ± 0.02	1.04 ± 0.01
SAR	1.04 ± 0.02	1.06 ± 0.02	1.03 ± 0.02	1.03 ± 0.01
POC entry				
D_{mean} (mm)	4.24 ± 0.02	4.26 ± 0.08*	4.10 ± 0.02	4.12 ± 0.06
D_{max} (mm)	4.66 ± 0.07	4.47 ± 0.07*	4.25 ± 0.03	4.22 ± 0.06
D_{min} (mm)	3.83 ± 0.06	4.04 ± 0.12	3.96 ± 0.05	4.01 ± 0.08
Area	14.22 ± 0.13	14.26 ± 0.50*	13.19 ± 0.16	13.34 ± 0.39
Ellipticity ratio	1.22 ± 0.04	1.11 ± 0.03*	1.07 ± 0.01	1.05 ± 0.02
SAR	1.05 ± 0.02	1.01 ± 0.01	1.01 ± 0.01	1.01 ± 0.02
Main branch				
D_{mean} (mm)	3.49 ± 0.05	3.45 ± 0.06	3.47 ± 0.05	3.47 ± 0.05
Ellipticity ratio	1.05 ± 0.02	1.03 ± 0.01	1.03 ± 0.01	1.04 ± 0.02
SAR	1.06 ± 0.06	1.05 ± 0.04	1.06 ± 0.02	1.06 ± 0.03
Global malapposition (%)	10.3 ± 4.6	1.4 ± 2.1	7.9 ± 4.6	2.6 ± 1.5
SBO (%)	9.1 ± 7.2	8.9 ± 6.9	3.3 ± 3.6	5.6 ± 3.5
Fractal ratio	0.65 ± 0.02	0.66 ± 0.01	0.65 ± 0.01	0.65 ± 0.01

Derimay et al. Int J Cardio 2018

Mechanical results POT-KBI-POT vs rePOT

	KBI technique ($n = 5$)		rePOT technique ($n = 5$)	
	Before final POT	After final POT	Before final POT	After final POT
Proximal mother vessel				
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D_{min} (mm)	3.83 ± 0.06	4.04 ± 0.12	3.96 ± 0.05	4.01 ± 0.08
Area	14.22 ± 0.13	14.26 ± 0.50*	13.19 ± 0.16	13.34 ± 0.39
Ellipticity ratio	1.22 ± 0.04	1.11 ± 0.03*	1.07 ± 0.01	1.05 ± 0.02
SAR	1.05 ± 0.02	1.01 ± 0.01	1.01 ± 0.01	1.01 ± 0.02
Main branch				
D_{mean} (mm)	3.49 ± 0.05	3.45 ± 0.06	3.47 ± 0.05	3.47 ± 0.05
Ellipticity ratio	1.05 ± 0.02	1.03 ± 0.01	1.03 ± 0.01	1.04 ± 0.02
SAR	1.06 ± 0.06	1.05 ± 0.04	1.06 ± 0.02	1.06 ± 0.03
Global malapposition (%)	10.3 ± 4.6	1.4 ± 2.1	7.9 ± 4.6	2.6 ± 1.5
SBO (%)	9.1 ± 7.2	8.9 ± 6.9	3.3 ± 3.6	5.6 ± 3.5
Fractal ratio	0.65 ± 0.02	0.66 ± 0.01	0.65 ± 0.01	0.65 ± 0.01

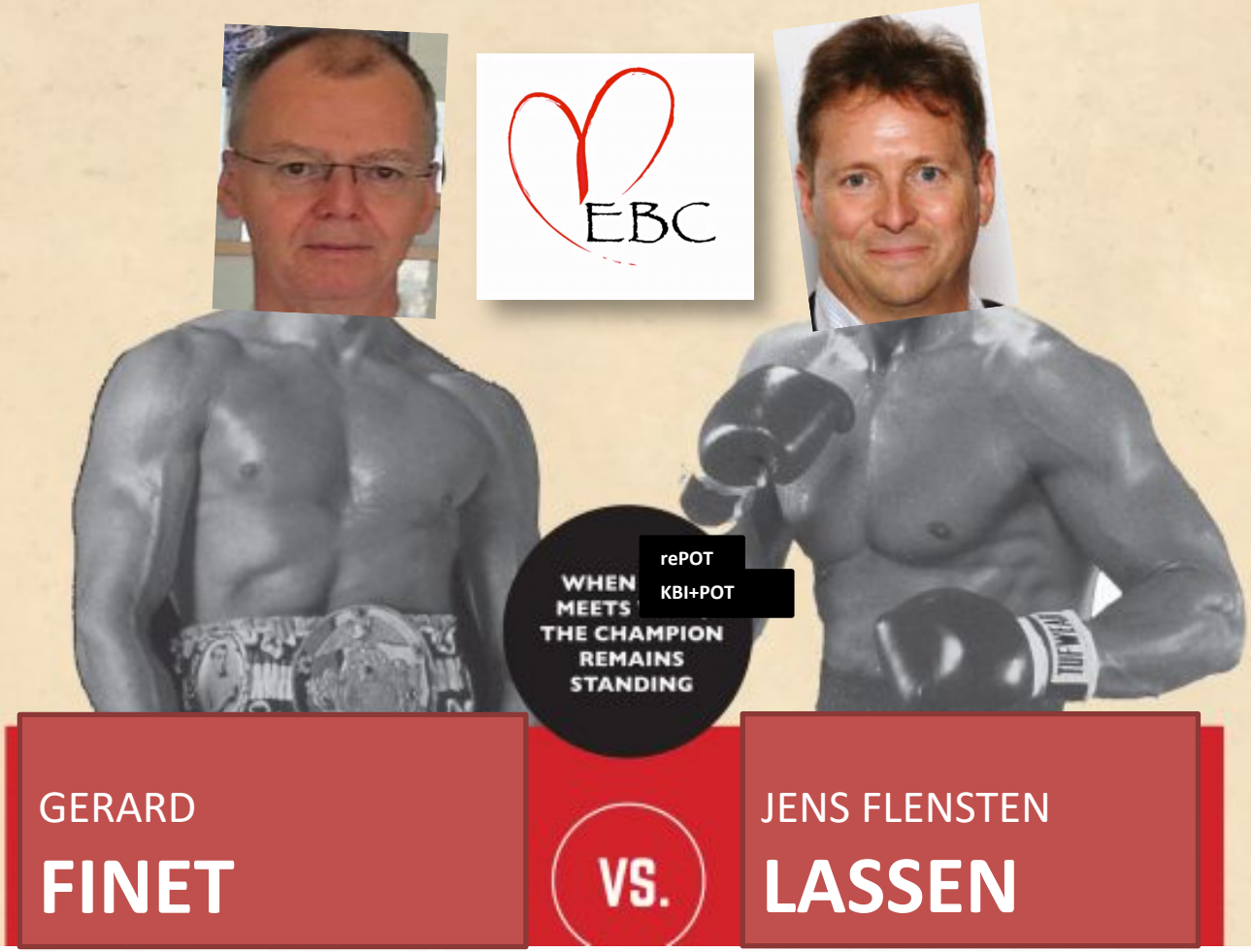
Derimay et al. Int J Cardio 2018

Conclusions

- A final POT performed after KBI does not appear sufficient to totally correct the detrimental mechanical effects of KBI
- In case of KBI, final POT is mandatory
- RePOT seems to be experimentaly better than all strategies with KBI
- RePOT is a simple/safe strategy that can be applied in most bifurcation lesions (KISS principle)
- Excellent immediate procedural outcome (large OCT study)
- Demonstration of long-term safety and effectiveness is ongoing (Cabriolet)

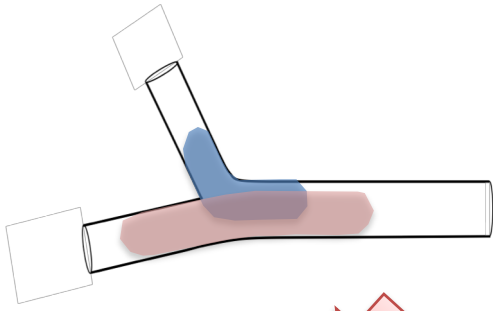
When we plan to open a strut toward a large SB (> 2.5 mm) we should perform a POT Side rePOT!

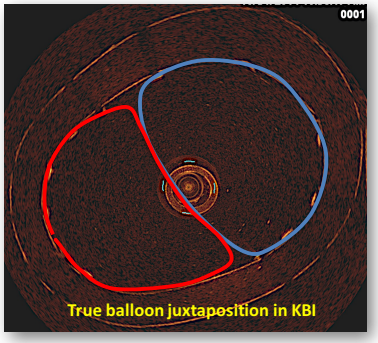
WORLD HEAVYWEIGHT BOXING CHAMPIONSHIP

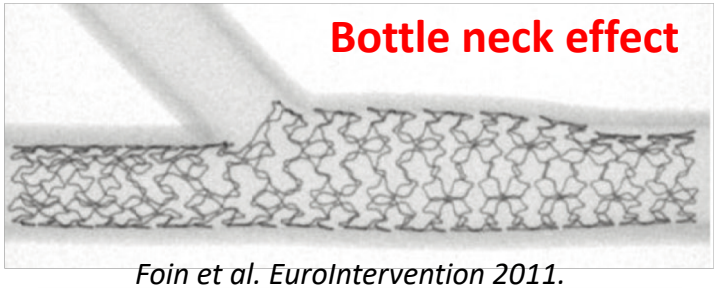


BACK UP SLIDES

Detrimental mechanical effect after KBI demonstrated in vitro!



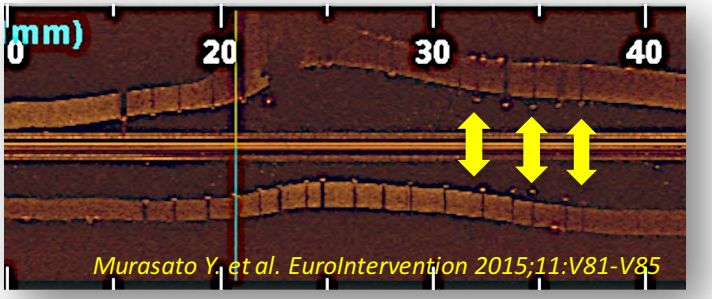




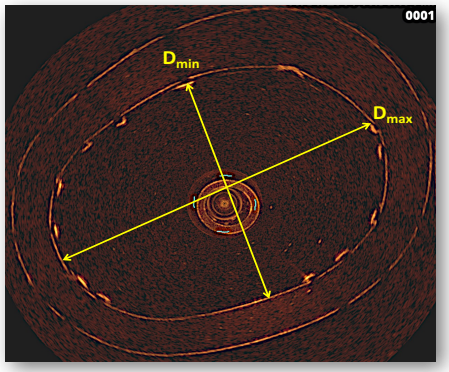
Bottle neck effect

Foin et al. EuroIntervention 2011.

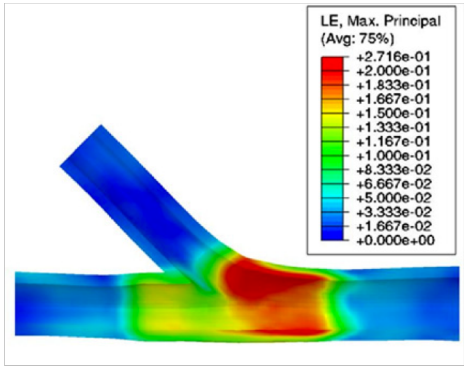
Proximal elliptic deformation
High stress concentration
(arterial + plaque overstretch)



MV Proximal edge malapposition



Mortier P et al. JACC CI 2014



Foin et al. JACC CI 2012

RESULTS

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Contrast medium w/o OCT	**152±69 ml**
Fluoroscopy time	14.9±6.6 min

Immediate in vivo assessment of the rePOT sequence by *serial OCT analysis*
The REPOT clinical study

Procedural results

	N= 106
Complete rePOT successfull	106 (100%)
MV stented	106 (100%)
SB Slow flow (TIMI 2)	2 (3.2%)
SB dissection	1 (1.6%)
SB stented (TAP technique)	1 (1.6%)
Residual SB stenosis	22.4± 13.0%

Derimay F et al. Eurointervention 2018