

Ce qui pourrait changer ma pratique en 2022

FFR et infarctus : FLOWER MI

Nicolas Meneveau

CHU Besançon

## Potential conflict of interest

### Consultant :

Abbott Medical, Bayer Healthcare, Bristol-Myers Squibb, Pfizer, Edwards Lifesciences, Terumo,

### Honoraires :

Abbott Medical, AstraZeneca, Bayer Healthcare, Bristol-Myers Squibb, Pfizer, Terumo, Boston Scientific

# Revascularisation du STEMI pluritronculaire : ce que l'on sait

Revascularisation non  
culprit lesions

FFR-guided vs  
medical treatment

- DANAMI PRIMULTI
- COMPARE ACUTE

↘ 65% revascularisation

FFR-guided vs angio-  
guided treatment

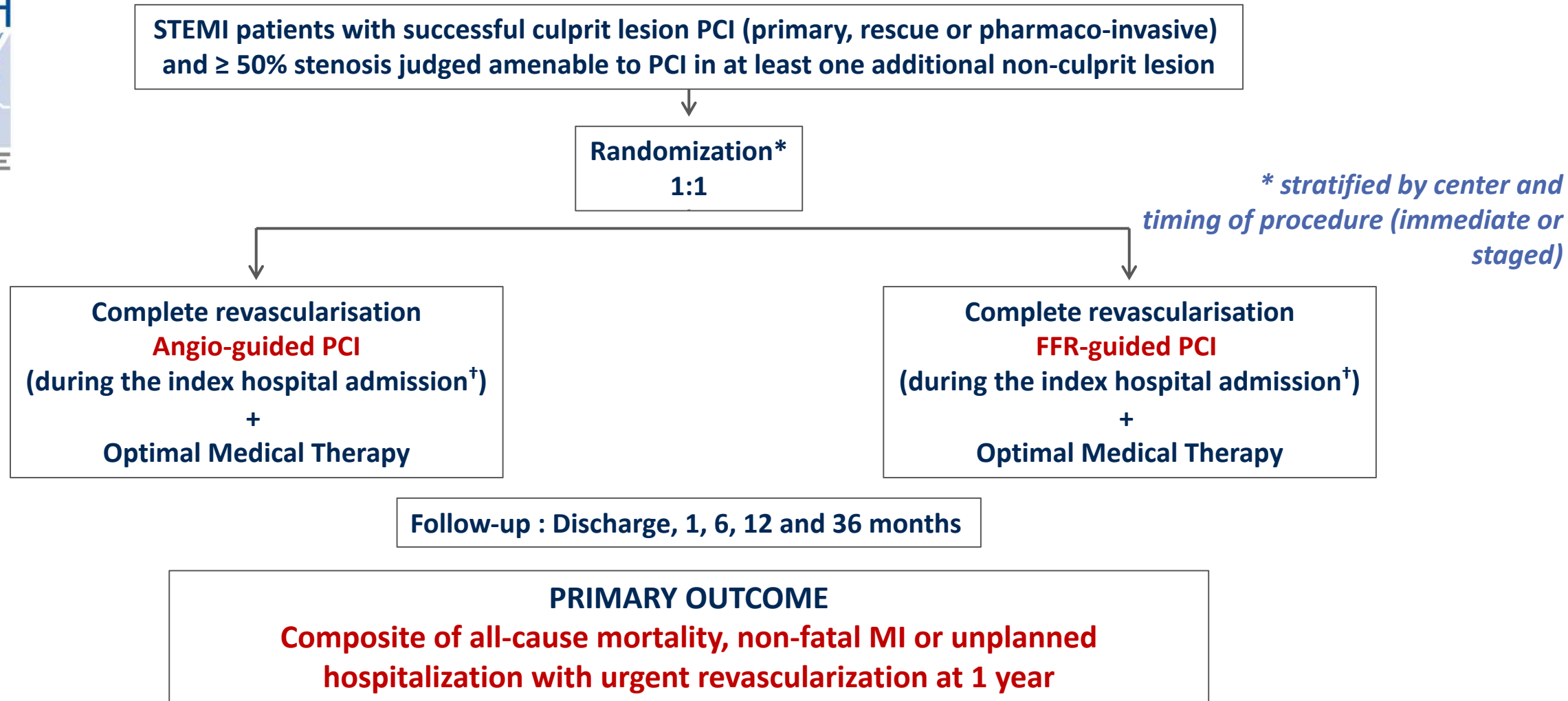
- FLOWER-MI

Angio-guided vs  
medical treatment

- PRAMI
- CULPRIT
- COMPLETE

↘ 60% revascularisation  
↘ 50% re-IDM

# FLOWER MI Study Design



Hypothesis: To demonstrate **the superiority of the FFR-guided strategy over the angio-guided strategy**

Sample size : Using a 0.05 level of significance, a power of 0.80, a **1-year risk of MACE in the FFR-guided strategy of 9.5%** & a **1-year risk of MACE in the angio-guided strategy of 15%**, at least 557 pts/group should be enrolled

# Baseline characteristics & procedural data

Characteristics	FFR-Guided PCI (n=586)	Angio-Guided PCI (n=577)
Age (year)	62.5 ± 11.0	61.9 ± 11.4
BMI (kg/m <sup>2</sup> )	26.7 (24.2-29.1)	26.6 (24.4-29.7)
Male	85.0	81.1
Hypertension	43.2	45.4
Diabetes mellitus	18.3	14.2
Hypercholesterolemia	39.6	41.1
Current smoker	40.1	36.4
Previous MI	7.7	5.4
Previous PCI	10.1	7.6
Previous stroke	2.7	3.0
Peripheral-vessel disease	2.7	4.0
Chronic renal insufficiency	1.9	12.1

‡ no./total no. of lesions (%); † per patient

\* < 0,01

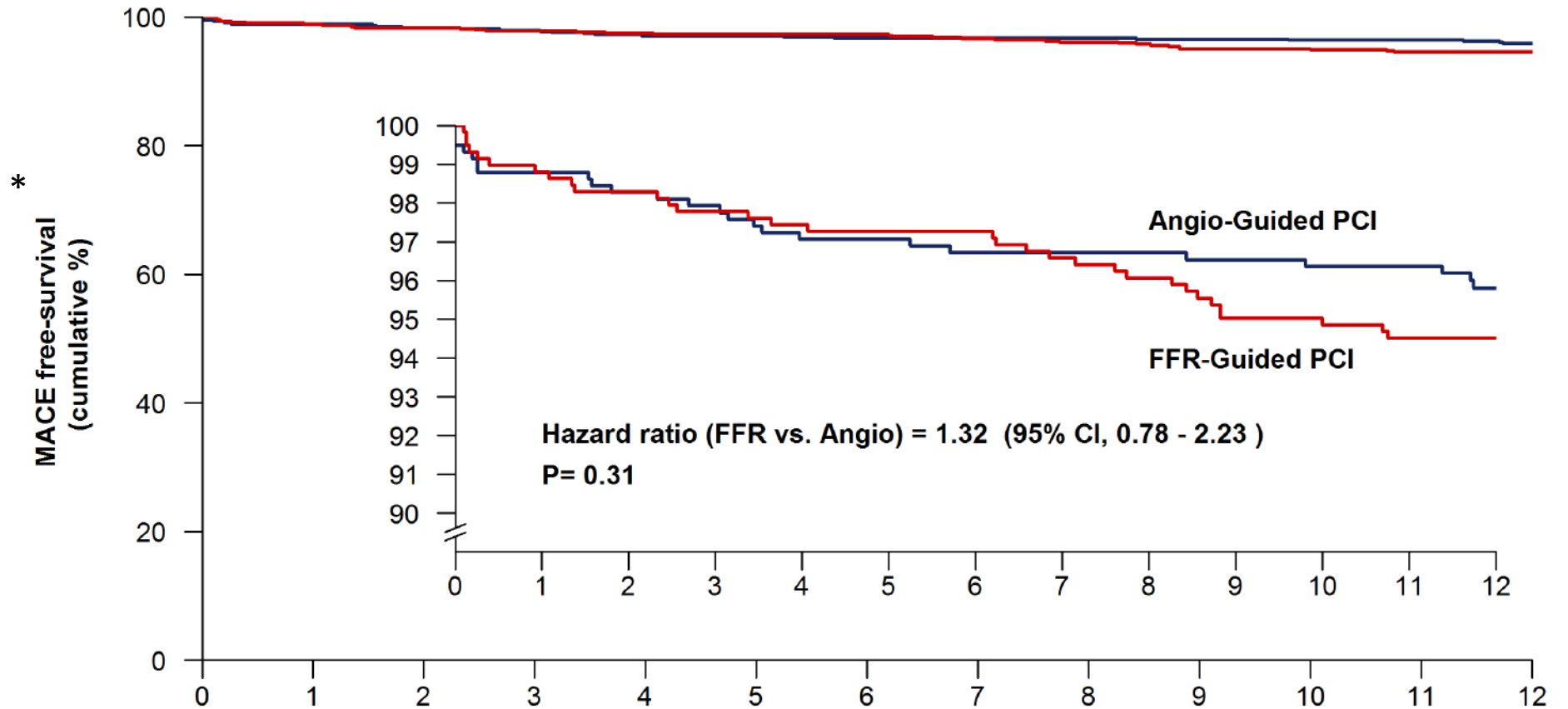
CL, culprit lesion

Clinical presentation	FFR-Guided PCI (n=586)	Angio-Guided PCI (n=577)
Anterior infarction	29.8	34.6
Arteries with stenosis		
• 2	72.4	77.5
• 3	25.8	19.9
Killip class ≥ 2	6.7	5.3
LVEF (%)	50 (45-60)	50 (45-58.3)

PCI of non-culprit lesion	FFR-Guided PCI (n=586)	Angio-Guided PCI (n=577)
Staged procedure of non-CL	96.6	95.8
Mean FFR value		
• FFR before PCI	0.79 ± 0.11	NA
• FFR post PCI	0.90 ± 0.06	NA
Lesions with FFR ≤0.80	55.7	NA
PCI (≥1) per patient	66.2	97.1*
Mean no. of stents used†	1.01 ± 0.99	1.50 ± 0.86*

# Primary outcome

\* Major Adverse Cardiac Events (MACE) denotes the composite of all-cause mortality, nonfatal MI, and unplanned hospitalization leading to urgent revascularization, at one year



<b>Angio-Guided PCI</b>	<b>577</b>	<b>570</b>	<b>567</b>	<b>565</b>	<b>560</b>	<b>560</b>	<b>557</b>	<b>555</b>	<b>555</b>	<b>554</b>	<b>552</b>	<b>548</b>	<b>371</b>
<b>FFR-Guided PCI</b>	<b>586</b>	<b>577</b>	<b>573</b>	<b>570</b>	<b>567</b>	<b>566</b>	<b>566</b>	<b>562</b>	<b>559</b>	<b>553</b>	<b>553</b>	<b>549</b>	<b>385</b>

# Primary outcome

Primary outcome at 1 year	FFR-Guided PCI (n=586)	Angio-Guided PCI (n=577)	HR (95% CI)	P Value
<b>MACE*</b>	5.5	4.2	1.32 (0.78-2.23)	0.31
<b>Death from any cause</b>	1.5	1.7	0.89 (0.36-2.20)	-
<b>Myocardial infarction</b>	3.1	1.7	1.77 (0.82-3.84)	-
<b>Unplanned hospitalization leading to urgent revascularization</b>	2.6	1.9	1.34 (0.62-2.92)	-
• % of non-culprit lesions treated	53.3	27.3		

\* Major Adverse Cardiac Events (MACE) denotes the composite of all-cause mortality, nonfatal MI, and unplanned hospitalization leading to urgent revascularization, at one year

## Prespecified clinical outcomes at 1 Year

Secondary outcome at 1 year	FFR-Guided PCI (n=586)	Angio-Guided PCI (n=577)	HR (95% CI)
<b>Stent thrombosis</b>	0.7	1.0	0.65 (0.19-2.32)
<b>Any revascularization</b>	6.5	4.5	1.45 (0.88-2.38)
<b>Hospitalization for heart failure</b>	1.5	1.9	0.82 (0.34-1.98)
<b>Hospitalization for recurrent ischemia</b>	5.5	3.3	1.68 (0.95-2.97)
<b>Any hospitalization in Cardiology</b>	11.6	8.0	1.49 (1.03-2.17)

Functional status at 1 year	FFR-Guided PCI (n=586)	Angio-Guided PCI (n=577)	HR (95% CI)
<b>Number of anti-anginal medications used *</b>	1.0 ± 0.5	1.0 ± 0.5	1.01 (0.90-1.14)
<b>QALY based on EQ-5D score</b>	0.86 ± 0.19	0.87 ± 0.18	0.01 (0.004-0.01)
<b>Recurrent ischemia</b>	5.5	3.3	0.82 (0.21-3.24)
• CCS class ≥2	64.5	68.4	

\* Antianginal medications included beta-blockers, calcium antagonists, and nitrates. Rate of means estimated by a negative binomial model

† Odds ratio estimated by logistic model



# FLOWER MI : limitations

## Un taux d'évts observés + bas qu'attendu :

- Taux observé FFR-guided = 5.5% vs taux attendu = 9.5%
- Taux observé Angio-guided = 4.4% vs taux attendu = 15%

## Intervalles de confiance très larges : 95% CI [0.78 – 2.23]

- compatible avec un bénéfice relatif de 22% ou un effet délétère de 123% de la FFR

> 8000 pts nécessaires pour montrer une  $\searrow$  de 15% du RR du critère combiné, soit une  $\searrow$  de 0.6% du risque absolu avec la stratégie FFR-guided :  
pour quelle pertinence clinique ?

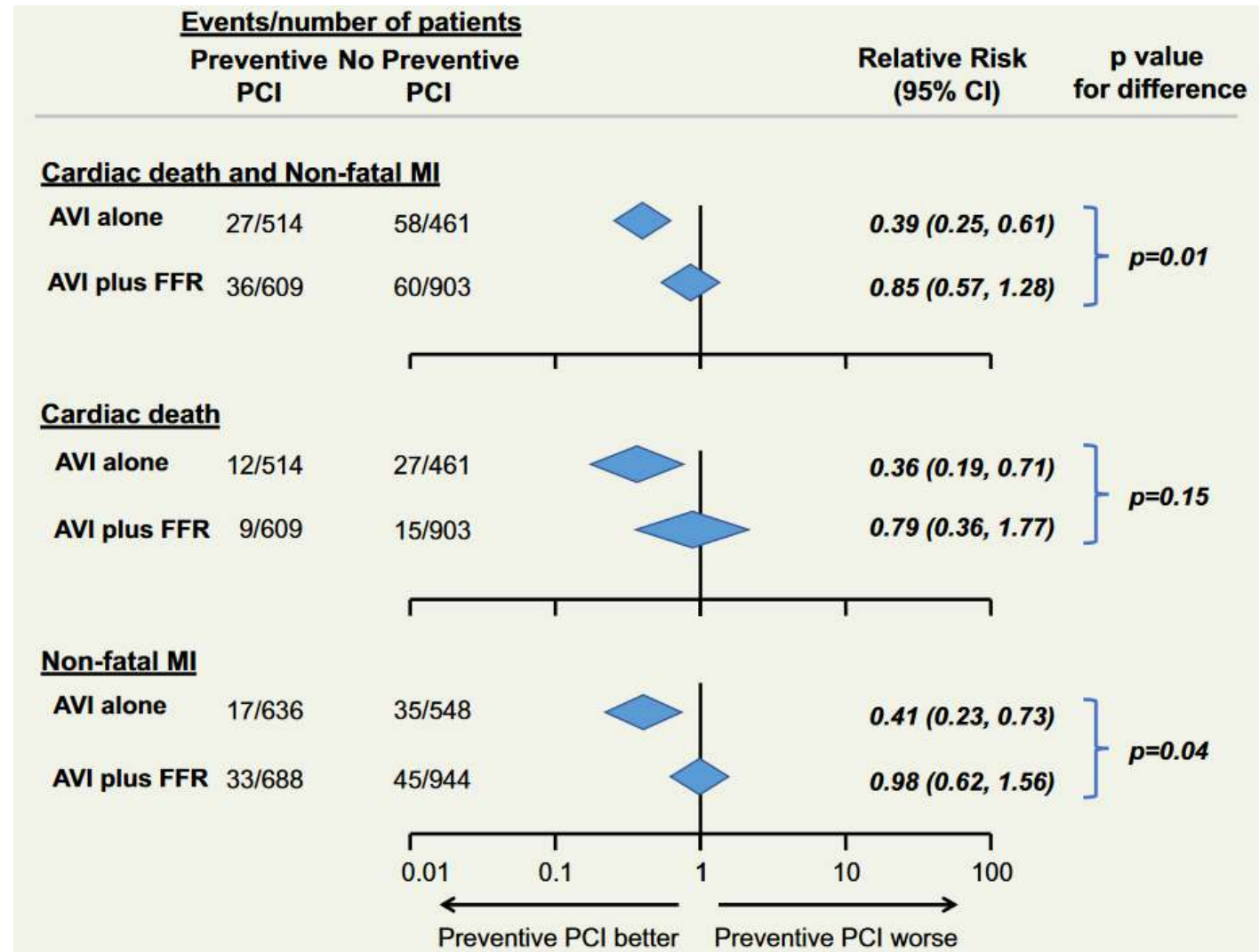
# Apport additionnel de la FFR dans la revascularisation du patient STEMI pluritronculaire

Méta-analyse  
de 10 essais  
randomisés

Chez les pts STEMI pluritronculaires :

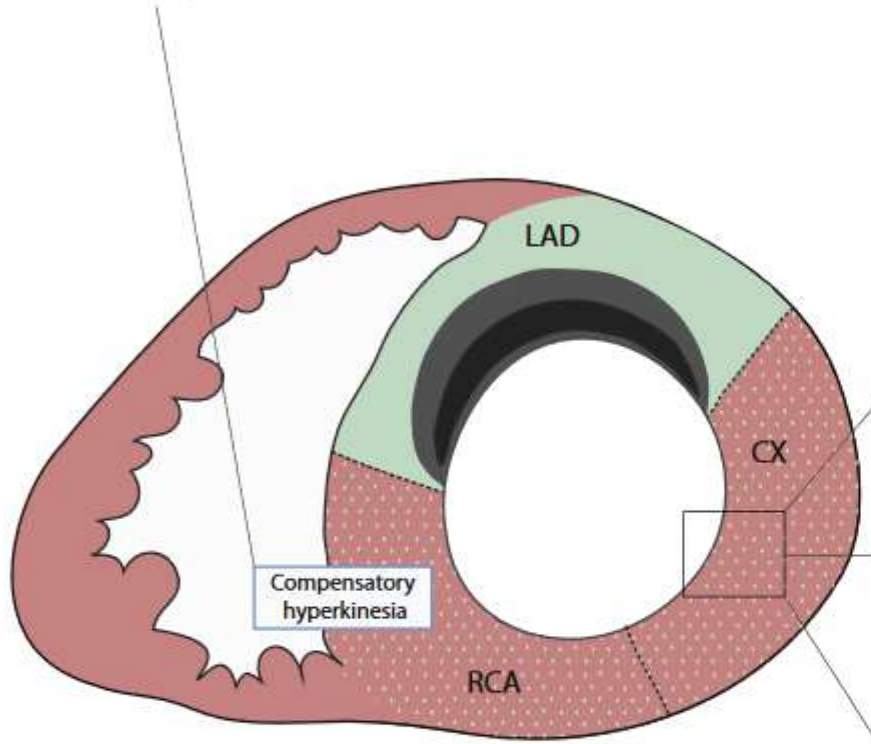
- la revascularisation basée sur l'angio ↘ de 60 % les DC CV et IDM vs TTT conservateur
- la revascularisation basée sur l'angio et la FFR ne montre pas de bénéfice vs TTT conservateur

=> privilégier la revascularisation basée sur l'estimation angio visuelle sans FFR dans ce groupe de pts.



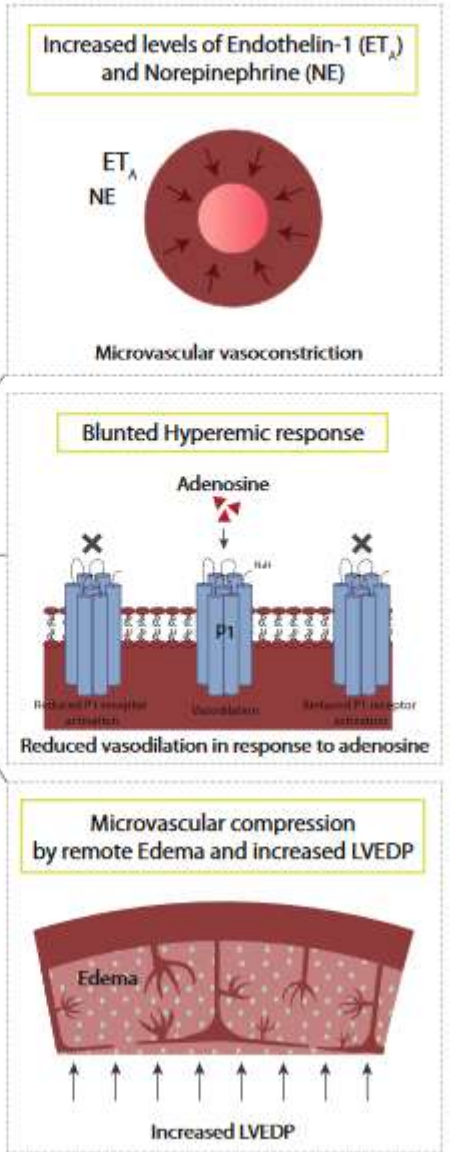
# La FFR sous estime t'elle les lésions non coupables à la phase aiguë de l'IDM

?  
Potential mechanism for increased nonculprit coronary resting flow



↗ débit de repos de l'artère non coupable liée à l'hyperkinésie du myocarde non infarcté.

Potential mechanisms for decreased nonculprit coronary hyperemic flow



**Figure legend**

Infarct-related area

- Myocardial Necrosis
- Intramyocardial Hemorrhage
- Myocardial Edema

Nonculprit-related area

- Remote Myocardial edema
- Increased Resting flow
- Decreased Hyperemic flow

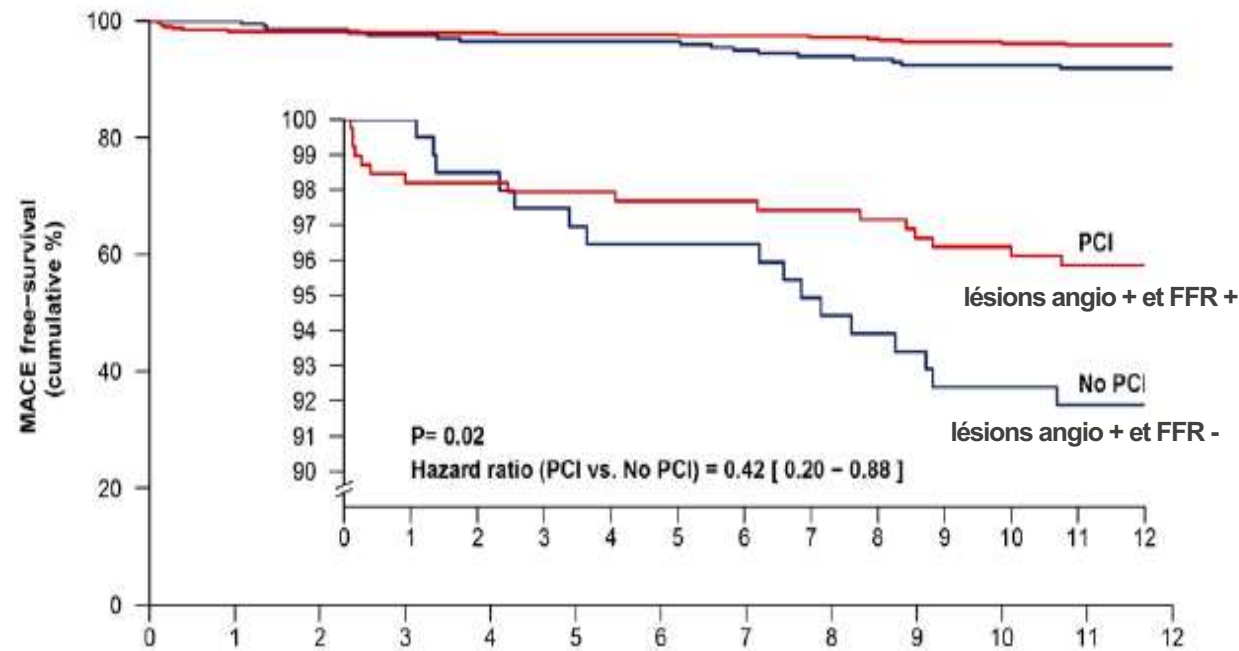
↘ débit hyperémique :

- vasodilatation amortie (↘ activation des récepteurs de l'adénosine, ↗ de l'endothéline-1 et la norépinéphrine)
- ↗ PTDVG
- oedème zone non infarcté.

Grpe FFR-guided : pts soumis à  $\geq 1$  PCI (lésions angio + et FFR +) ont un meilleur Pc que ceux ayant des lésions visuellement significatives avec  $FFR \geq 0.80$  (lésions angio + et FFR – non abordées )

MACE : composite of all-cause mortality, nonfatal MI, & unplanned hospitalization leading to urgent revascularization, at 1 y.

Outcomes	Patients without PCI, n=198	Patients with PCI ( $\geq 1$ ), n=388	Hazard ratio (95% CI)
Primary outcome at 1 y*†	16 (8.1)	16 (4.1)	0.42 (0.20 to 0.88)
Death from any cause, n (%)	3 (1.5)	6 (1.6)	
Myocardial infarction, n (%)	11 (5.6)	7 (1.8)	
Unplanned hospitalization leading to urgent revascularization, n (%)	8 (4.0)	7 (1.8)	
Secondary outcome at 1 y*			
Stent thrombosis, n (%)	2 (1.0)	2 (0.5)	
Any revascularization, n (%)‡	20 (10.1)	18 (4.6)	0.45 (0.23 to 0.88)
Hospitalization for heart failure, n (%)	4 (2.0)	5 (1.3)	
Hospitalization for recurrent ischemia, n (%)	19 (9.6)	13 (3.4)	0.37 (0.18 to 0.76)
Any hospitalization in cardiology, n (%)	34 (17.2)	34 (8.8)	0.50 (0.30 to 0.81)
Functional status at 1 y*			
Mean number of antianginal medications used per patient, n§	0.98 $\pm$ 0.46	0.96 $\pm$ 0.44	0.02 (0 to 0.04)
EQ-5D score	0.86 $\pm$ 0.19	0.86 $\pm$ 0.19	0.00 (–0.01 to 0.01)
Recurrent ischemia, n (%)¶	19 (9.6)	13 (3.4)	0.37 (0.18 to 0.76)
CCS class $\geq 2$ ‡	12 (63.2)	8 (66.7)	...





# Que retenir de FLOWER-MI sur la revascularisation complète des pts avec STEMI et atteinte pluritronculaire

- Les taux d'événements cliniques (MACE) à un an sont bas
- Les opérateurs privilégient les procédures étagées
- L'angioplastie guidée par FFR des lésions non coupables :
  - ne réduit pas le risque d'évts cliniques à 1 an vs une stratégie guidée par l'angiographie
  - ne doit pas être la stratégie de référence pour guider la revascularisation de ces pts, car les lésions différées (angio + et FFR -) sont associées à un risque accru d'évts cliniques