

La QFR ou la FFR 2.0

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Jeudi 25 et Vendredi 26 novembre 2021
Novotel Paris Centre Tour Eiffel



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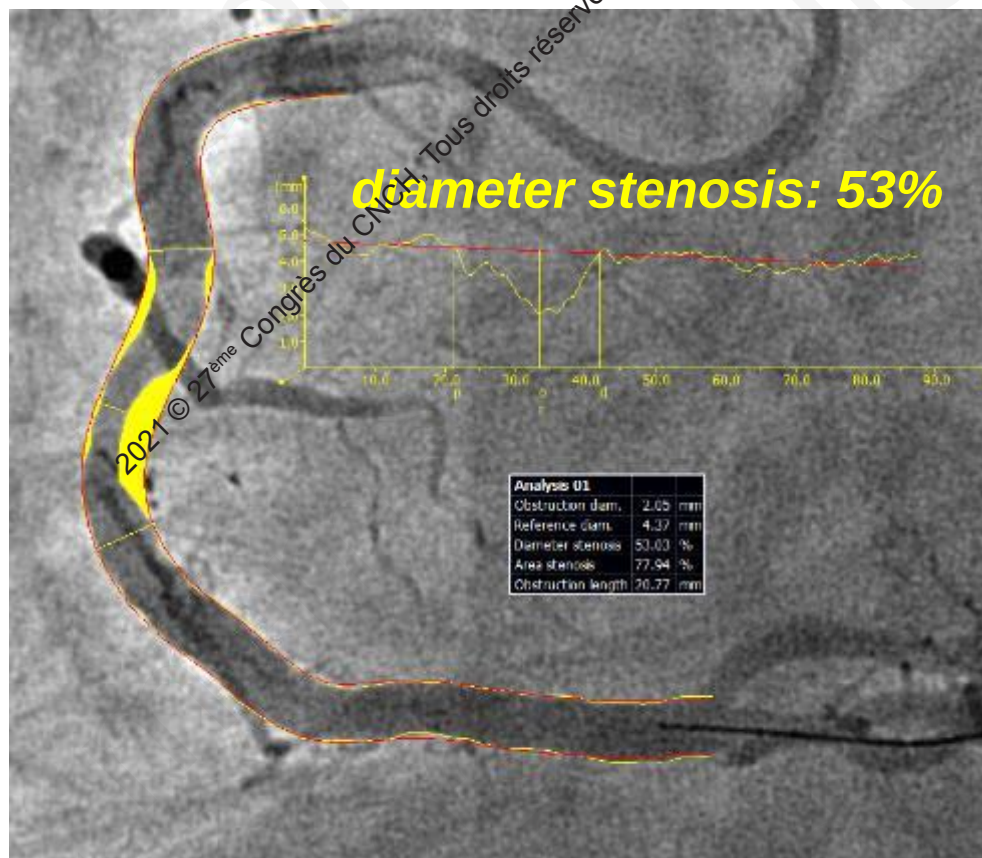
Orateur : ADJEDI Julien

☒ Je déclare les liens d'intérêt potentiels suivants :

• Consultant pour Abbott et Biotronik

Revascularisation ou non?

Quantitative Coronary Angiography (QCA)



Anatomy: diameter stenosis = 53%

vs.

Physiology: FFR = 0.85

Series Browser

Training_26 Case26 XA 4 14/06/2017

1 - 1 S4(1) 80 LAO 12, CAU 26
1 - 2 S5(1) 67 RAO 24, CAU 23
2 - 1 S11(1) 75 LAO 43, CAU 2
2 - 2 S12(1) 71 LAO 0, CAU 2

Training_26 M 14/06/2017

Frame: 23/80
Series: 4 (1)
Acq. speed: 15 f/s
Cal. fac.: 0.2257 mm/pixel (Isocenter calibration)
LAO 12, CAU 26
Derived WL 171 131

Training_26 M 14/06/2017

Frame: 23/67
Series: 5 (1)
Acq. speed: 15 f/s
Cal. fac.: 0.2207 mm/pixel (Isocenter calibration)
RAO 24, CAU 23
Derived WL 132 136

Training_26 M 14/06/2017

Frame: 23/75
Series: 11 (1)
Acq. speed: 15 f/s
Cal. fac.: 0.2247 mm/pixel (Isocenter calibration)
LAO 43, CAU 2
Derived WL 167 128

Training_26 M 14/06/2017

Frame: 23/71
Series: 12 (1)
Acq. speed: 15 f/s
Cal. fac.: 0.2251 mm/pixel (Isocenter calibration)
LAO 0, CAU 2
Derived WL 116 106

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Calibrations
Measurements
Annotations
Snapshots
Viewport layouts

Properties

- Cine Alt+Shift
- Zooming Ctrl+Shift
- Panning Ctrl
- Window/Level
- Calibration
- Distance Measurement D
- Area Measurement A
- Text Annotation
- Snapshot S
- Viewport Layout Snapshot
- Invert Image Ctrl+I**
- QFR

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FFR virtuelle

FFR

$$FFR = \frac{Q_s^{\max}}{Q_N^{\max}}$$

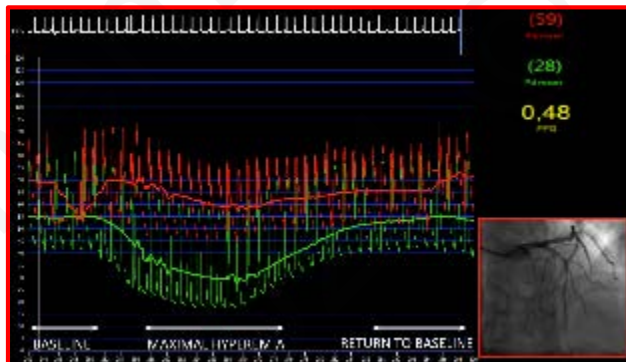
FFR virtuelle

$$FFR = \frac{(P_a - P_v) / R_s^{\max}}{(P_a - P_v) / R_N^{\max}}$$

• Hyperemie maximale $\rightarrow R_s = R_N$

• $P_v \ll P_a$ et P_d

$$FFR = \frac{P_d}{P_a}$$

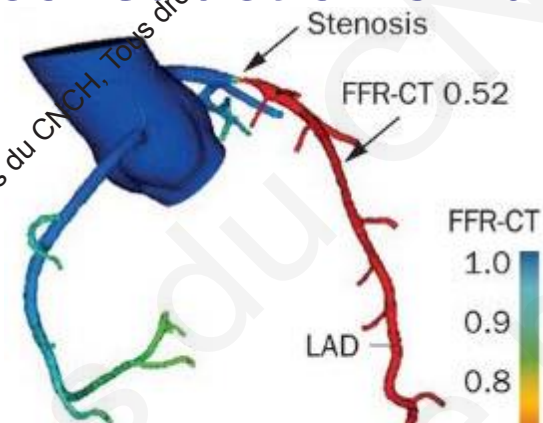


Algorithme

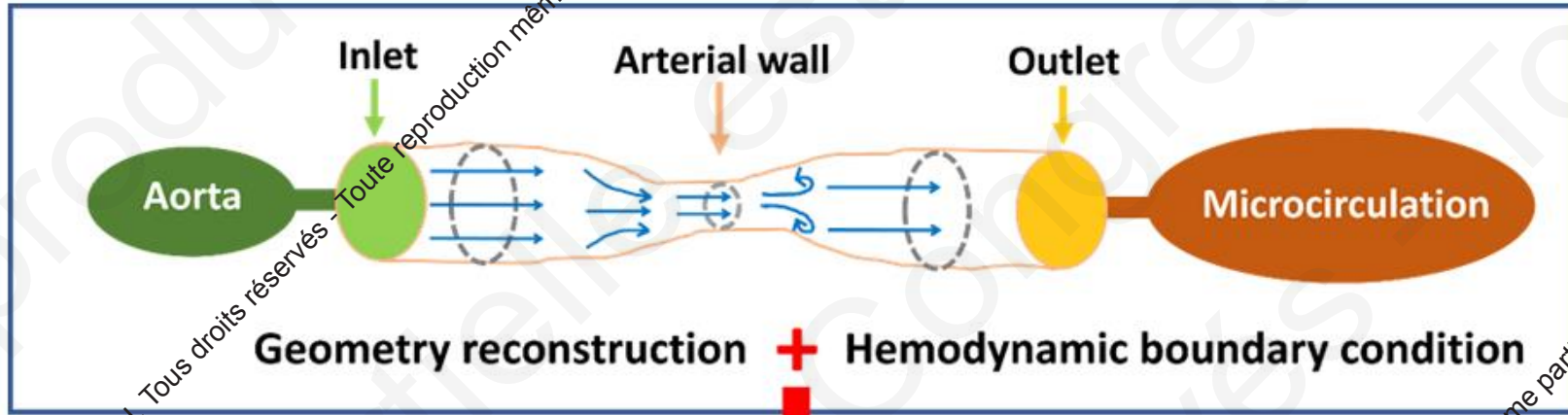
$$\frac{D\mathbf{v}}{Dt} = -\text{grad } V - \frac{1}{\rho} \text{grad } p + \frac{1}{\rho} \text{div } \boldsymbol{\tau}$$

$$\tau_{ik} = \mu \left(\frac{\partial v_i}{\partial x_k} + \frac{\partial v_k}{\partial x_i} - \frac{2}{3} \delta_{ik} \frac{\partial v_s}{\partial x_s} \right) + \mu_0 \delta_{ik} \frac{\partial v_s}{\partial x_s}$$

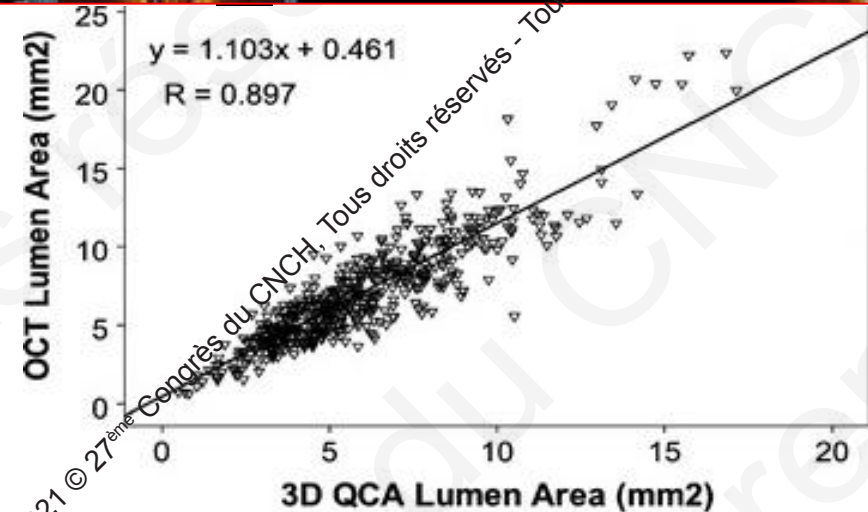
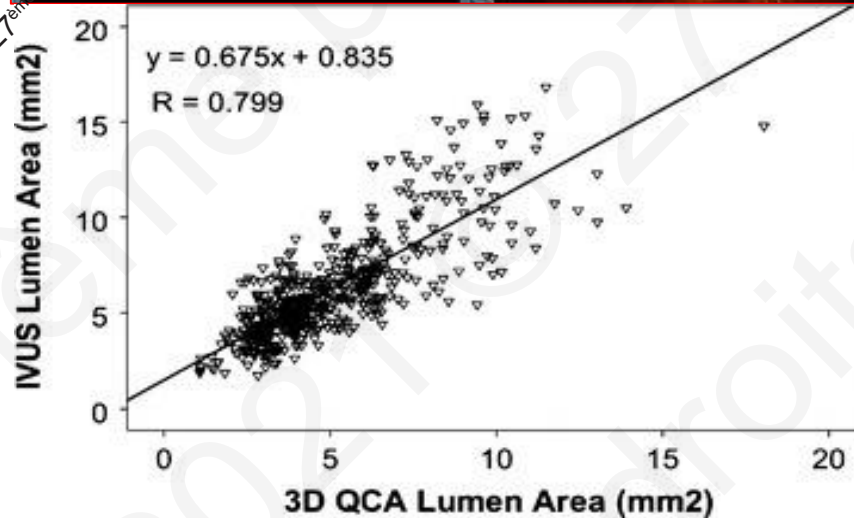
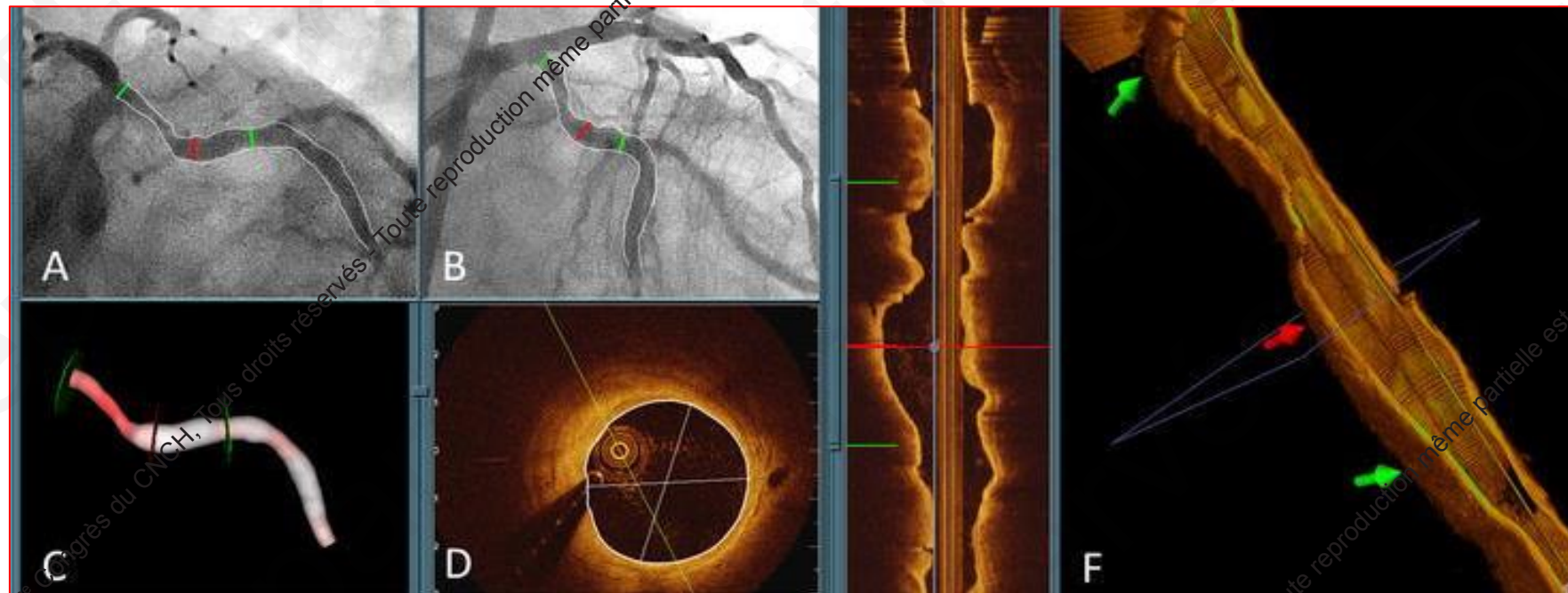
Reconstruction 3D du vaisseau



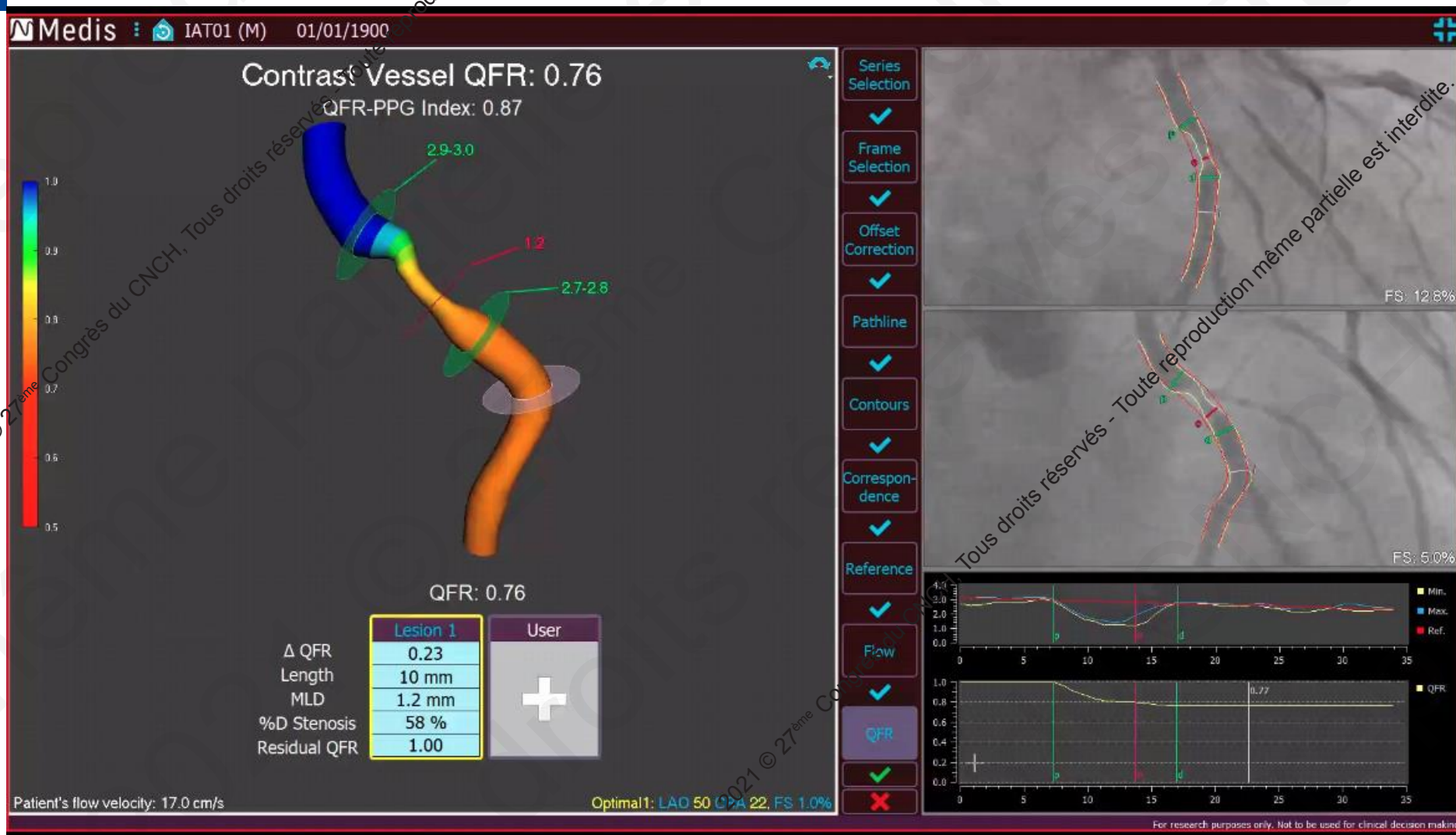
FFR virtuelles: principes



Corrélation 3D QCA et imagerie endocoronaire



Vue d'ensemble



Etudes clinique: la saga FAVOR

FAVOR I: QFR sans adenosine n=78

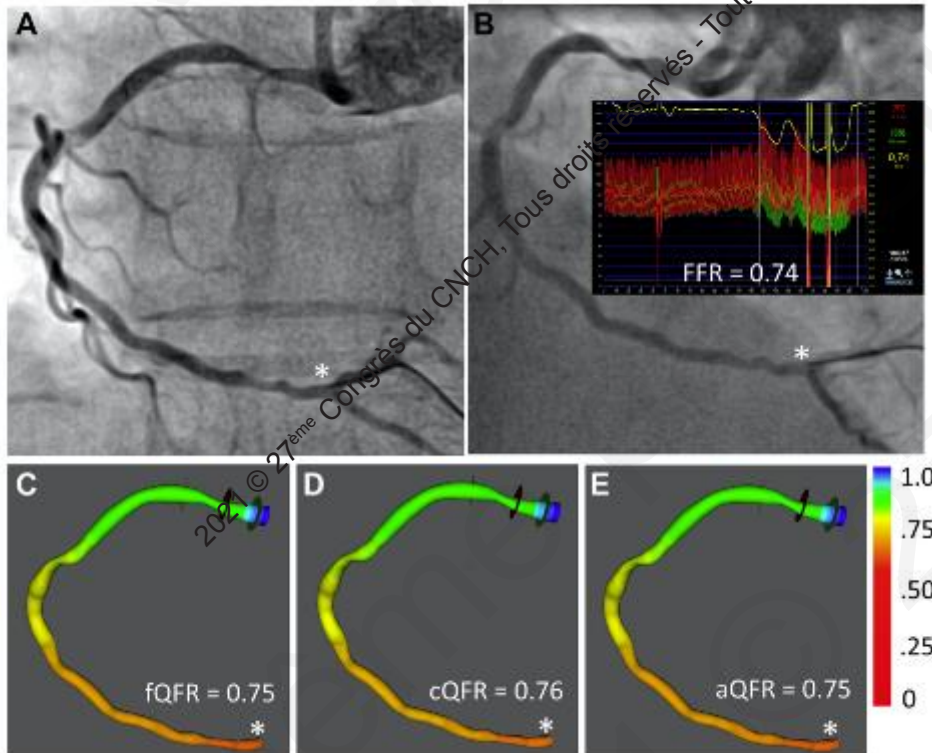
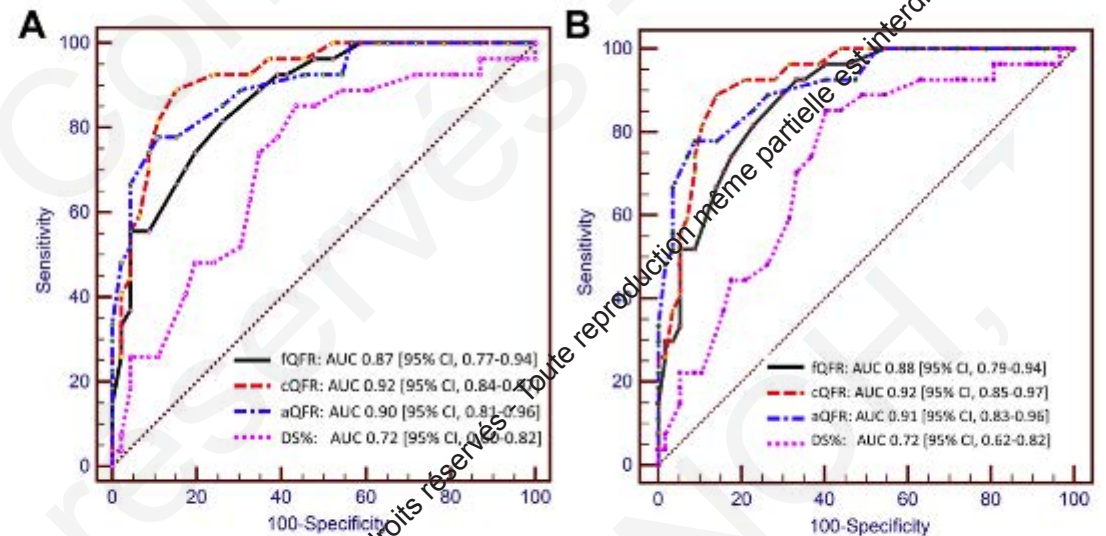


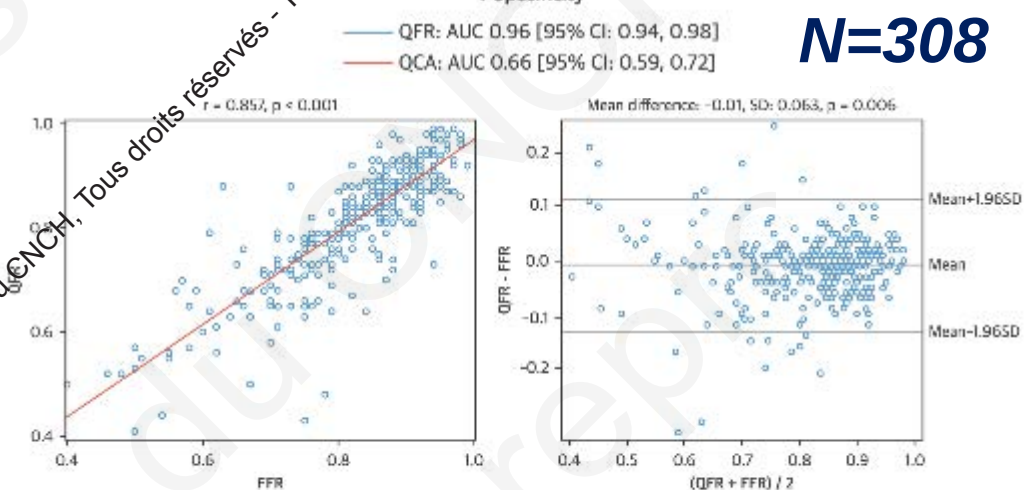
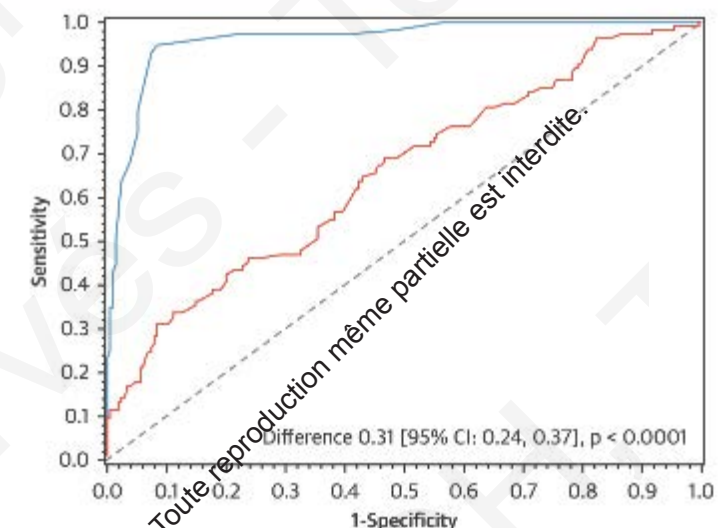
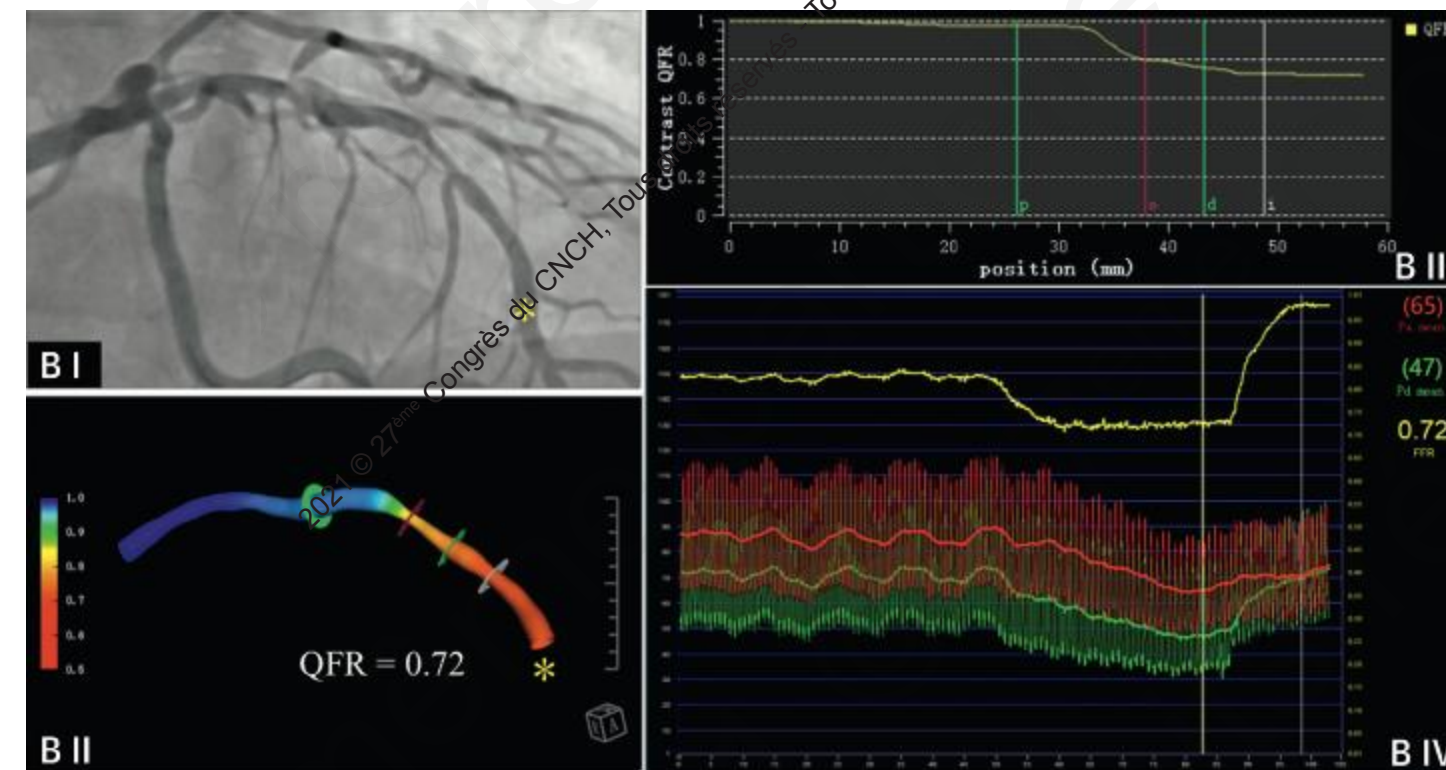
FIGURE 6 Comparison of Receiver Operating Curves for the Discrimination of Functionally Significant Stenoses



(A) Per patient. (B) Per vessel. The AUC was significantly higher for FQFR, cQFR, and aQFR, as compared with the anatomic parameter DS%. AUC = areas under the receiver-operating characteristics curve; DS% = percent diameter stenosis; other abbreviations as in Figure 1.

Etudes clinique: la saga FAVOR

FAVOR II China: QFR correlation avec FFR



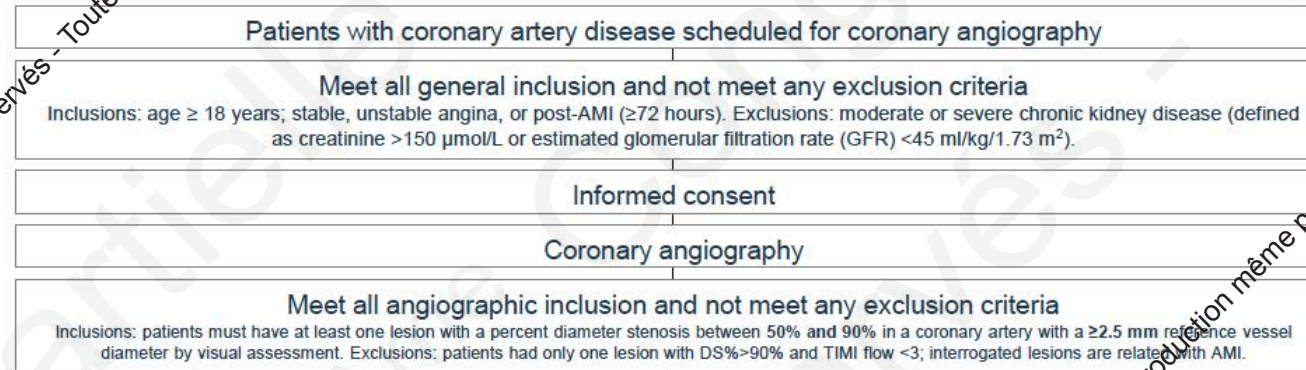
N=308

Etudes clinique: la saga FAVOR

FAVOR III China: QFR versus angioguided PCI

Study Design

Investigator-Initiated, Multicenter, Sham-Controlled Blinded Randomized Trial



Randomization Stratifications

- Diabetes Mellitus
- Multivessel Disease
- Presence of any vessel with DS% $>90\%$ and TIMI flow <3
- Center

Identify target vessels intended to be treated with standard angiography guidance

N=3830 (1:1 randomization)

**QFR-guided strategy
N=1915**

QFR was measured in all coronary arteries containing any lesion with visually-assessed DS% $\geq 50\%$ and $\leq 90\%$ and RVD $\geq 2.5 \text{ mm}$

- QFR ≤ 0.80 : PCI
- QFR >0.80 : deferral
- All measured vessel QFR >0.80 : OMT alone

**Angiography-guided strategy
N=1915**

PCI was performed based on visual angiographic assessment per local standard of practice

Independent Organizations

- Core Lab
- CEC
- DSMB
- Data Management
- Statistical Analysis

Imaging core lab analysis; clinical follow-up at 1 month, 6 months, 1 year, 2 years, and 3 years; EQ-5D questionnaires collected at 1, 6, and 12 months



ClinicalTrials.gov Identifier: NCT03656848

Song L, et al. *Am Heart J* 2020.

FAVOR
Series of QFR Studies

Etudes clinique: la saga FAVOR

FAVOR III China: QFR versus angioguided PCI

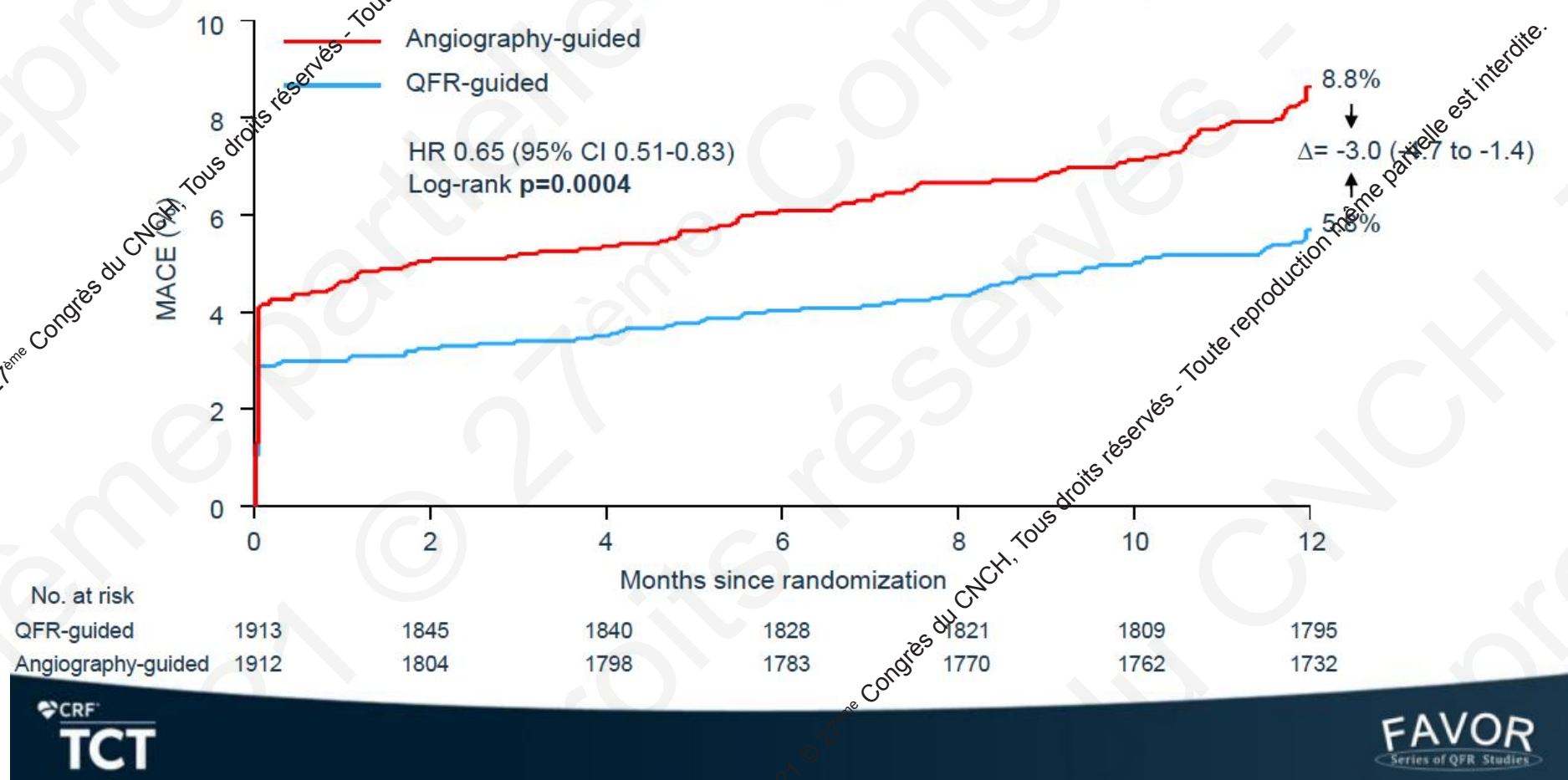
Key Procedural Results

	QFR-guided group (N=1913)	Angiography-guided group (N=1912)	P-value
PCI performed	90.5%	99.1%	<0.0001
Number of stents placed per patient	1.45 ± 1.02	1.58 ± 0.97	<0.0001
Use of intravascular imaging	6.2%	6.3%	0.89
Contrast medium used per patient, ml	163.0 ± 75.6	169.7 ± 74.2	0.0060
Fluoroscopy time, min	14.1 ± 8.0	14.9 ± 7.4	0.0013
Procedure time, min	53.7 ± 30.4	59.4 ± 30.4	<0.0001
Adjusted procedure time, min	44.6 ± 28.8	49.5 ± 30.2	<0.0001
PCI lesion success	99.0%	99.3%	0.38
Residual anatomic SYNTAX score	2.4 ± 3.6	2.4 ± 4.0	0.49
Residual functional SYNTAX score	0.7 ± 2.3	1.0 ± 2.8	<0.0001
Residual functional SYNTAX score=0	88.1%	82.2%	<0.0001

Etudes clinique: la saga FAVOR

FAVOR III China: QFR versus angioguided PCI

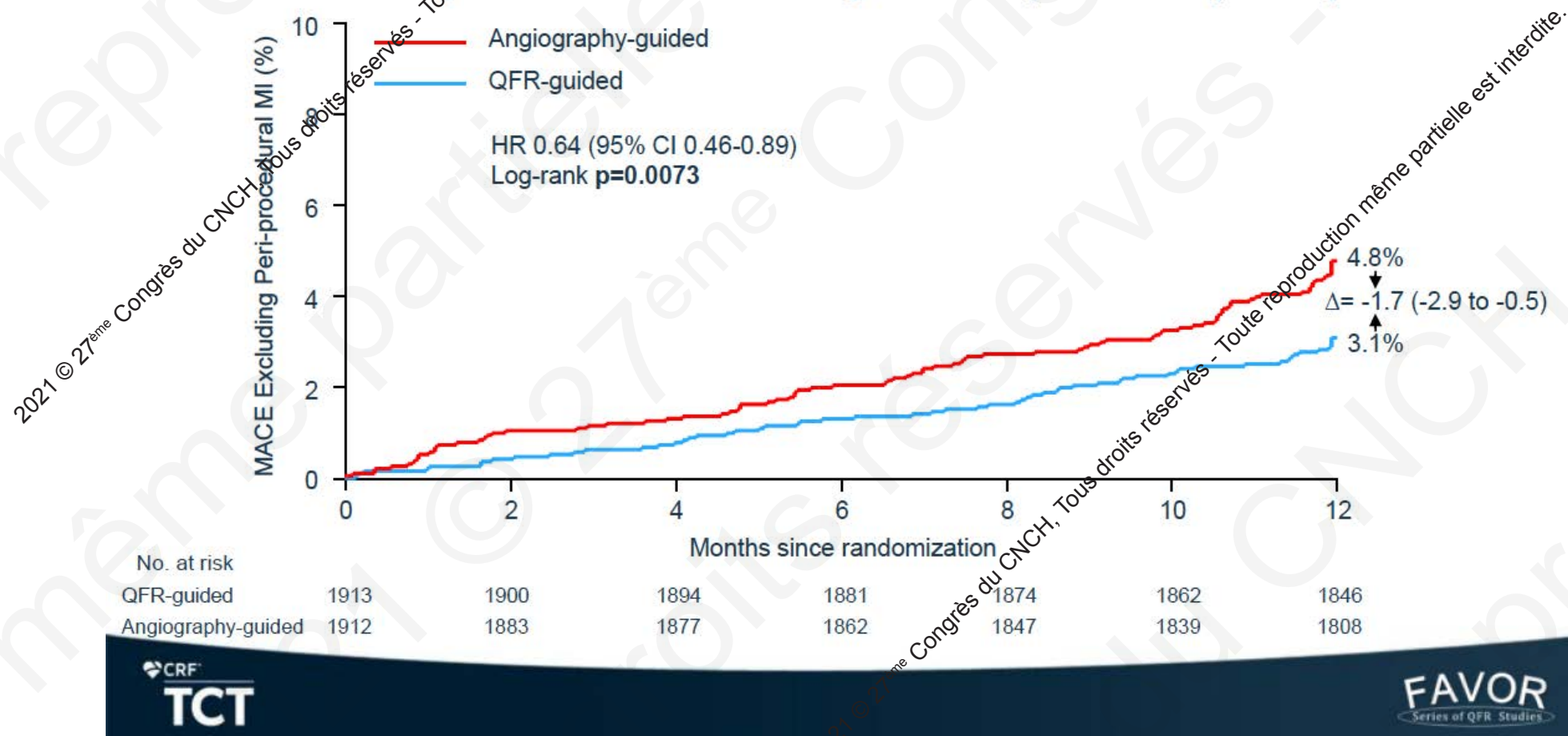
Primary Endpoint (ITT)



Etudes clinique: la saga FAVOR

FAVOR III China: QFR versus angioguided PCI

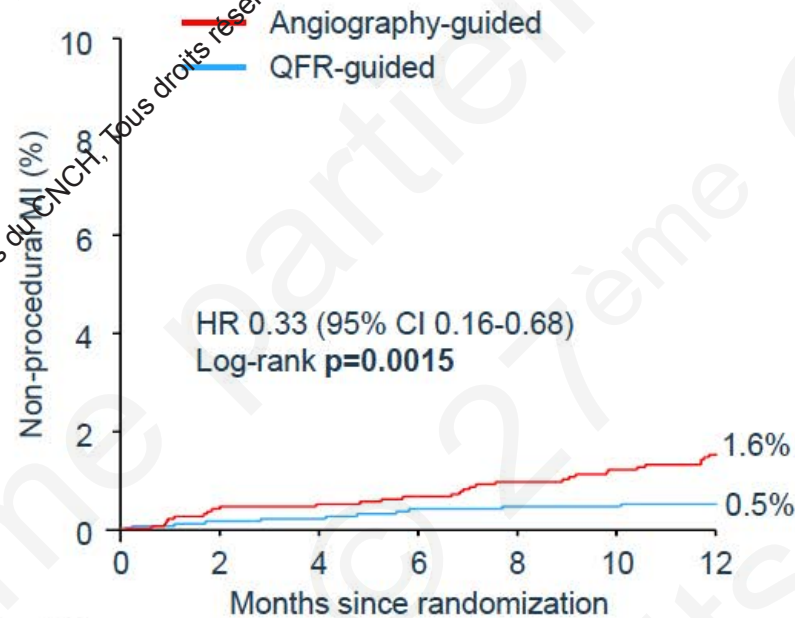
Major Secondary Endpoint (ITT)



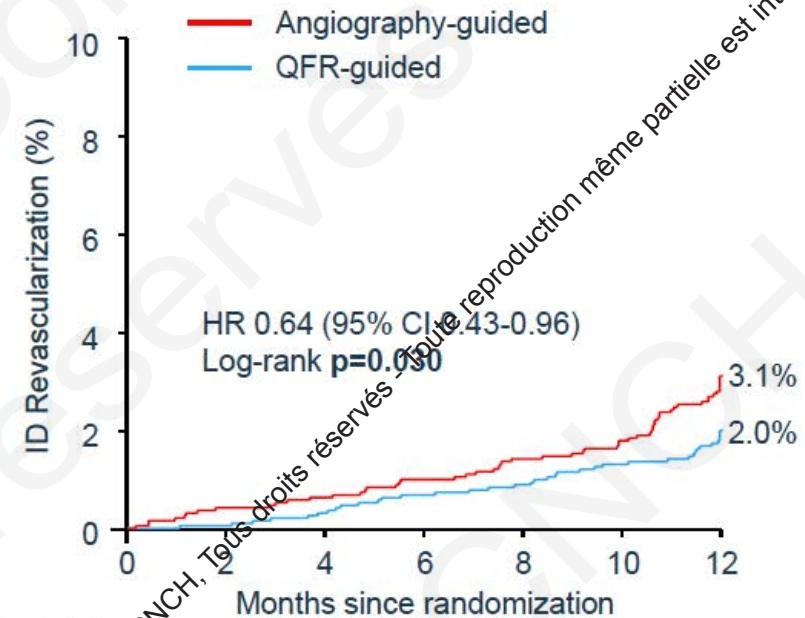
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FAVOR III China: QFR versus angioguided PCI

Non-procedural MI and ID Revascularization



No. at risk							
QFR-guided	1913	1901	1899	1892	1889	1885	1882
Angiography-guided	1912	1891	1889	1881	1872	1867	1861



No. at risk							
QFR-guided	1913	1903	1897	1887	1881	1869	1854
Angiography-guided	1912	1891	1887	1874	1863	1859	1831

Etudes clinique: la saga FAVOR

FAVOR III Europe Japan

FAVOR III

- Stable angina pectoris or evaluation of secondary stenosis after MI
- Coronary stenosis of 40-90% by visual estimate

1:1 randomization of 2000 patients

QFR guiding

FFR guiding

Primary endpoint: One year PoCE for non-inferiority

Two-year follow-up

Only clinical follow-up

Conclusion

- **QFR → FFR 2.0**
- **Etude simplifiée de la physiologie coronaire**
- **Outil plus largement disponible (rétrospectif, dématérialisé)**
- **Données cliniques convaincantes**
- **Outil complémentaire et de plus en plus indispensable au côté de la FFR**