Optimisation de l'angioplastie : de la physiologie à l'anatomie

L'OCT en pratique dans ma pratique

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CHU Jean Minjoz, Besançon
07/06/2017

Dans quelles situations utiliser l'OCT en pratique quotidienne ?

Les situations dans lesquelles l'OCT est utile :

- Syndromes coronaires aigus
- Resténose intrastent

Les situations dans lesquelles l'OCT est recommandée :

- Thromboses de stent
- Angioplastie des lésions du TC

Dans quelles situations utiliser l'OCT en pratique quotidienne ?

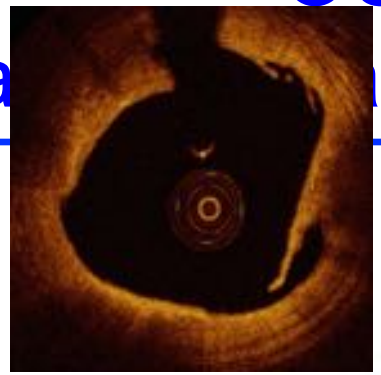
Les situations dans lesquelles l'OCT est utile :

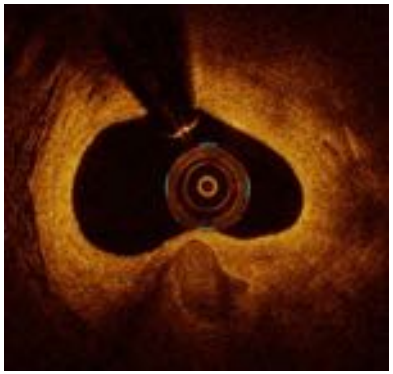
- Syndromes coronaires aigus
  - Analyser la lésion responsable
    - Érosion vs rupture de plaque
    - Hématome intramuraux
  - Optimiser l'angioplastie
- Resténose intrastent
  - Néointima vs néoathérosclérose

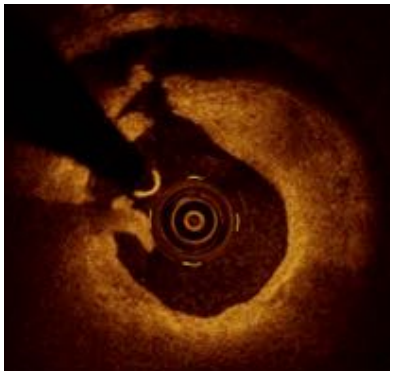
Les situations dans lesquelles l'OCT est recommandée

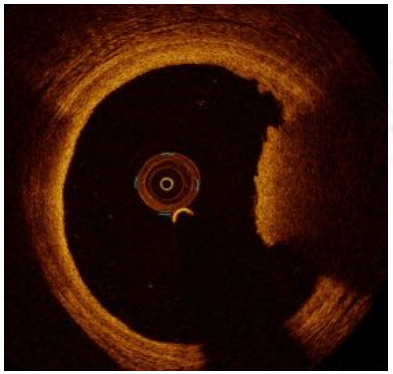
- Thromboses de stent
  - Malapposition vs sous déploiement vs défaut d'endothélialisation vs dissection des bords vs…….
- Angioplastie des lésions du TC

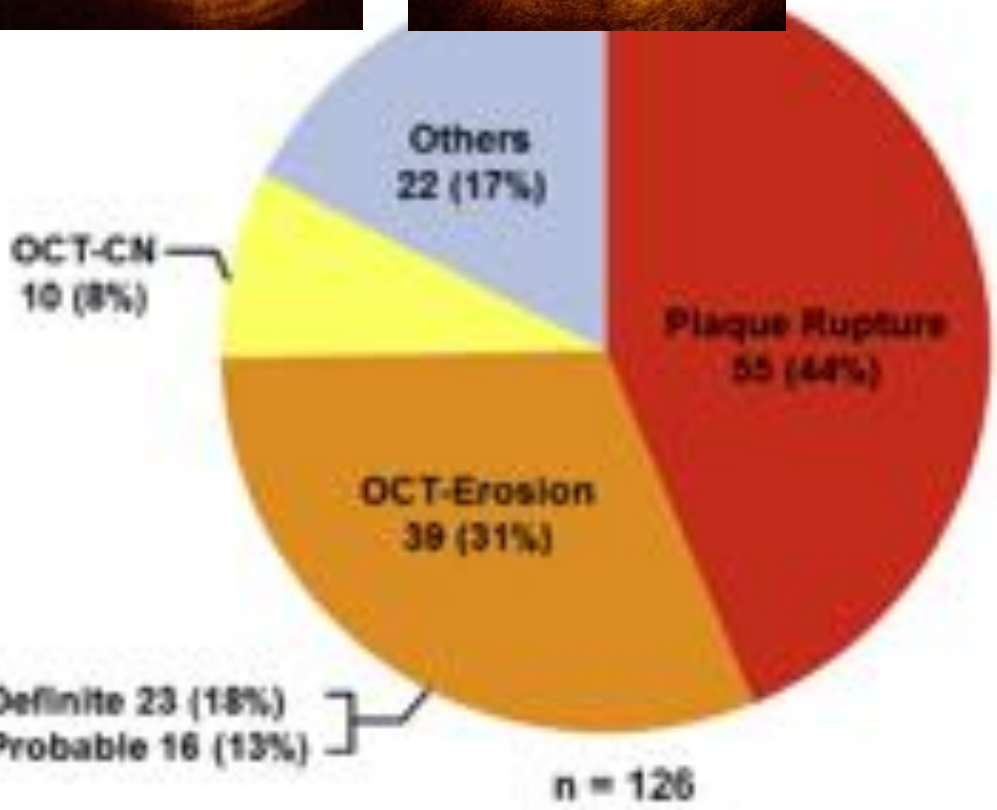
OCT et SCA : a[illegible] responsable





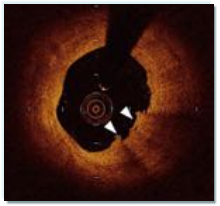




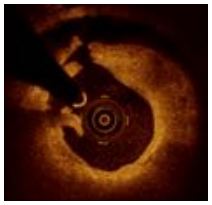


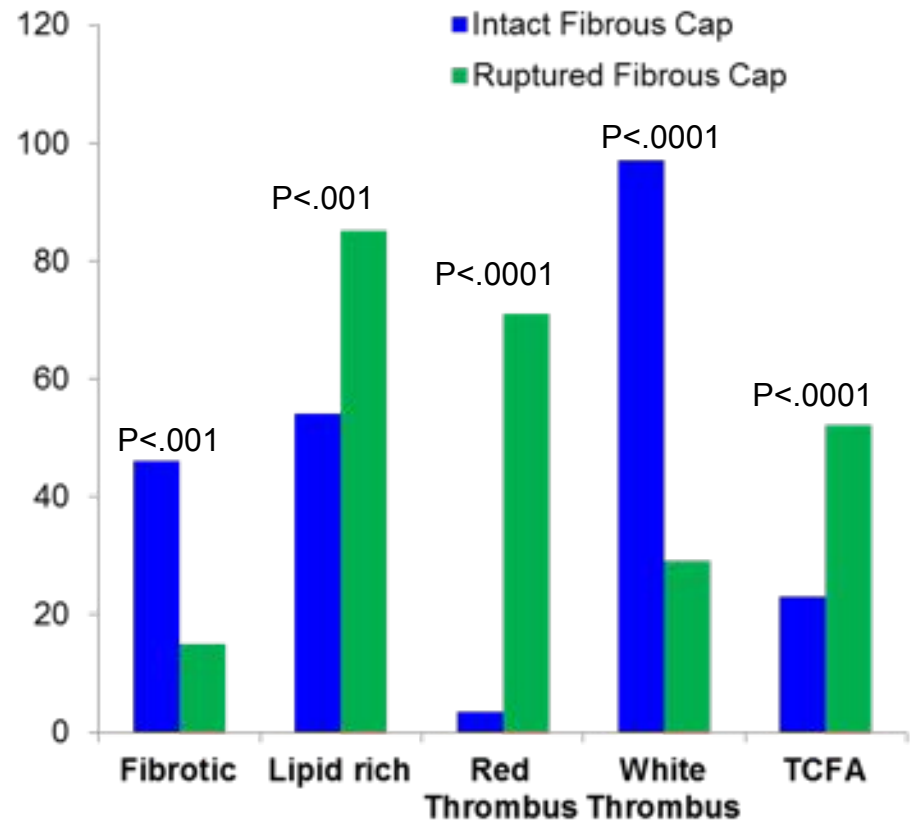
Jia H et al JACC 2013;62:1748-58.

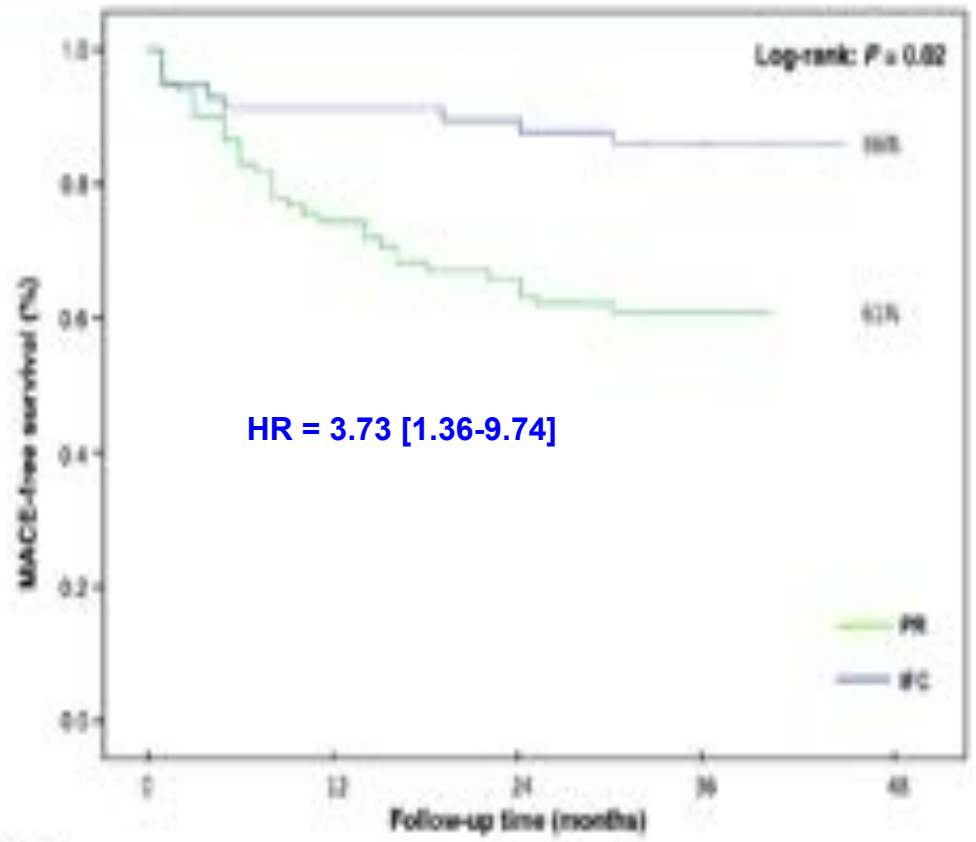
Rupture de plaque vs érosion : un impact pronostique différent



VS

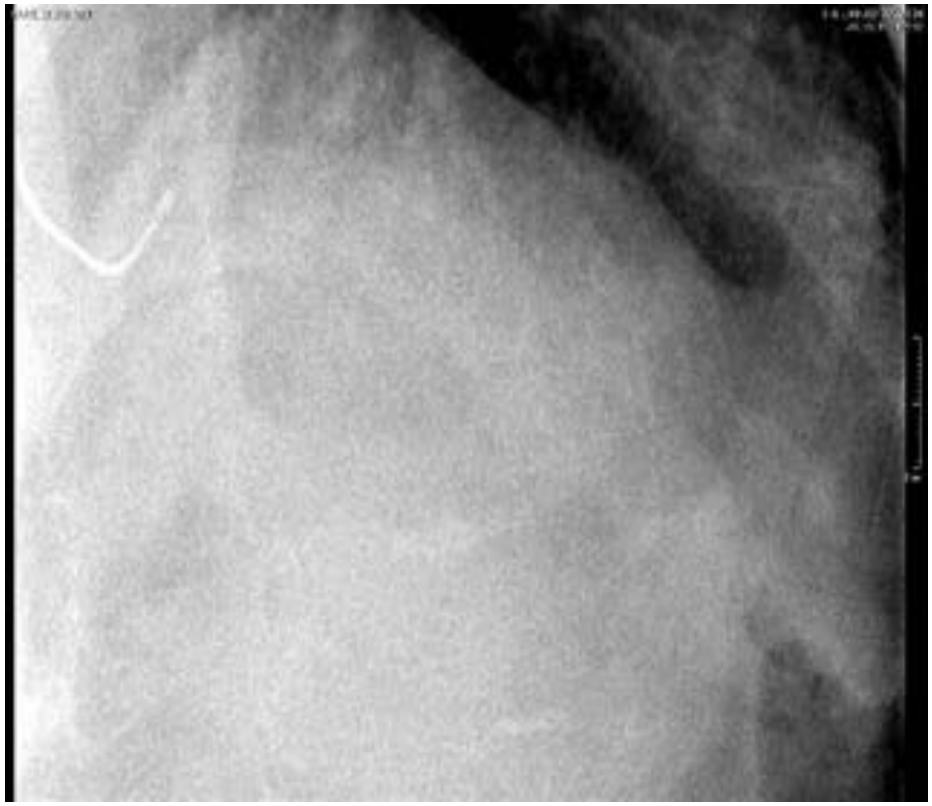


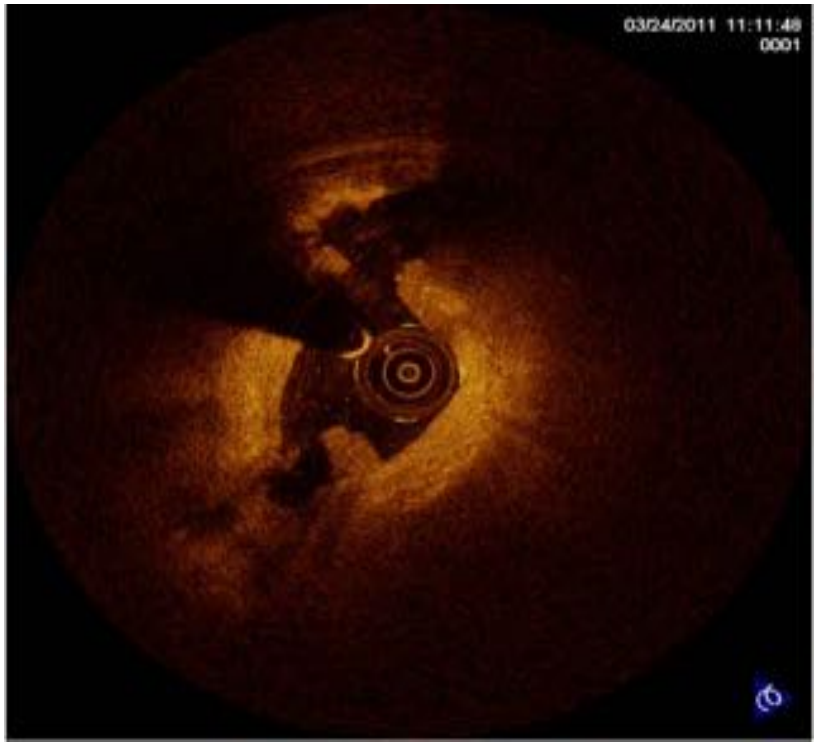




Niccoli G et al. Eur Heart J 2015.

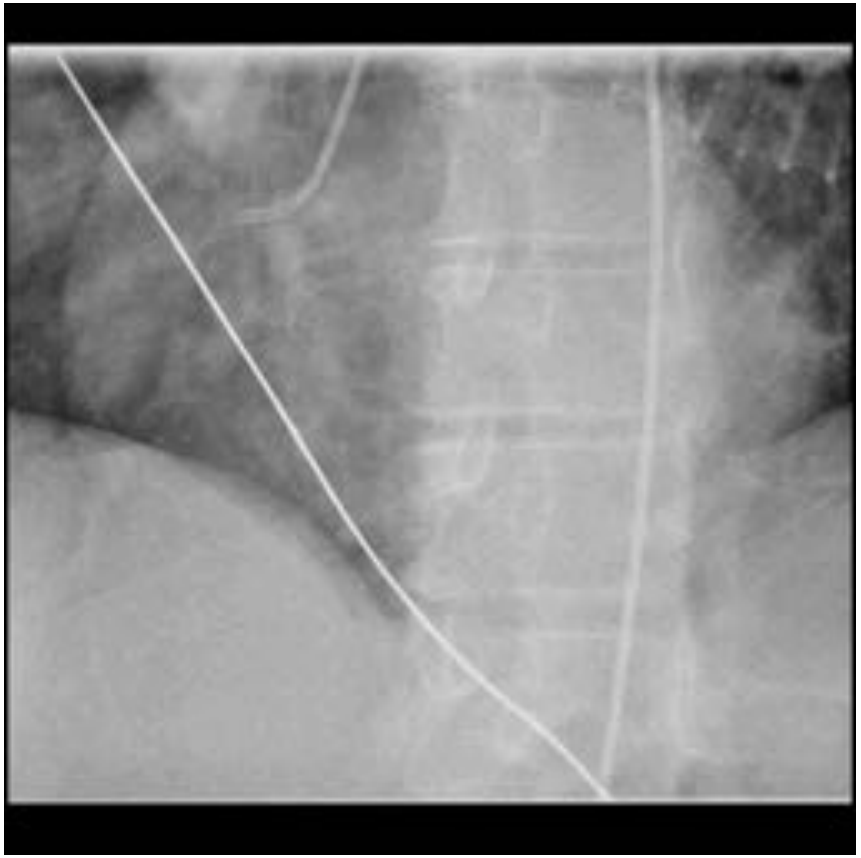
Plaque rupture and subintimal dissection

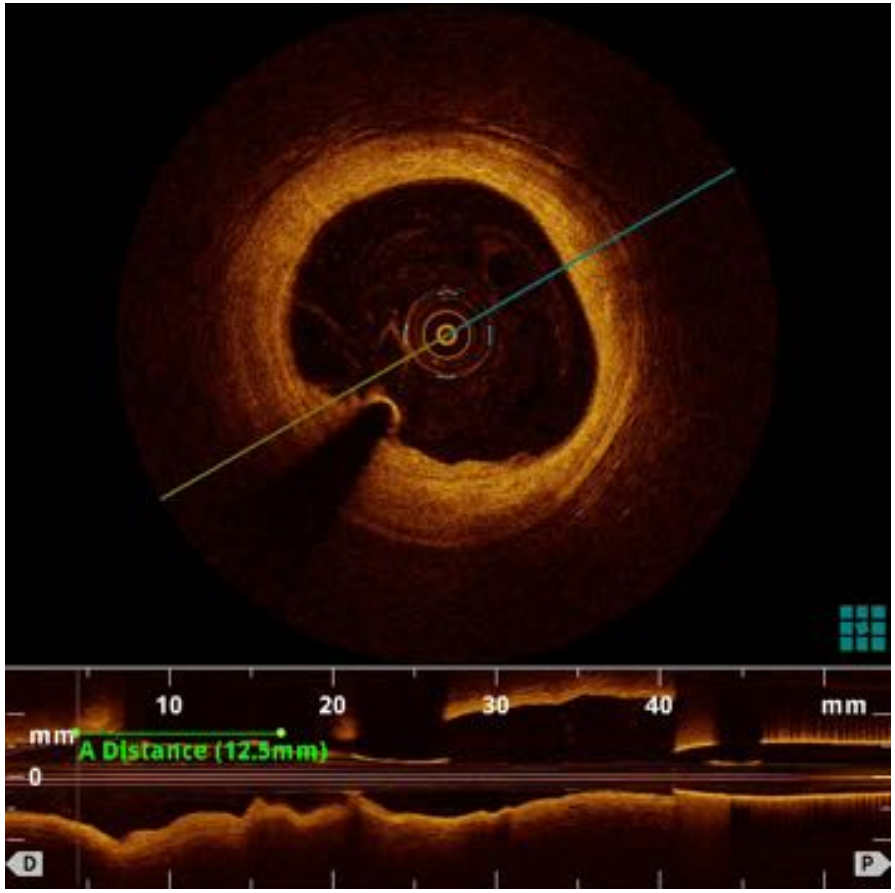




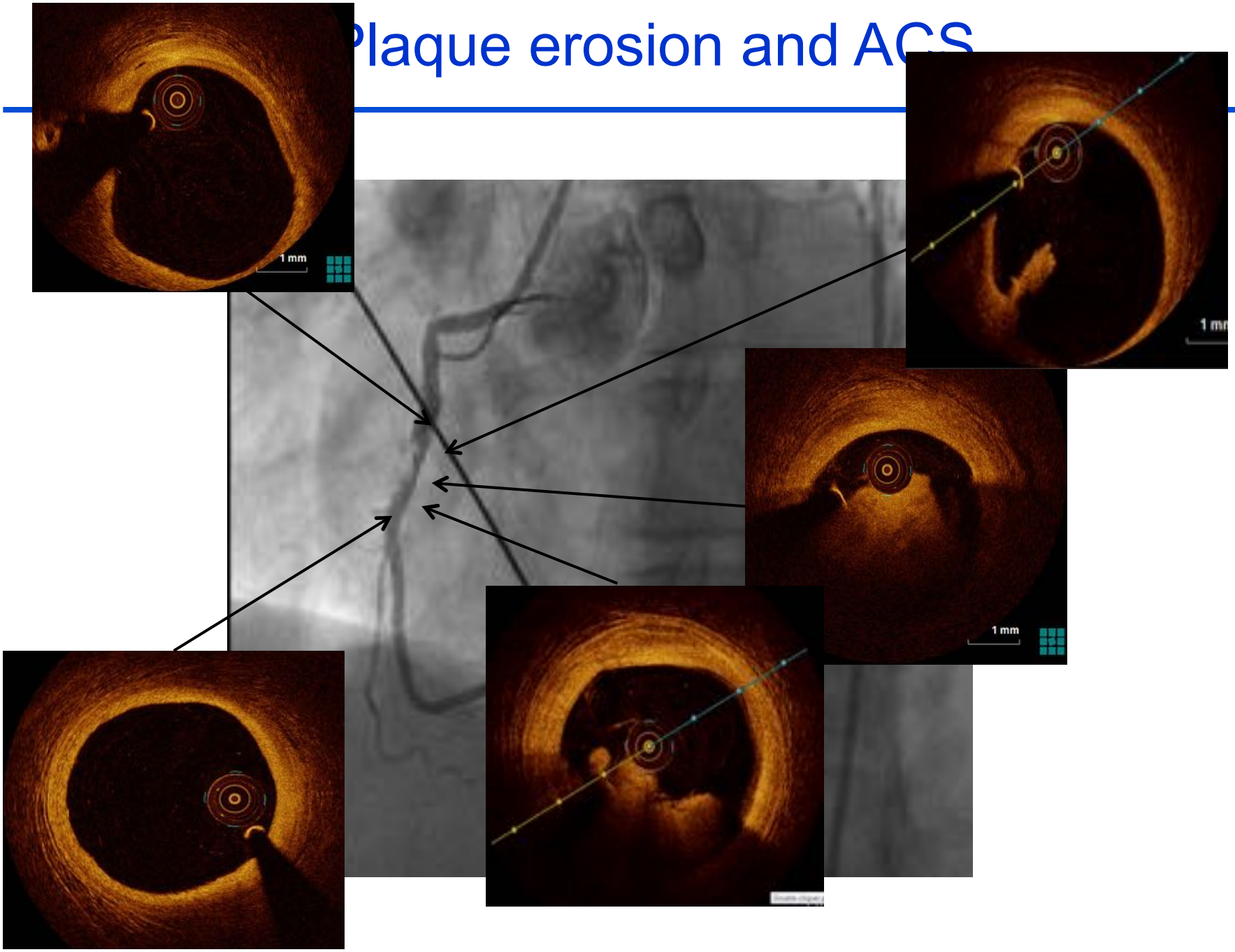
Plaque rupture and subintimal dissection

Plaque erosion and ACS

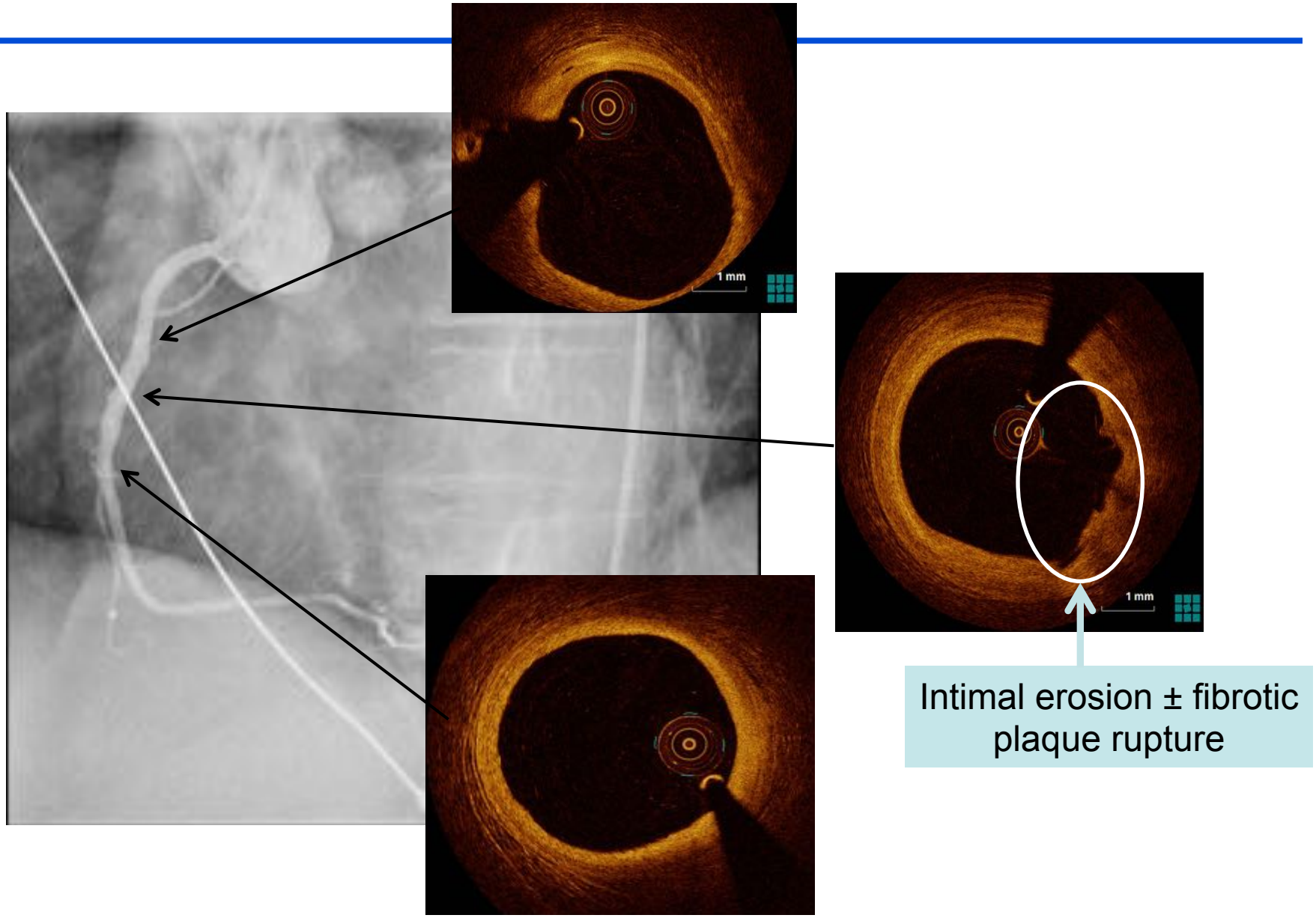




Plaque erosion and ACS

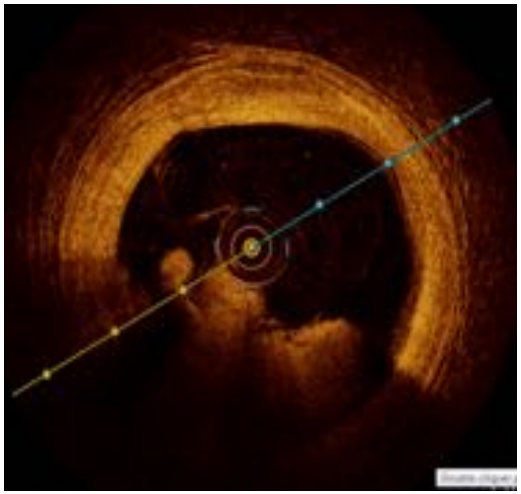


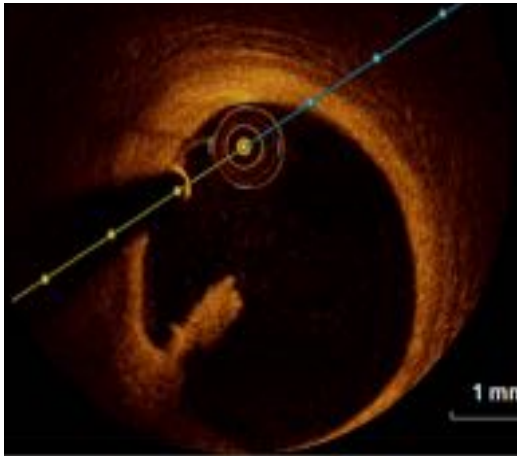
Plaque erosion and ACS

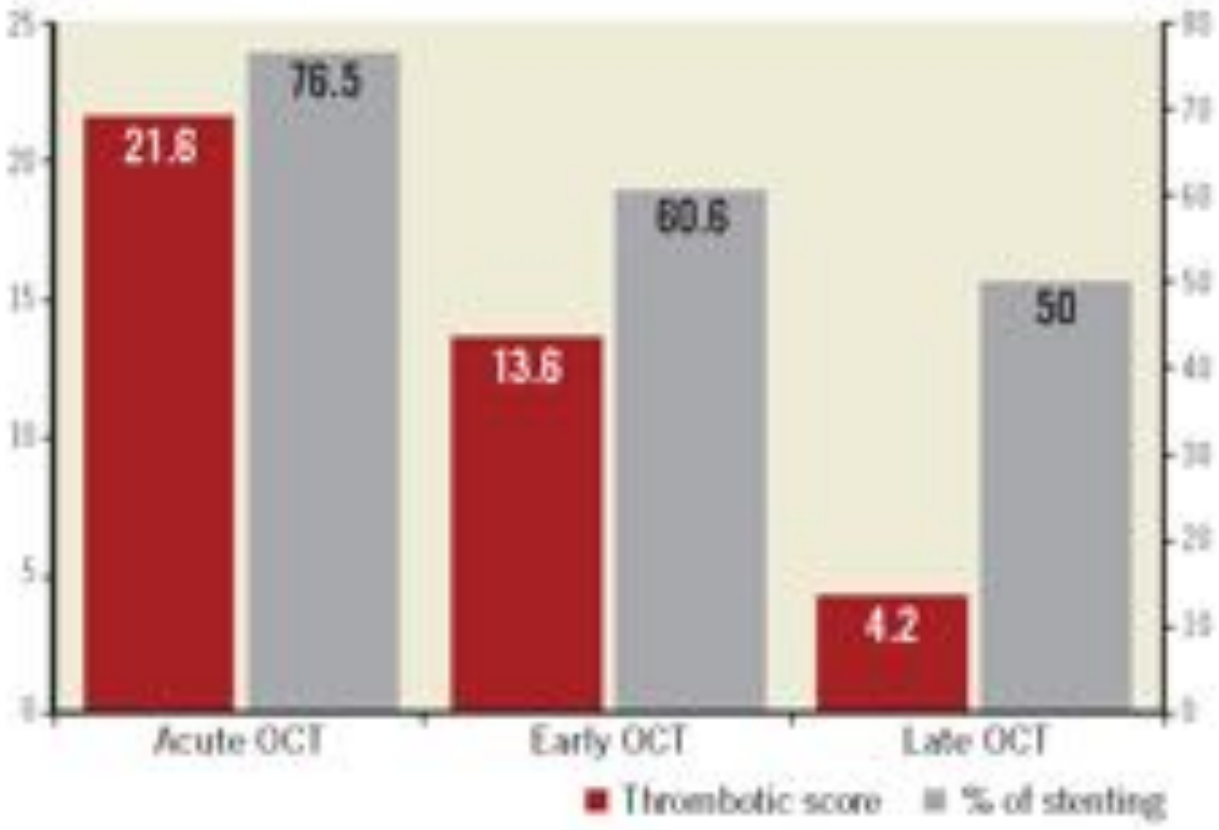


Erosion de plaque vs rupture de plaque : une prise en charge différente

OCT associée à une stratégie plus conservatrice : réduction du taux d'implantation de stents

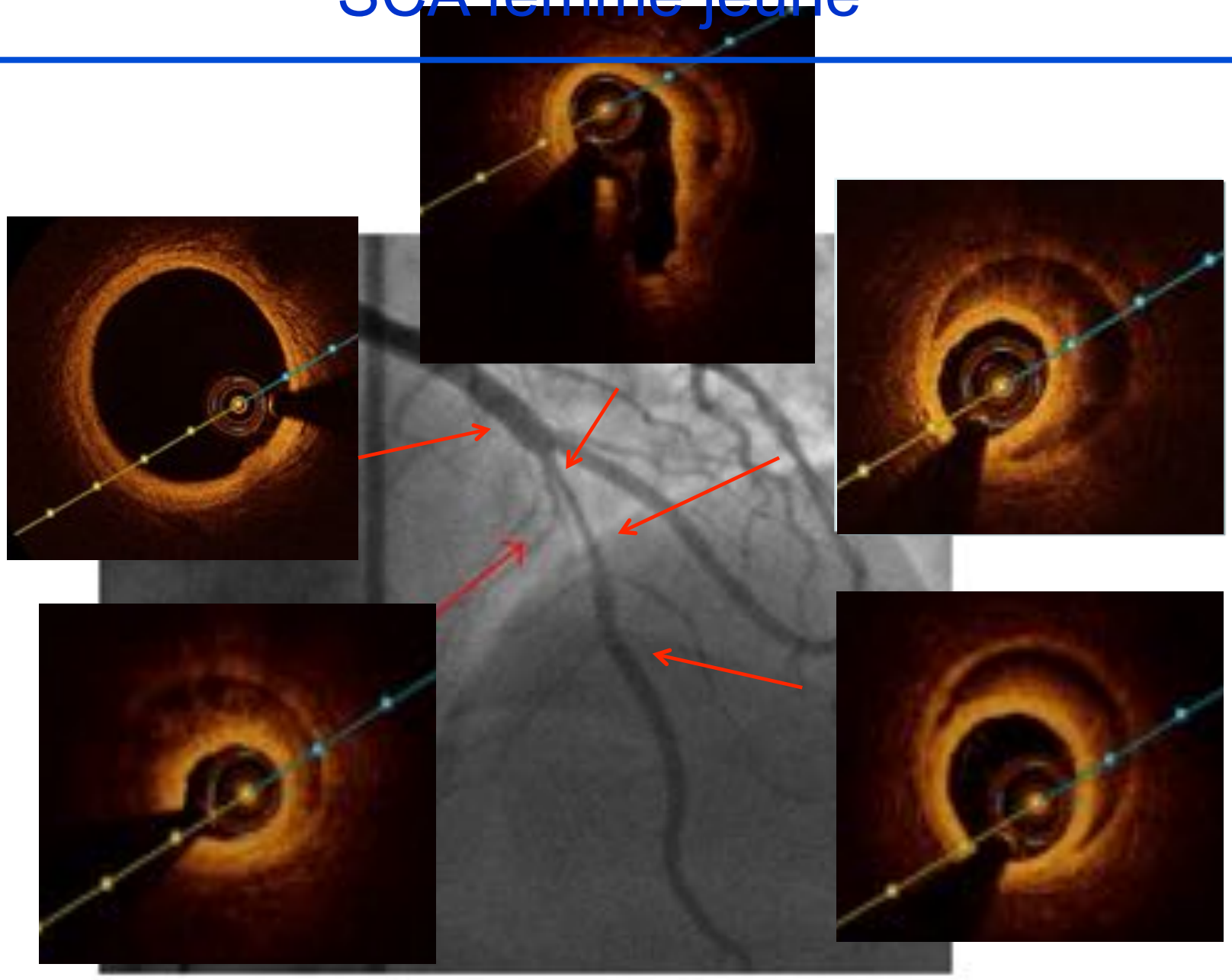




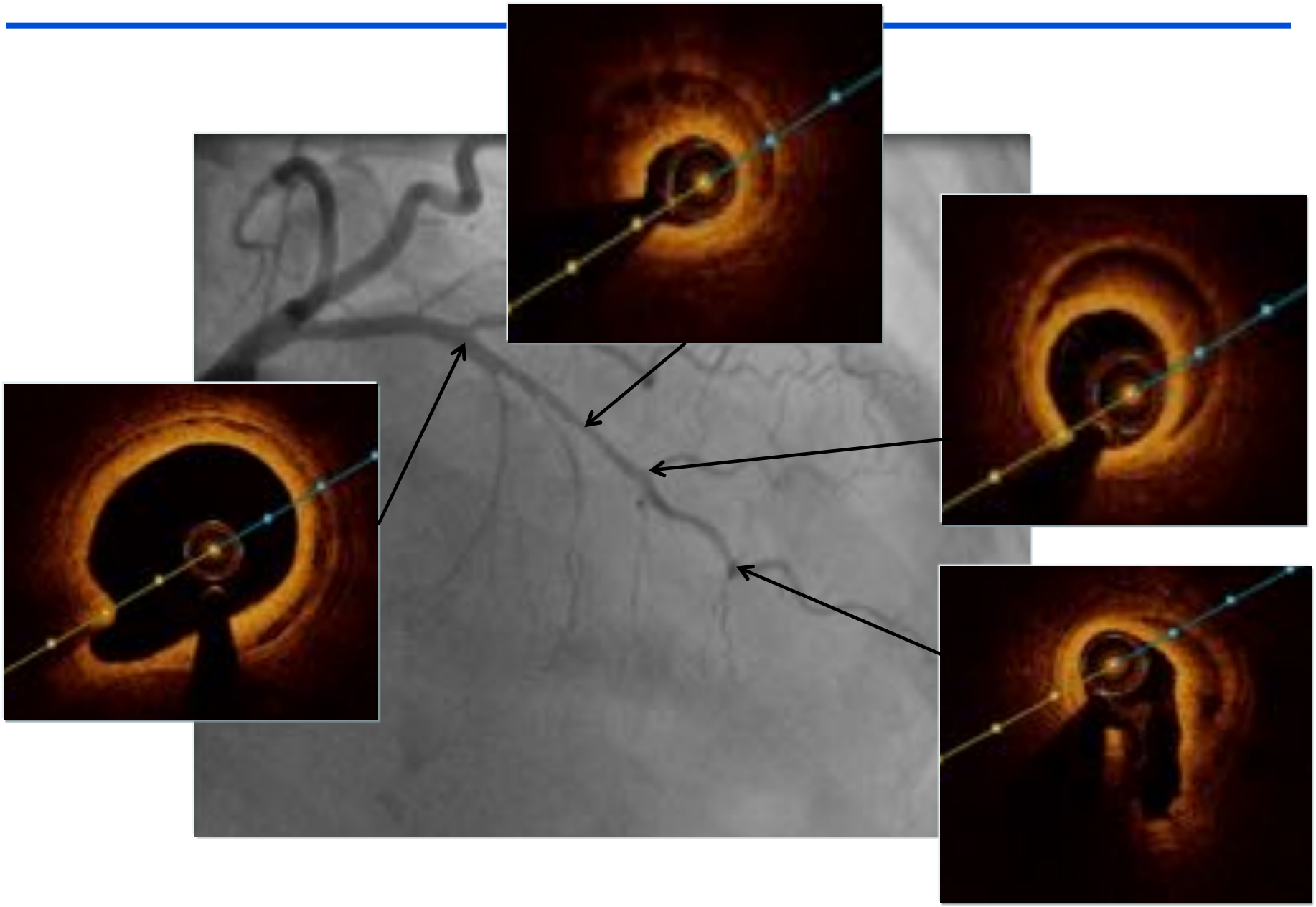


Souteyrand G et al. Eurointervention 2014.
Hammas S et al. In J Cardiol 2015;181:351-352.
Prati F et al. J Am Coll Cardiol Img 2013;6:283–7.

SCA femme jeune

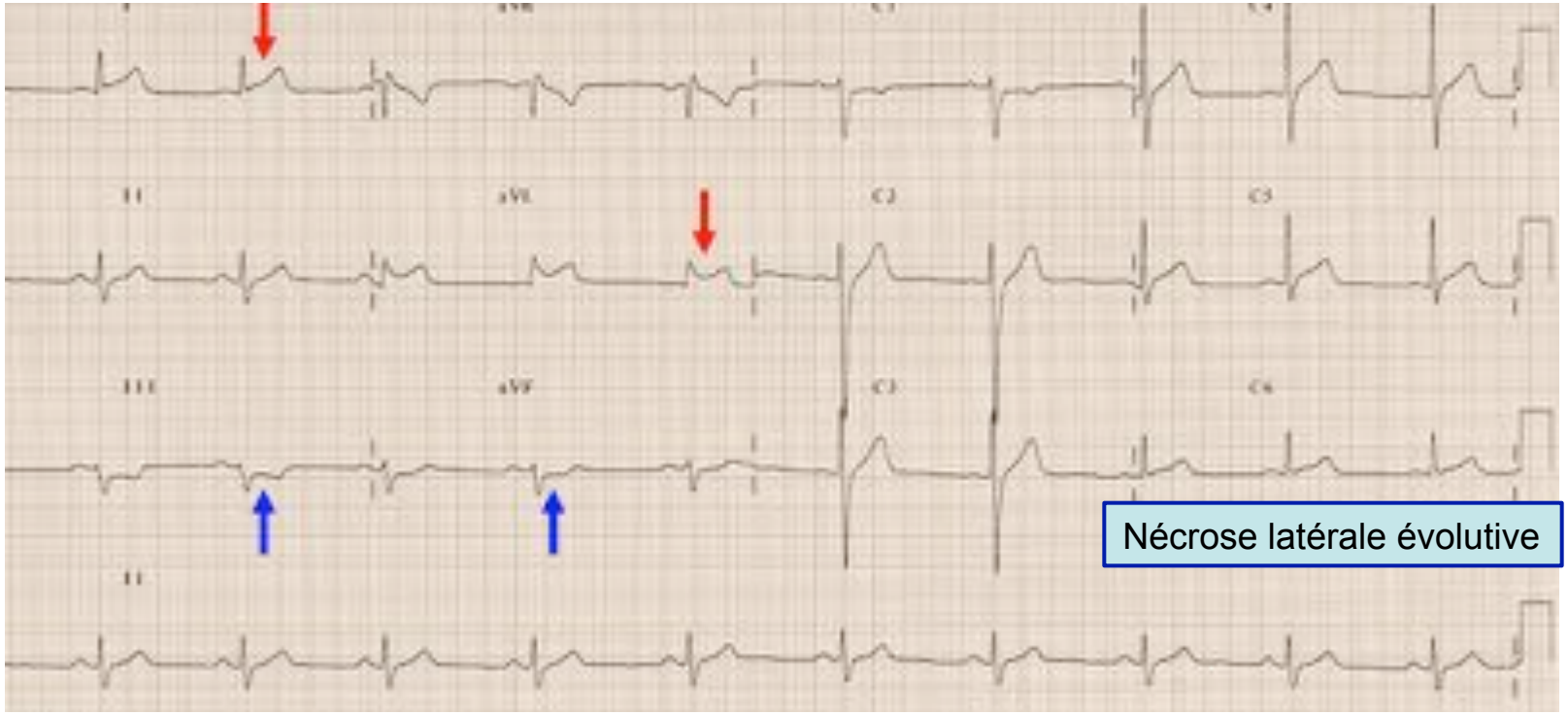


Spontaneous acute coronary dissection



Cas Clinique

- Patient de 41 ans
- FDRCV : tabagisme sevré, ATCD familiaux de cardiopathie ischémique
- Pas d'ATCD personnels
- Douleur thoracique constrictive spontanée sur son lieu de travail
- Épisode identique il y a 8 jours



Angiographie initiale

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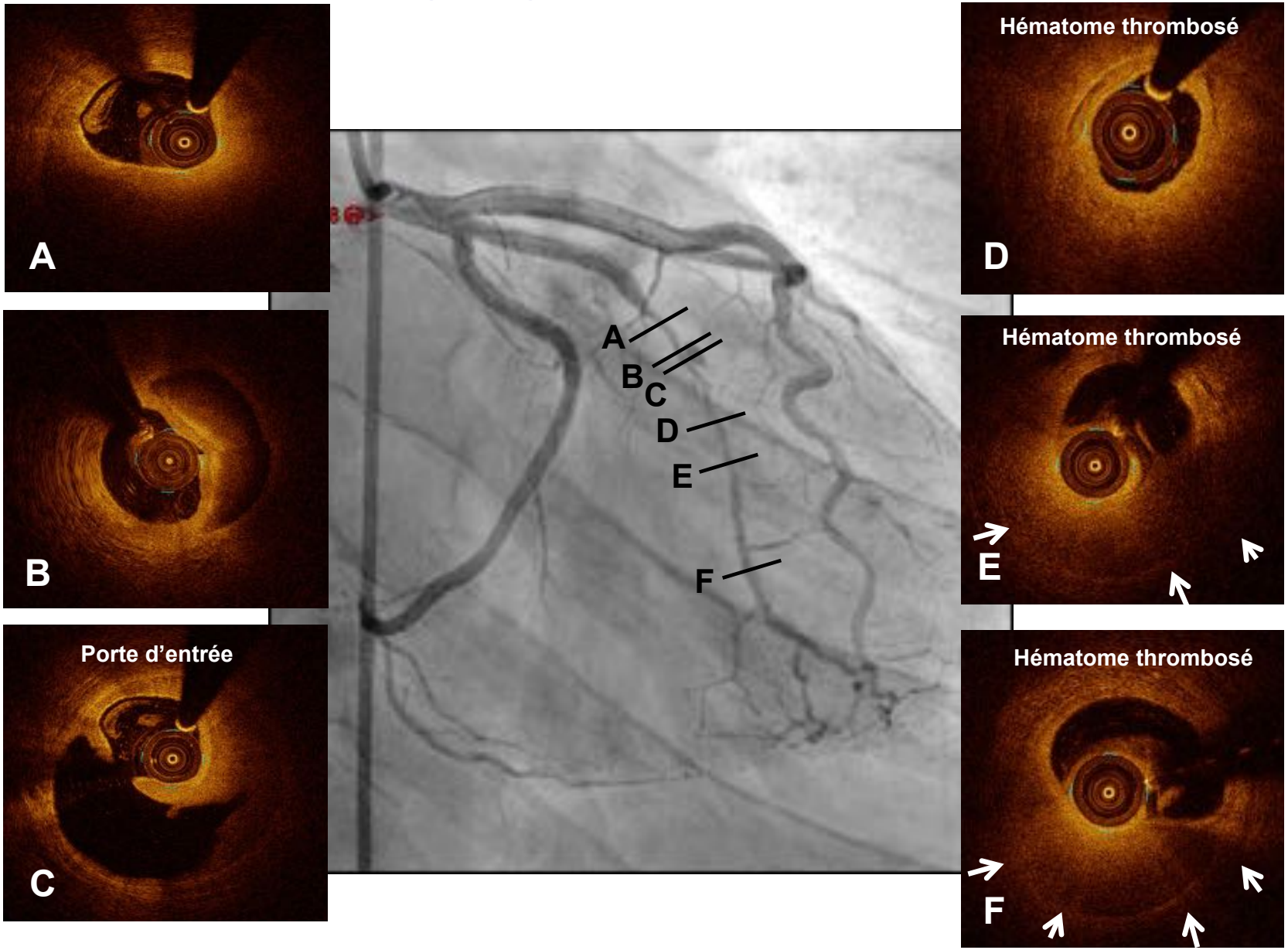
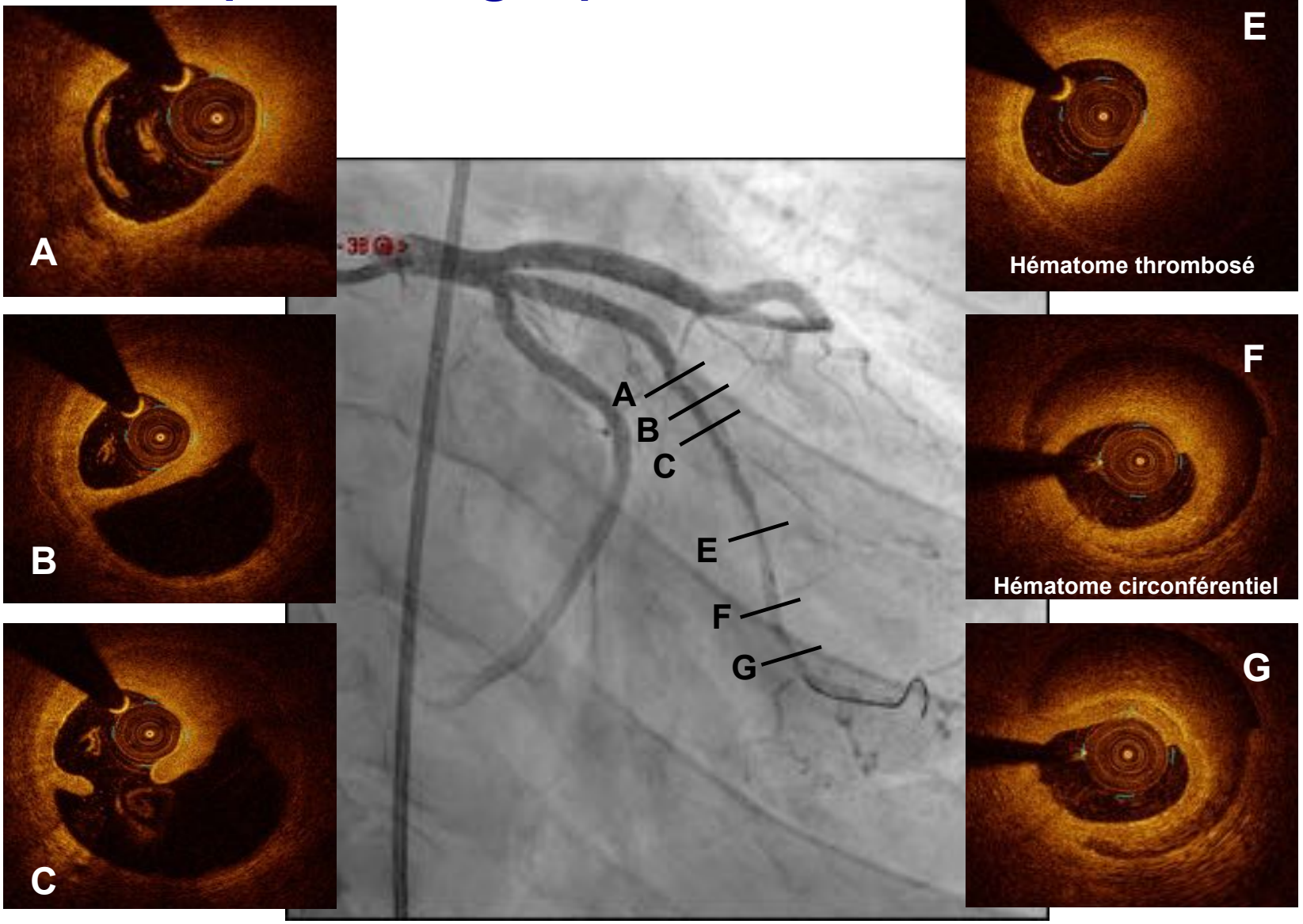


Après angioplastie au ballon

(Emerge Boston® 3.0 X 30 mm)

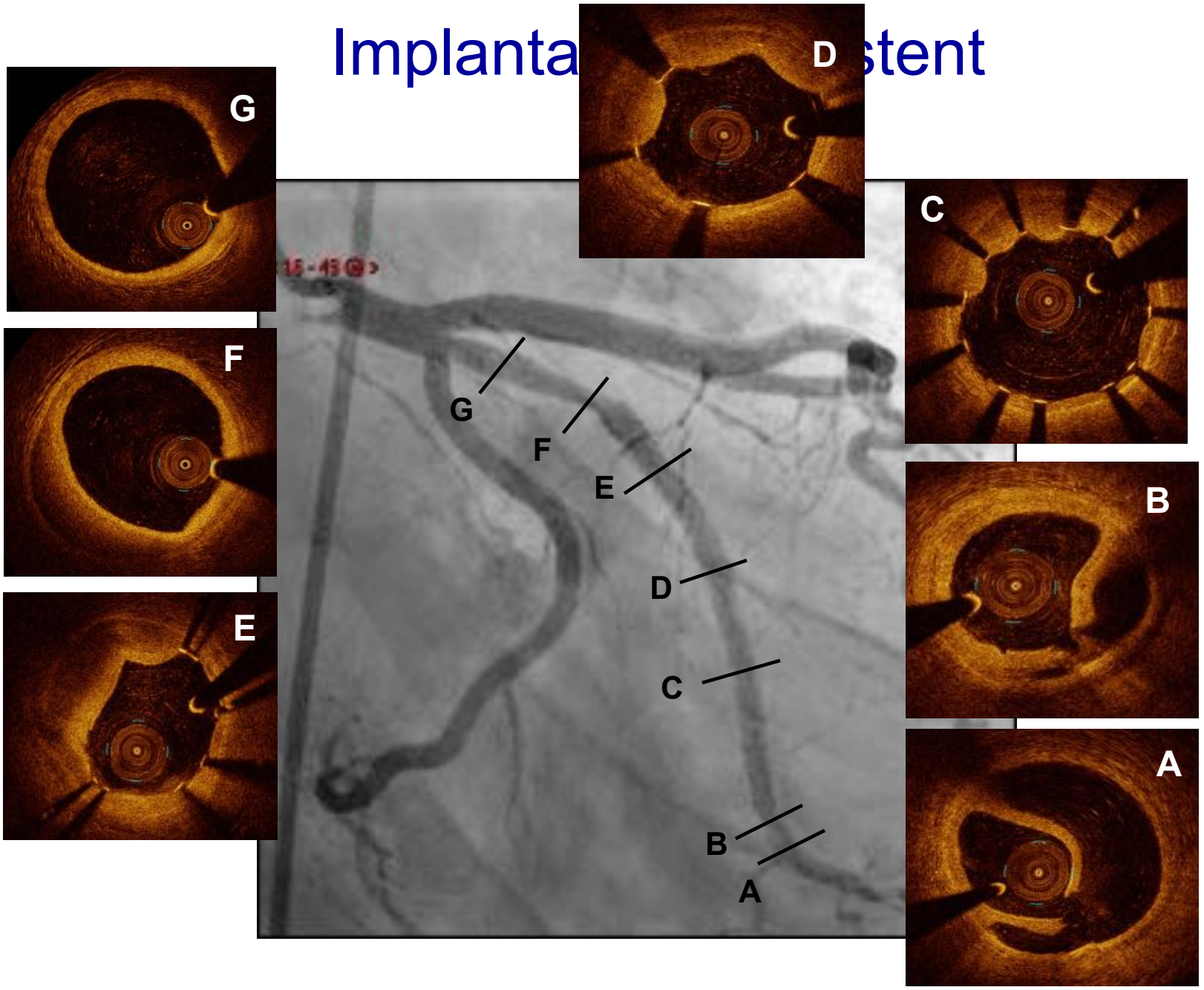
Après angioplastie au ballon



Après implantation de 2 stents

(Promus Premier Boston® 3.0 X 28 mm et 3.5 X 20 mm)

Implanta stent

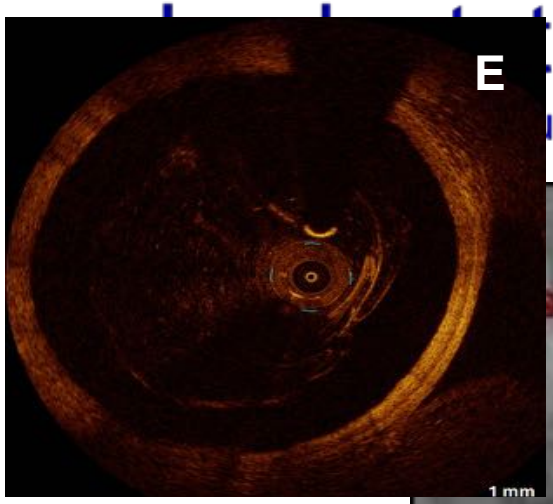


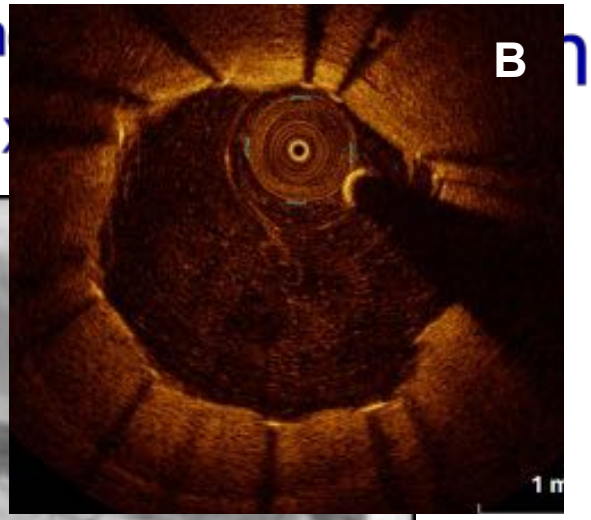
Implantation d'un 3ème stent proximal….

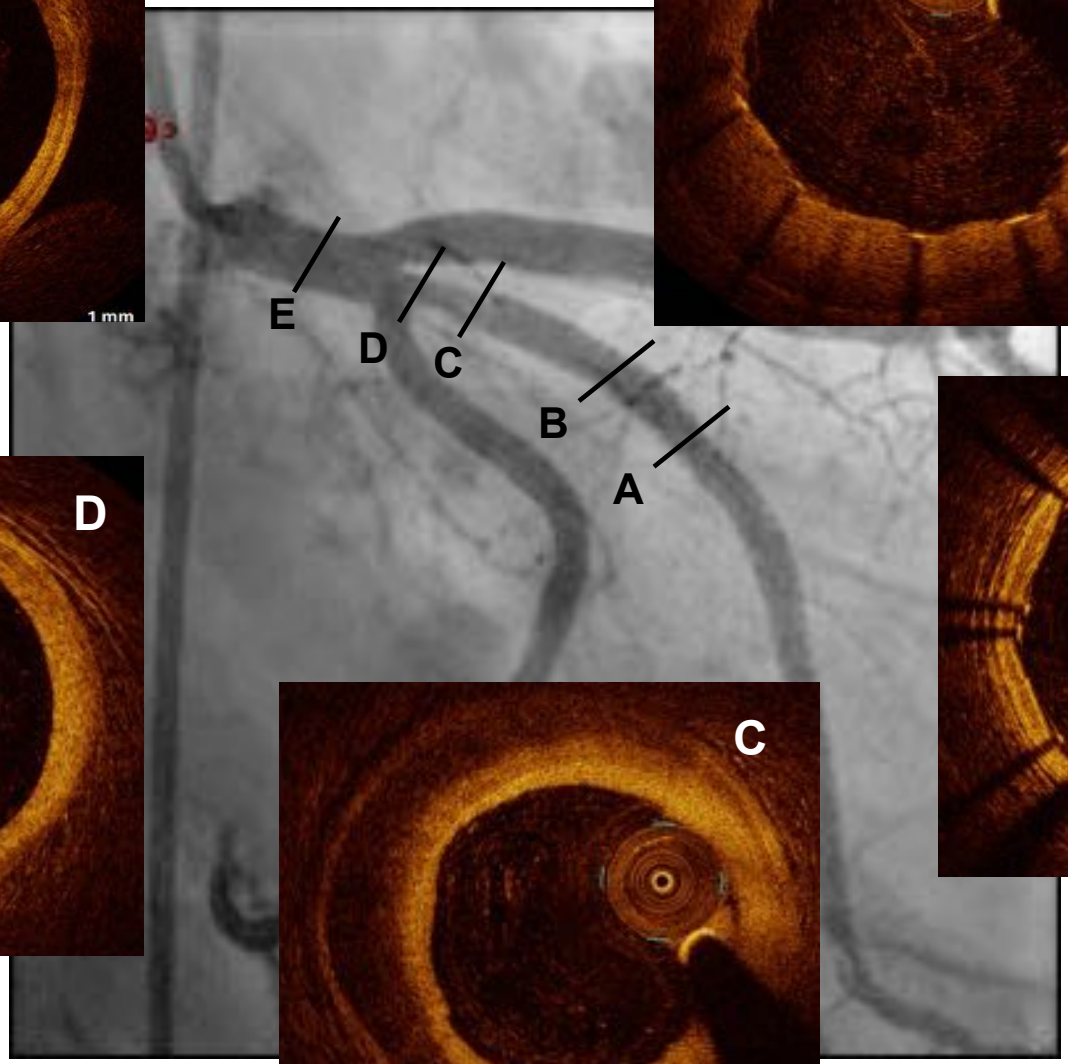
(Promus Premier Boston® 3.0 X 28 mm et 3.5 X 20 mm)

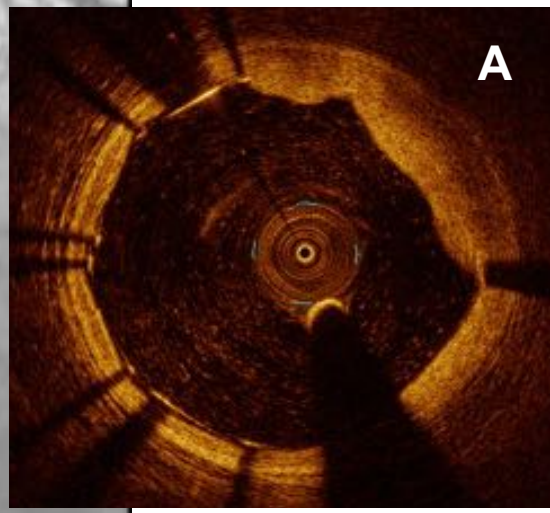
…tion d'un 3ème …nal….

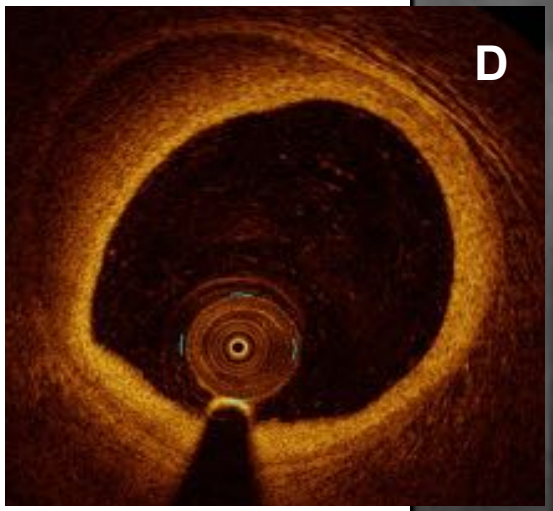
…s Premier Boston® 3.0 …

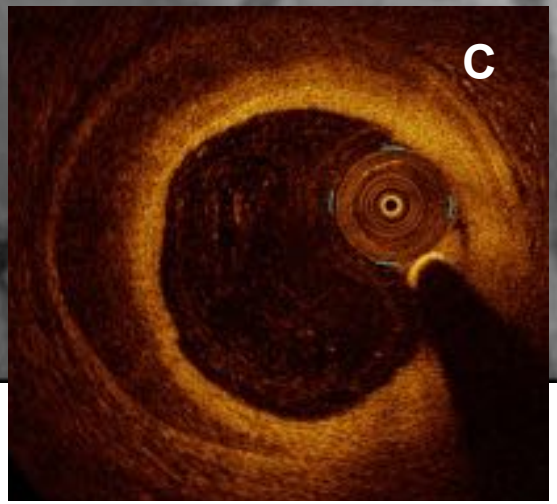










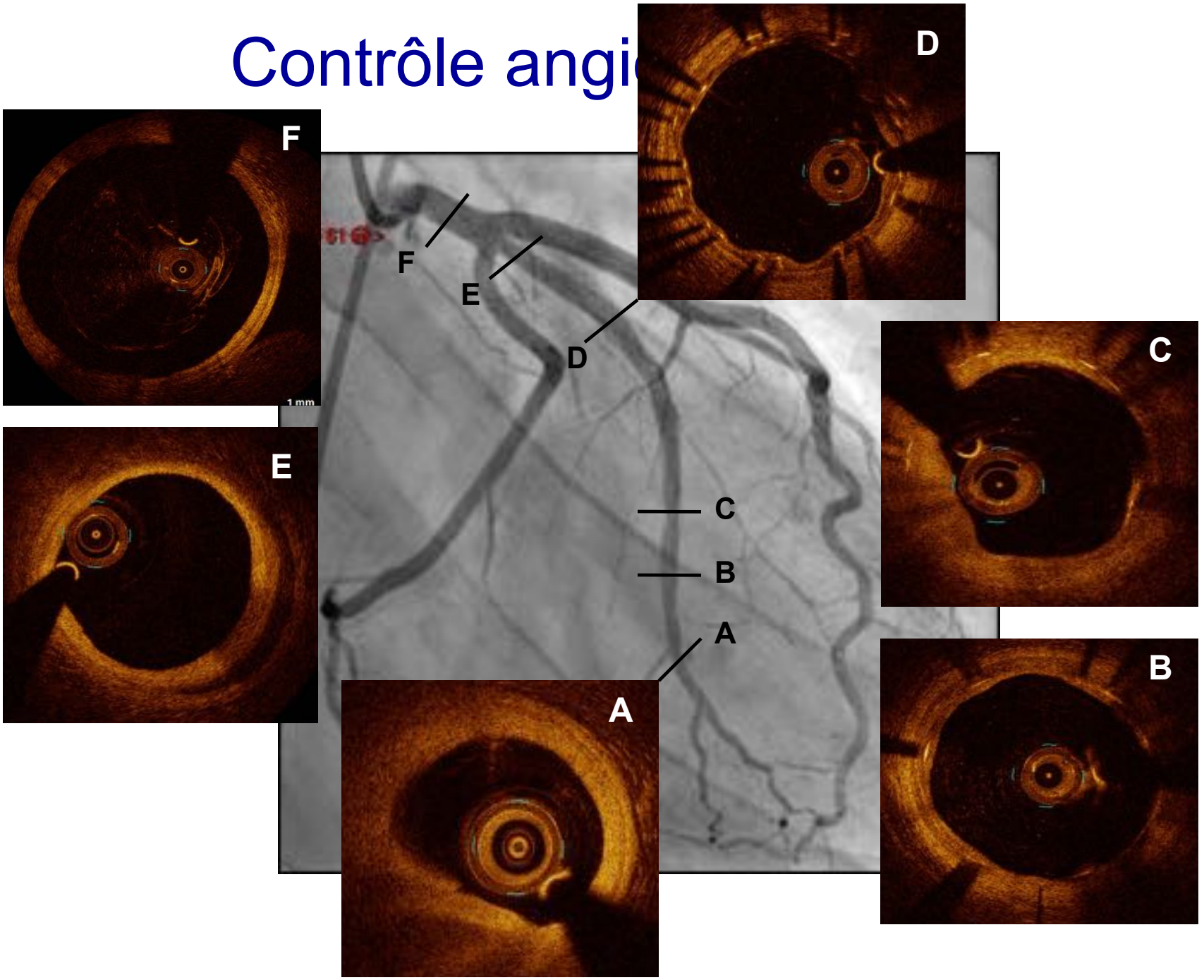


Cas Clinique

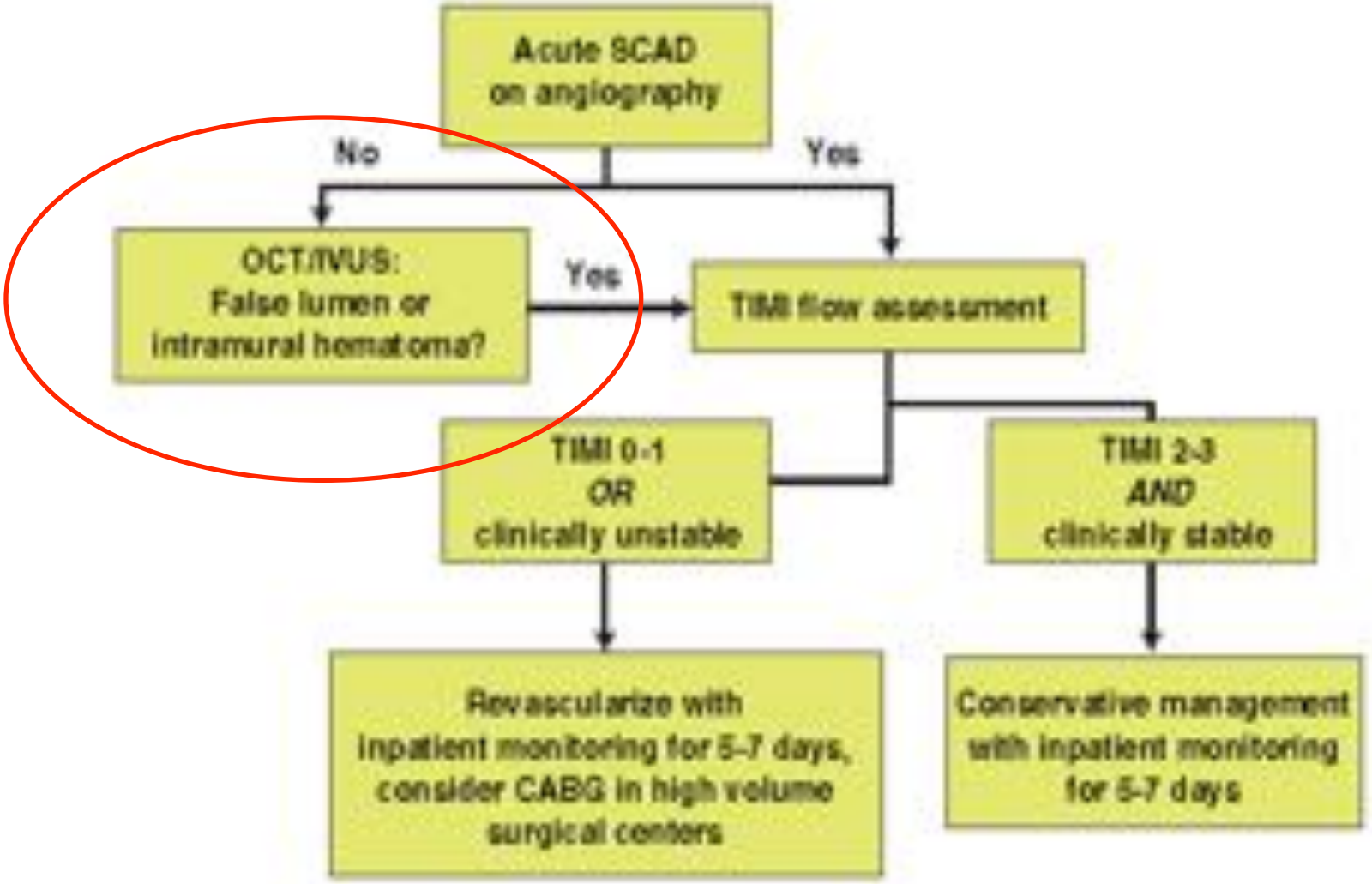
- Evolution simple
- Surveillance 4 jours en USIC
- Pic tropo : 9 µg/L (Nle = 0,04µg/L)
- FEVG : 68% sans trouble de la cinétique segmentaire
- Traitement de sortie :
    - Kardégic 75 mg/j
    - Clopidogrel 75 mg/j (VASP 35%)
    - Acébutolol 200 mg X 2/j
    - Atorvastatine 80 mg/j
    - Périndopril 4 mg/j

Contrôle angio à 2 mois

Contrôle angi



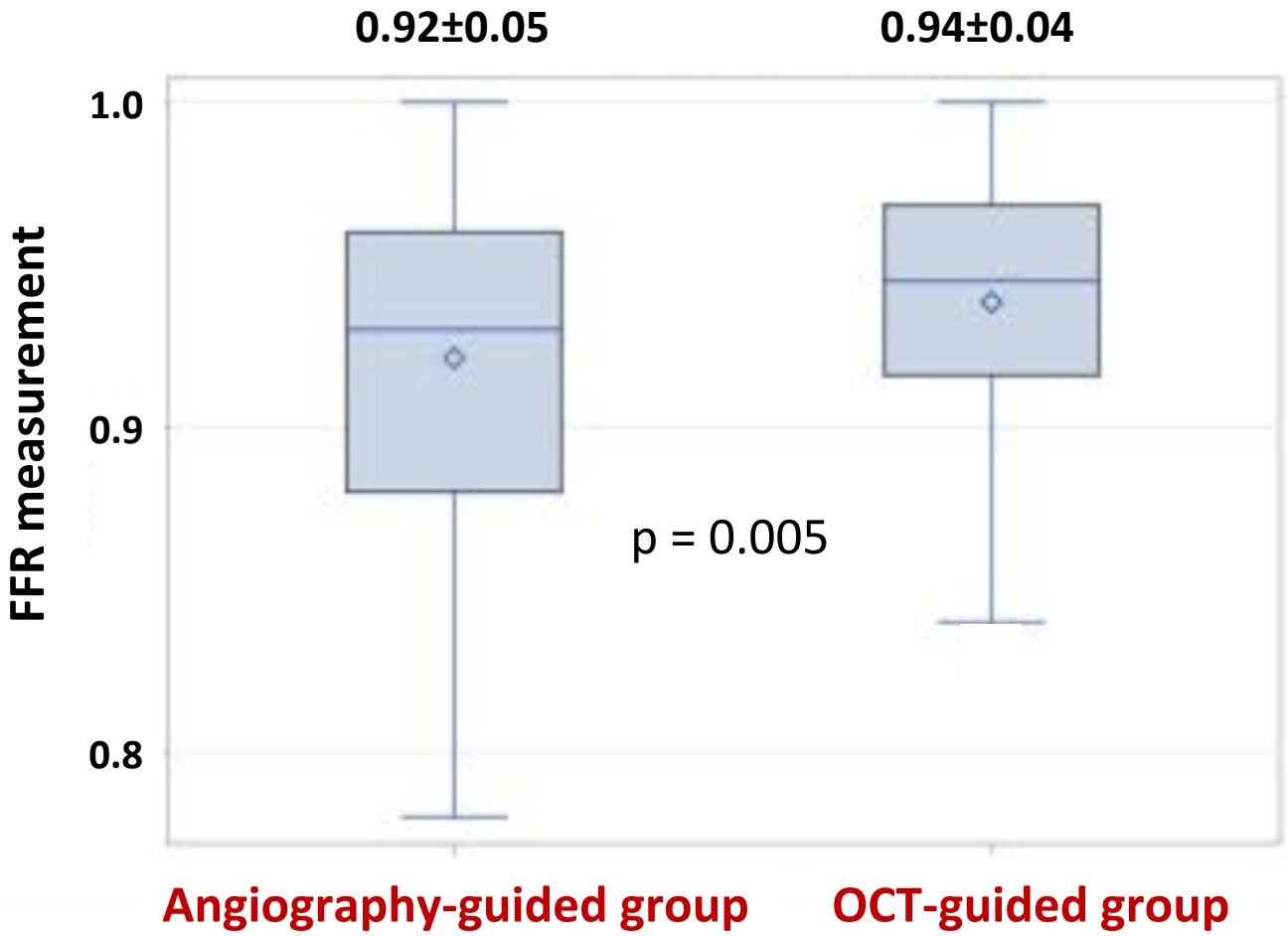
SCAD management



Saw J et al. J Am Coll Cardiol 2016;68:297–312.
Tweet MS et al. J Am Coll Cardiol Img 2016;9:436–50.

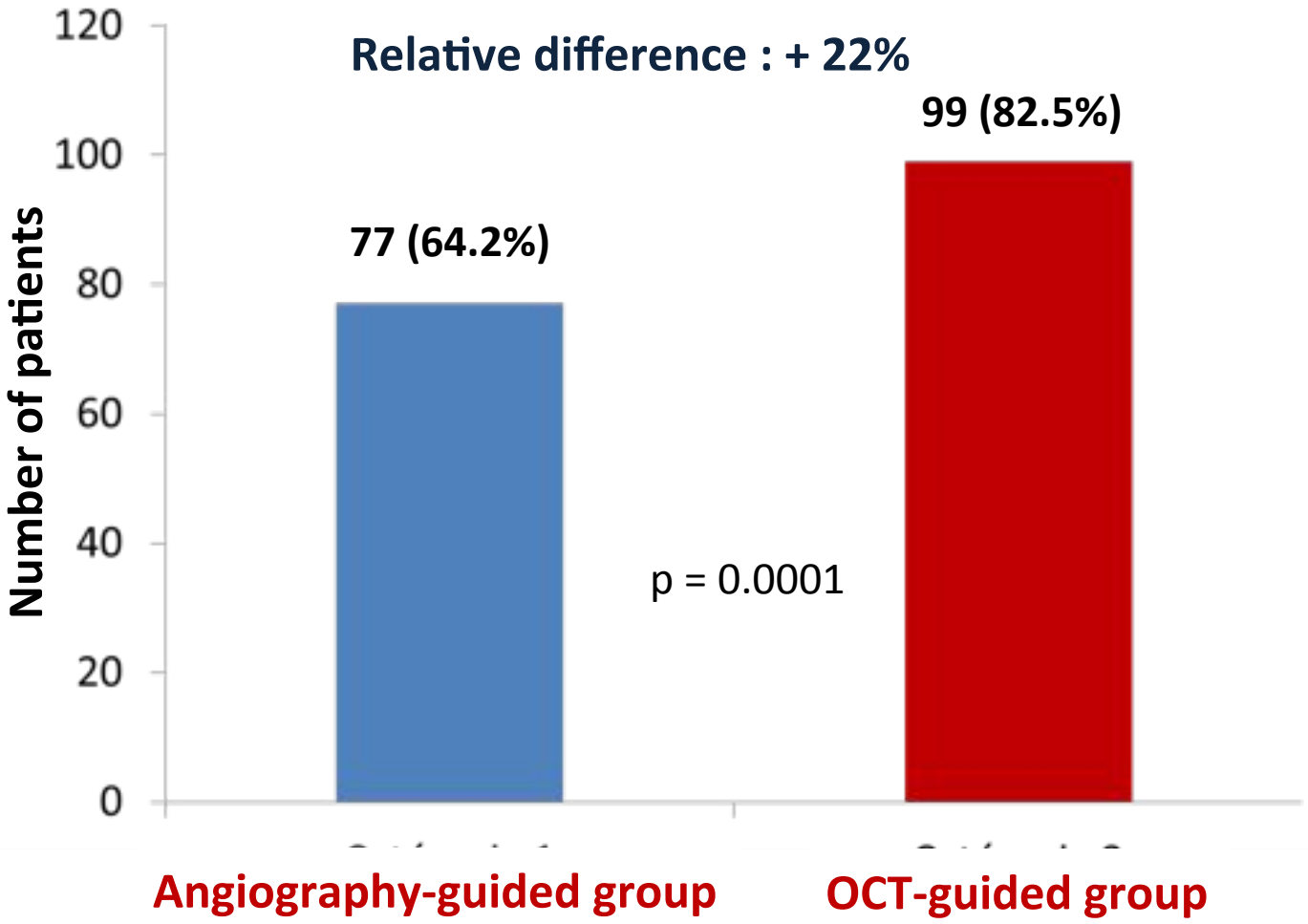
OCT et SCA : optimiser l'angioplastie

Etude DOCTORS



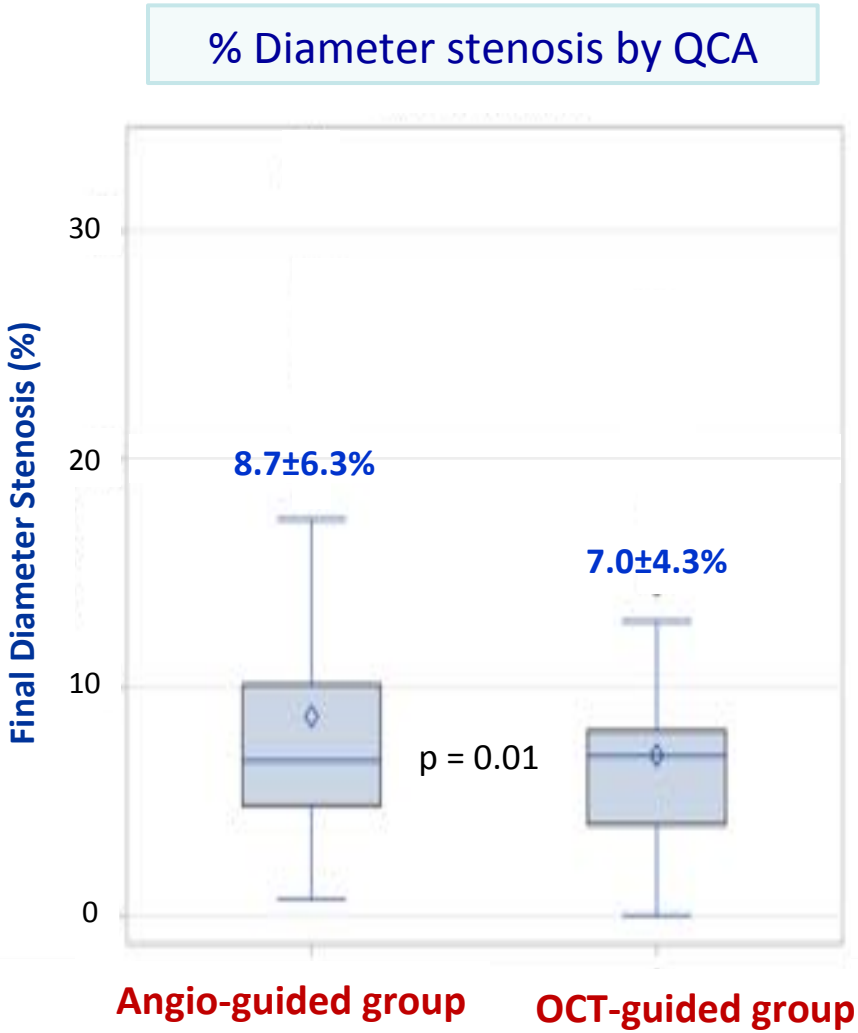
Meneveau N et al. Circulation 2016;134:906-17.

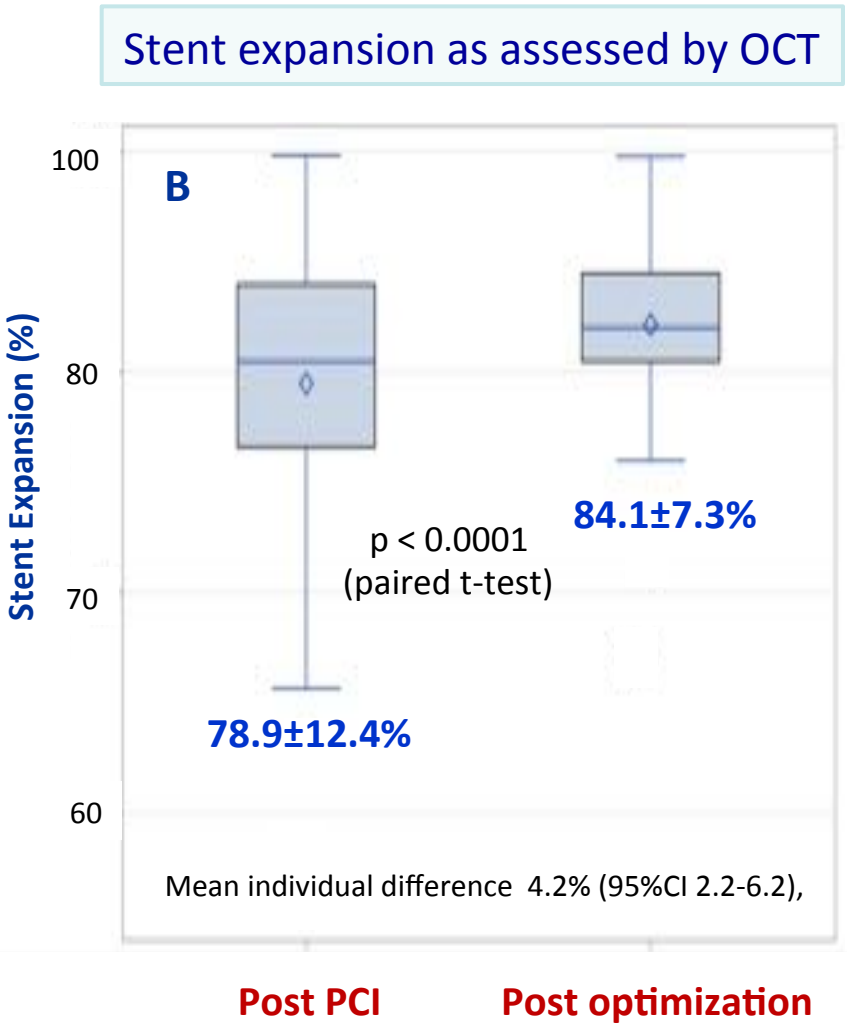
Number of Patients with post-PCI FFR > 0.90



Meneveau N et al. Circulation 2016;134:906-17.

OCT et SCA : 42% de sous déploiement des stent





Dans quelles situations utiliser l'OCT en pratique quotidienne ?

Les situations dans lesquelles l'OCT est utile :

- Syndromes coronaires aigus
- Resténose intrastent

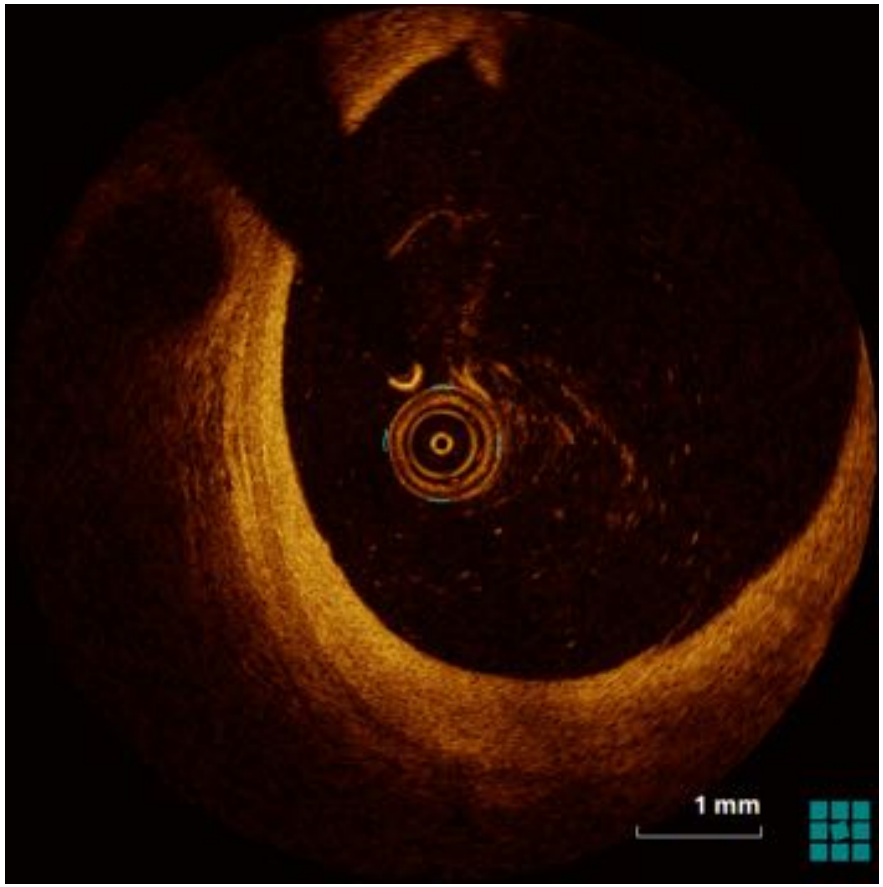
Les situations dans lesquelles l'OCT est recommandée :

- Thromboses de stent
- Angioplastie des lésions du TC

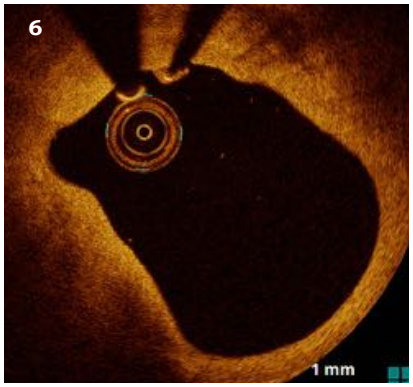
Cas clinique

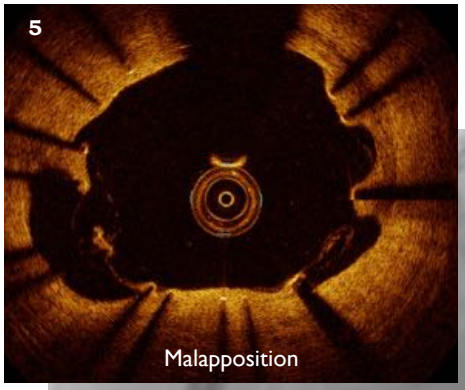
- ♂ 47 ans
- FDRCV : HTA, HCT, obésité
- ATCD : SCA 2012, avec mise en place d'un stent conventionnel en CD_2
- Manifestations dyspnéiques avec pesanteur rétro-sternale
- Scintigraphie : défaut de fixation inféro-latéral 12%

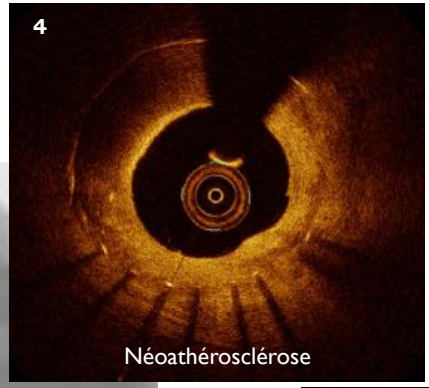
Coro et OCT initiales

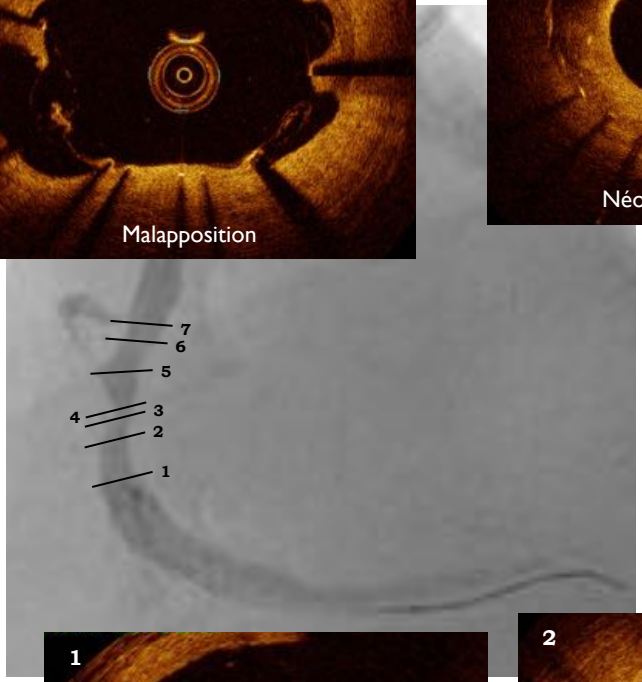


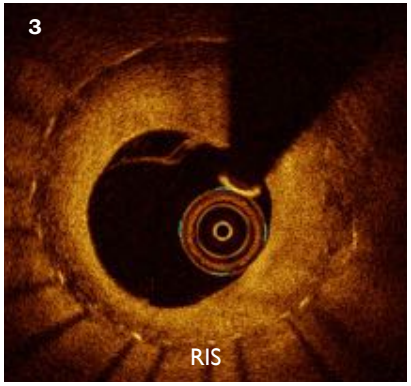
OCT findings

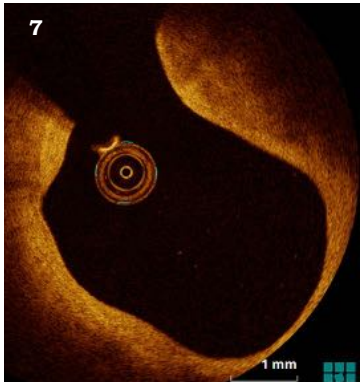


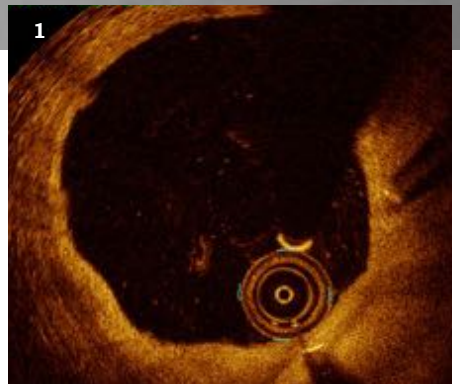


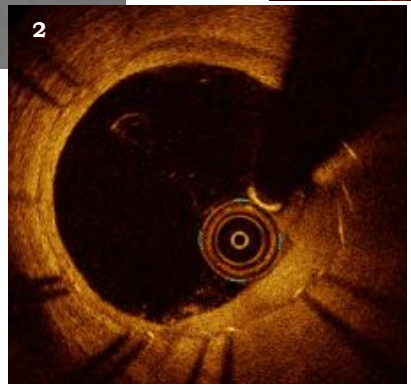




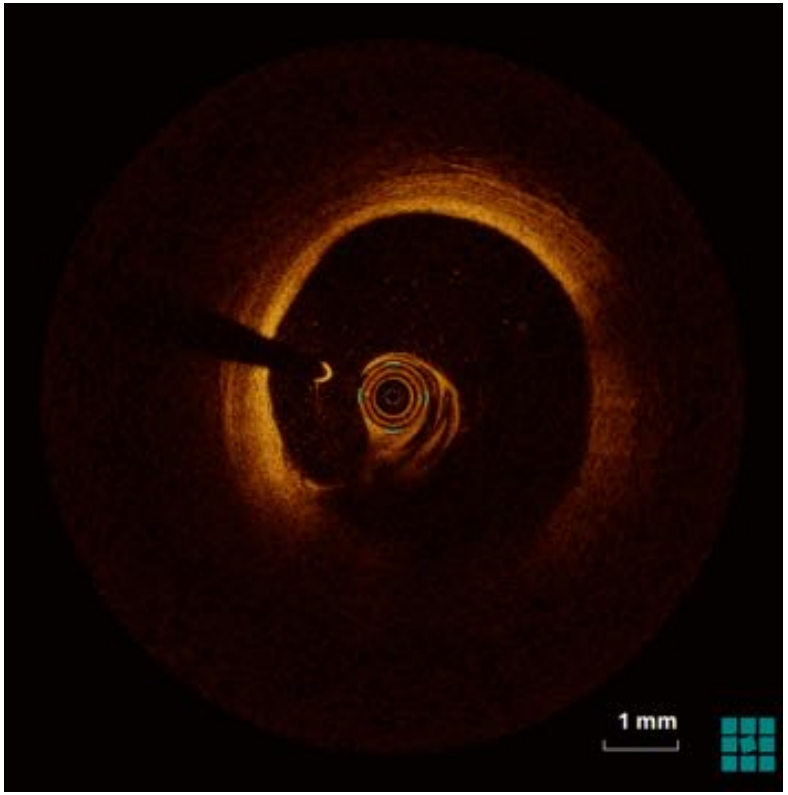




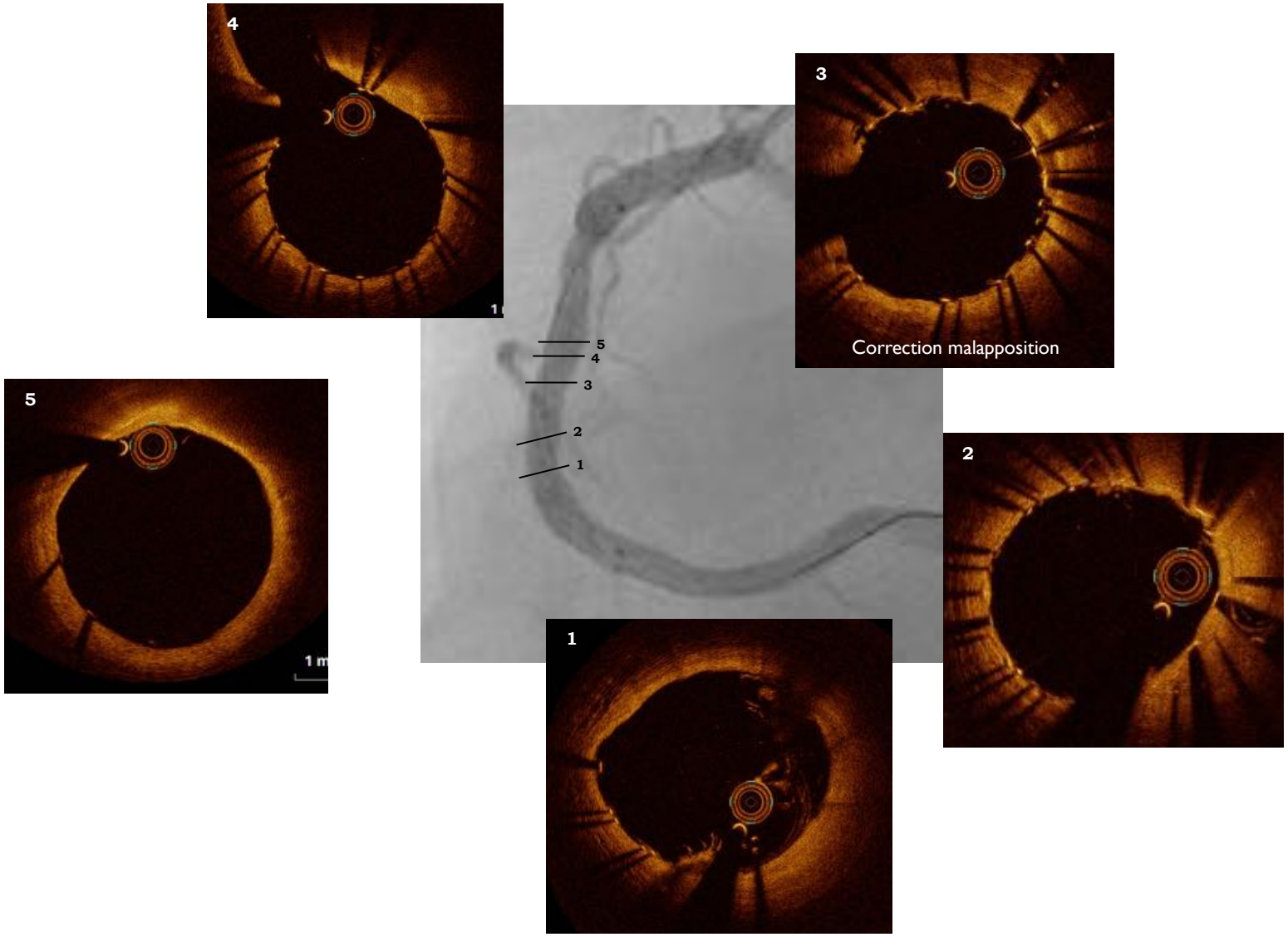




Coro et OCT post-DES 4.0 x 20 mm



Résultat final post-DES 4.0 x 20 mm



OCT for guidance in stent failure

Provides crucial informations in identifying mechanisms of stent failure

In stent restenosis :

- OCT may identify :
  - sent underexpansion
  - fracture
  - incomplete lesion coverage
  - neointimal proliferation
  - neoatherosclerosis
  - progression at edges

Appropriate management according to identified abnormality

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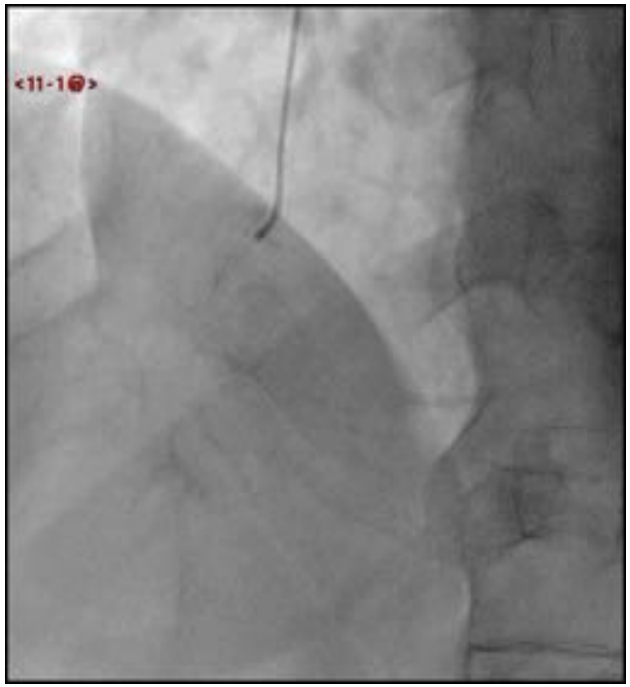
OCT et Thrombose de stent

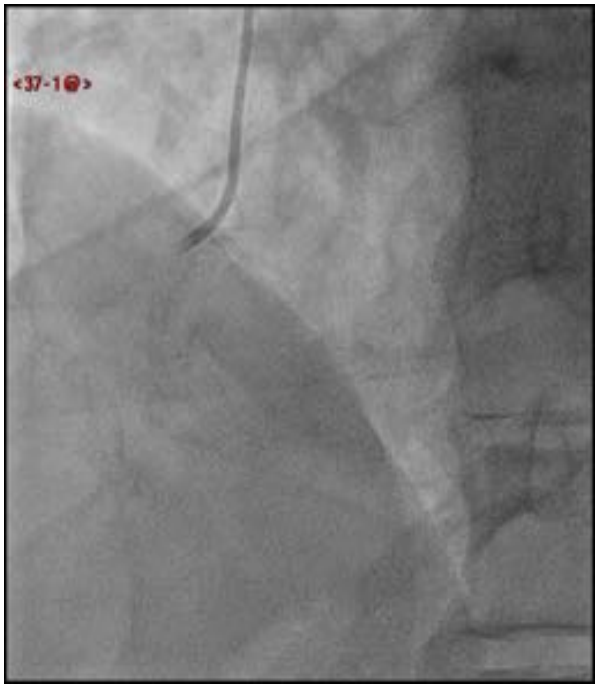
- ♂ né le 20/03/1943
- FDRCV : hypercholestérolémie
- ATCD : thyroïdectomie, lithiases urinaires, épisodes dépressifs
- Cardiopathie ischémique depuis Avril 2015 : ST^+ inférieur, atteinte tritronculaire. 3 BMS 3.0 mm sur CD3 et CD2 puis angioplastie à 1 mois du réseau gauche (1 DES IVA et 1 DES CX)
- Décembre 2016, récidive ST^+ inférieur : occlusion thrombotique CD, thromboaspiration + implantation DES 3.5 mm CD2
- Contrôle OCT à 15 jours

SCA ST + Avril 2015



Occlusion CD2

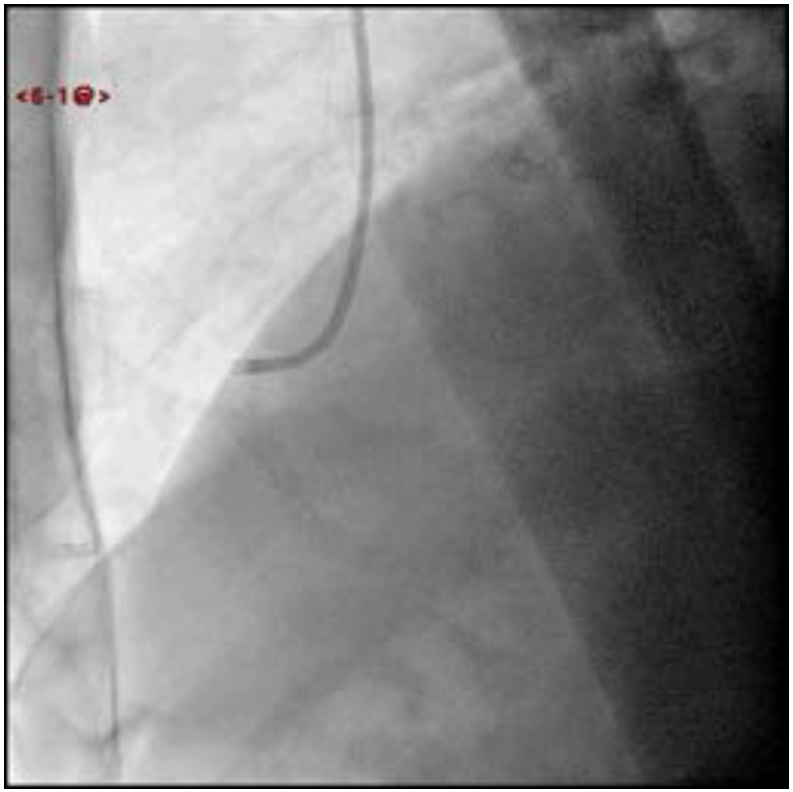
Thromboaspiration +
anti GPIIbIIIa + ballon



3 stents 3.0 mm
32 mm

Récidive SCA ST + Décembre 2016

Arrêt ticagrelor en avril 2016 après 12 mois

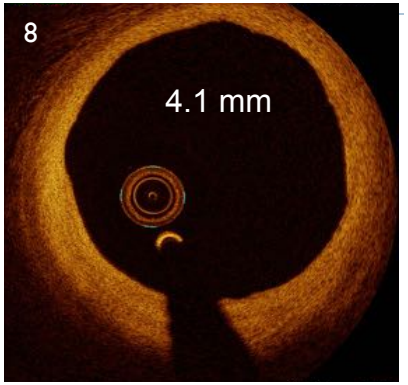


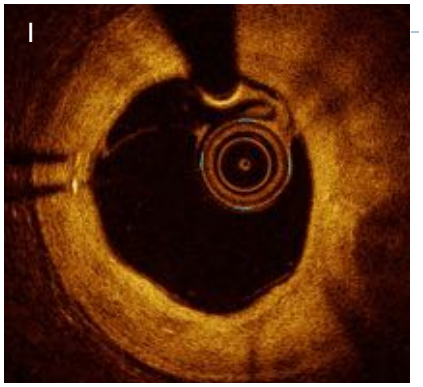
Occlusion CD2

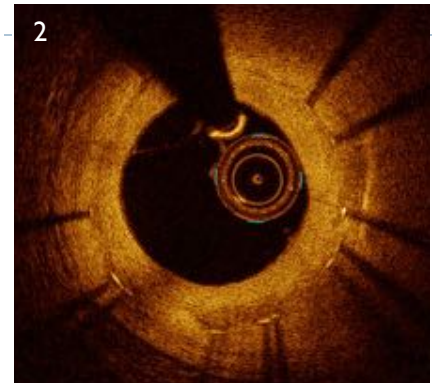
Thromboaspiration +
Ballon NC 3.5 mm CD2

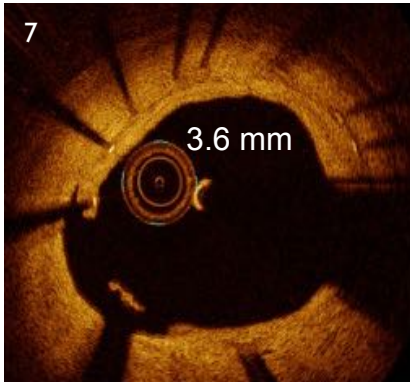
Contrôle coronaro Janvier 2017

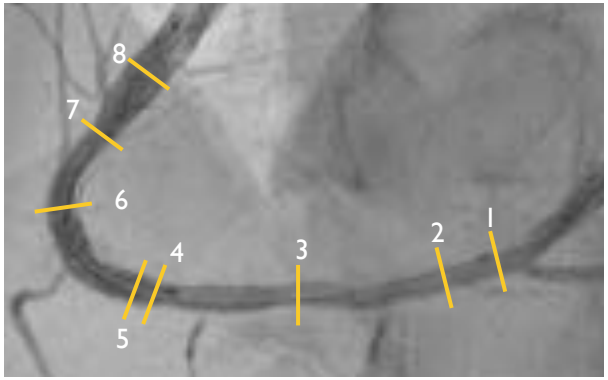
Run OCT CD

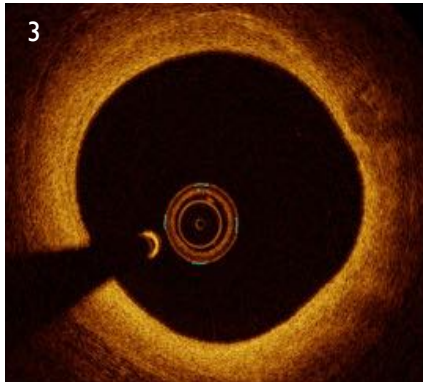


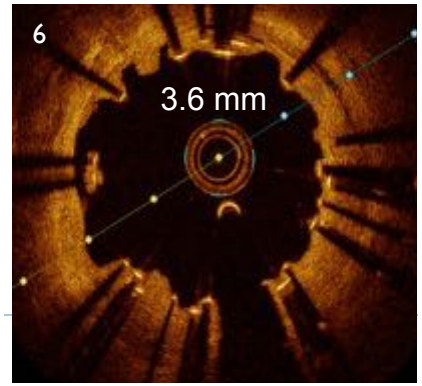


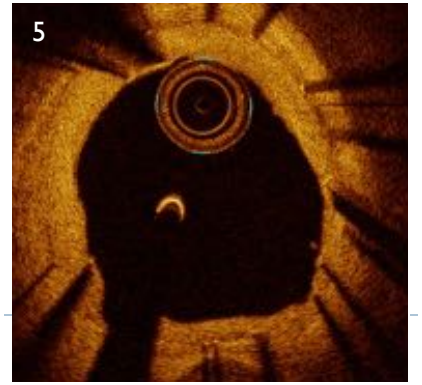


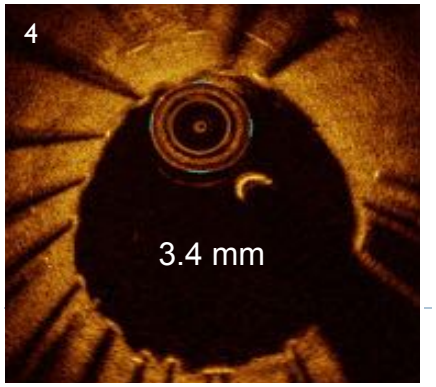






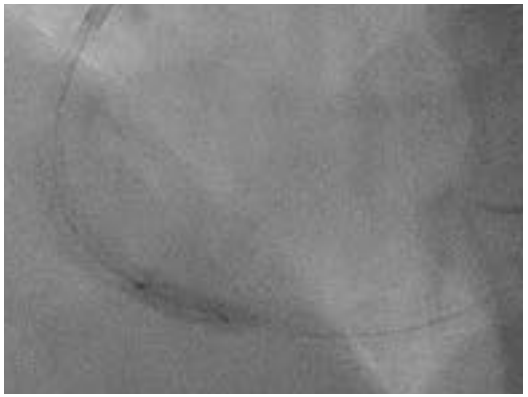


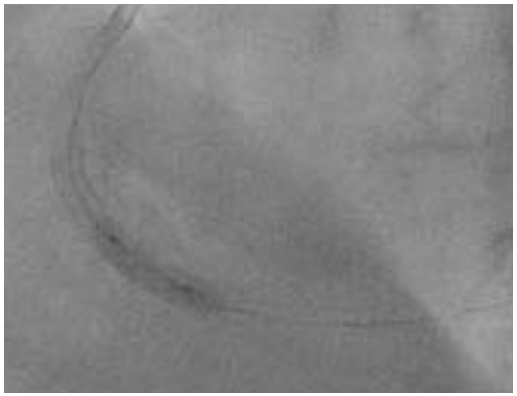




Angioplastie

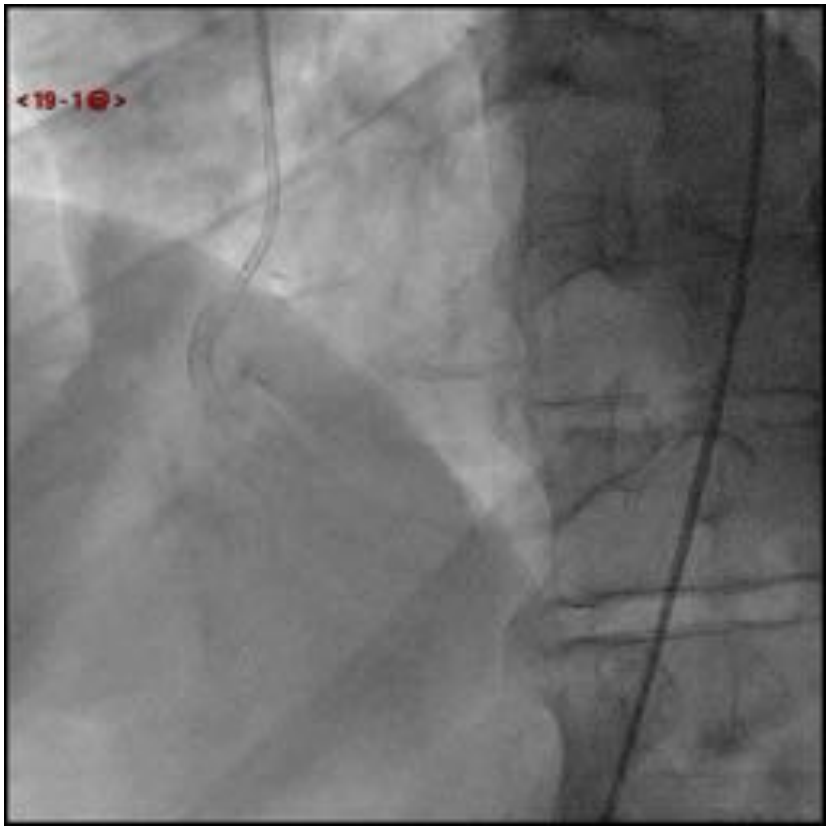
- Correction de la malapposition au ballon non compliant 3,75 x 12 :

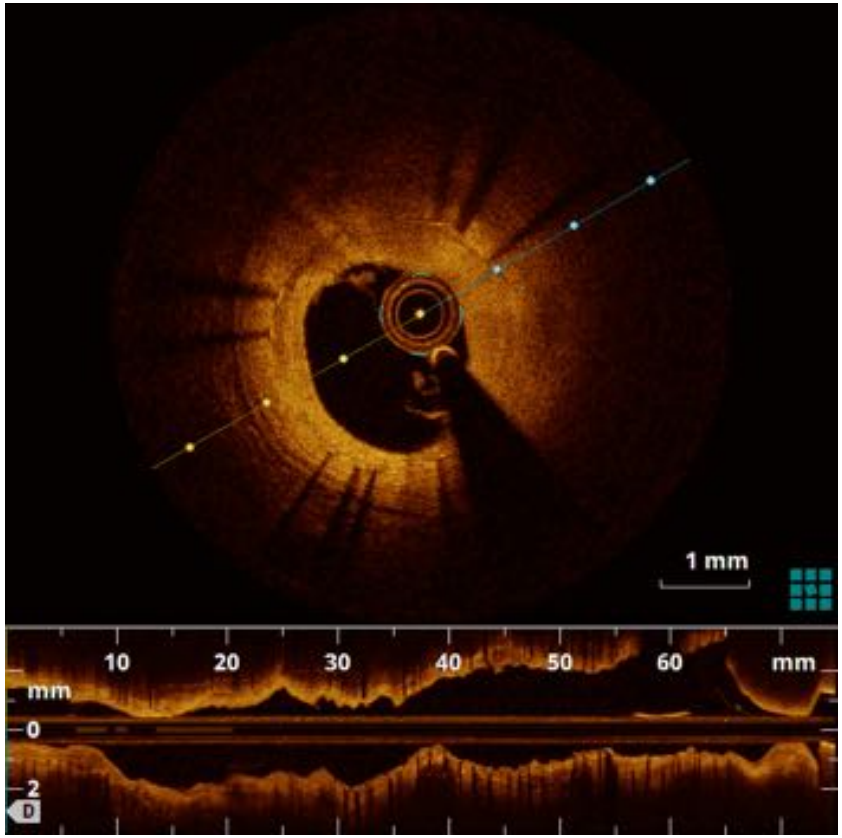




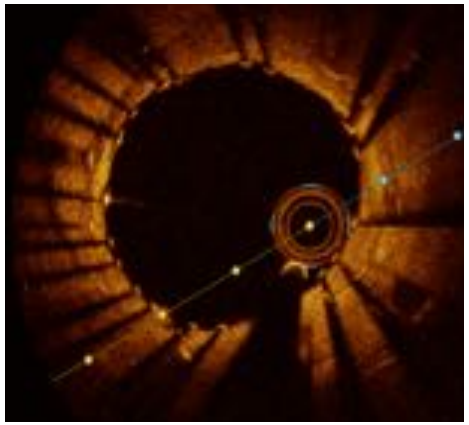
- Mise en place d'un DES 4,0 x 16 :

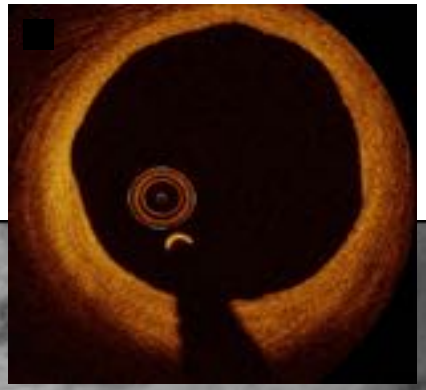
Résultat final

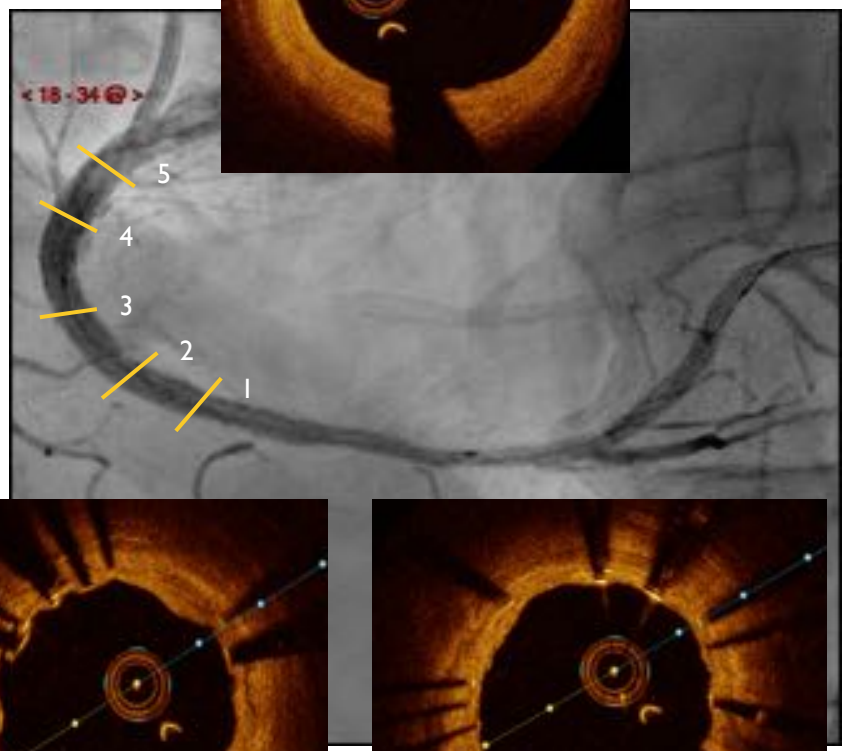


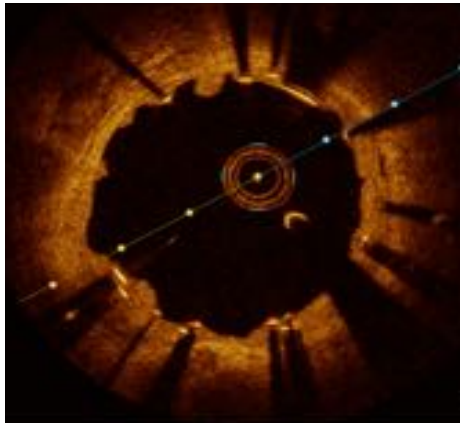


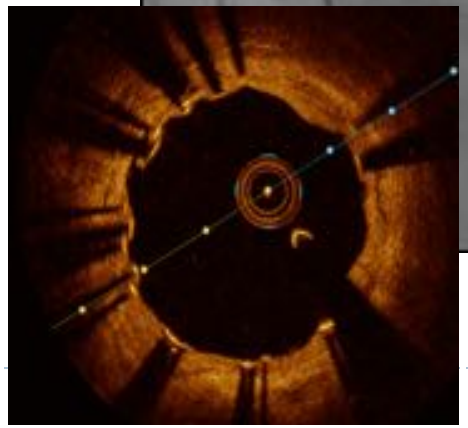
Résultat final

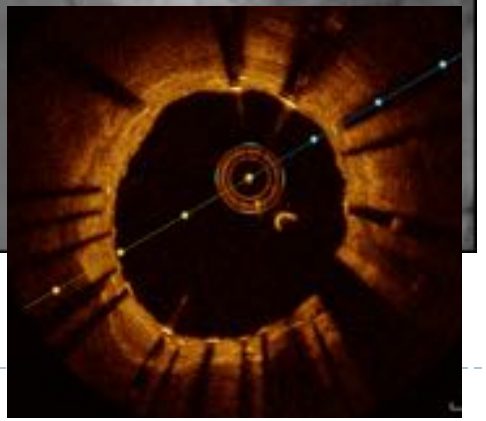








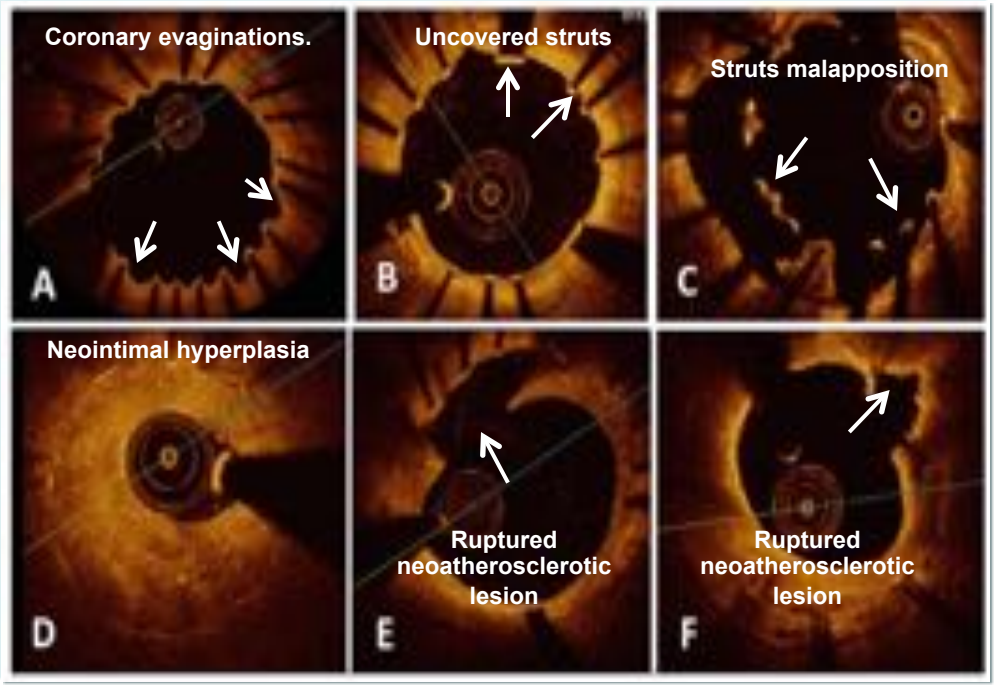




Mechanisms of stent thrombosis

PESTO french registry

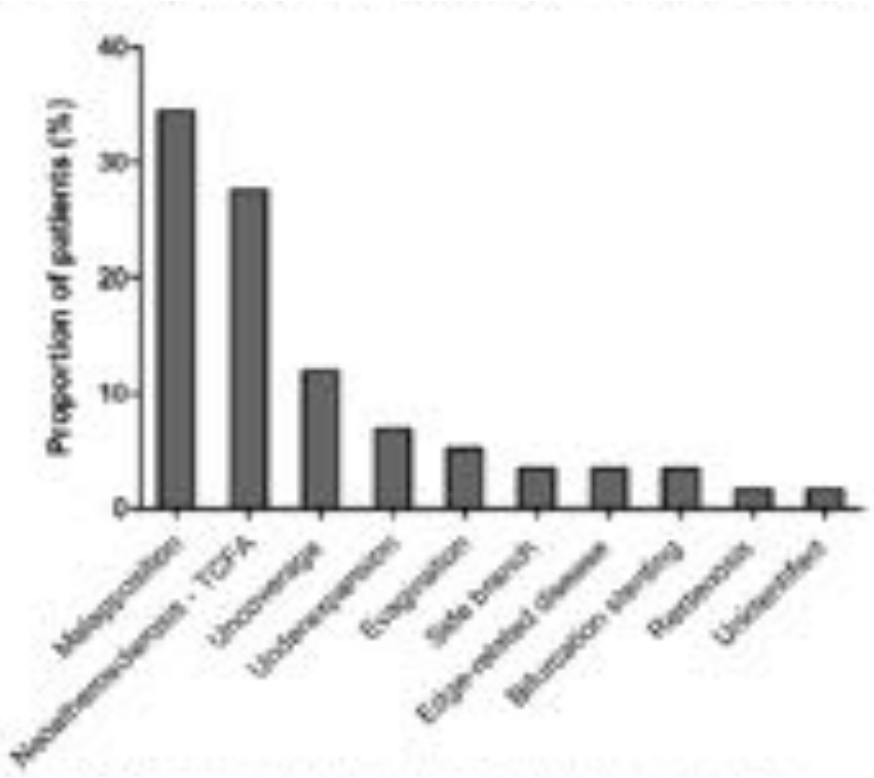
OCT imaging identified an underlying abnormality in 95% of cases



Souteyrand G et al. Eur Heart J. 2016;37:1208-16.
Amabile N et al. Int J Cardiol 2017;227:161–165.

European registry

Leading causes of very late stent thrombosis



Taniwaki M et al. Circulation 2016;133:650-660.

Dans quelles situations utiliser l'OCT en pratique quotidienne ?

Les situations dans lesquelles l'OCT est utile :

- Syndromes coronaires aigus
- Resténose intrastent

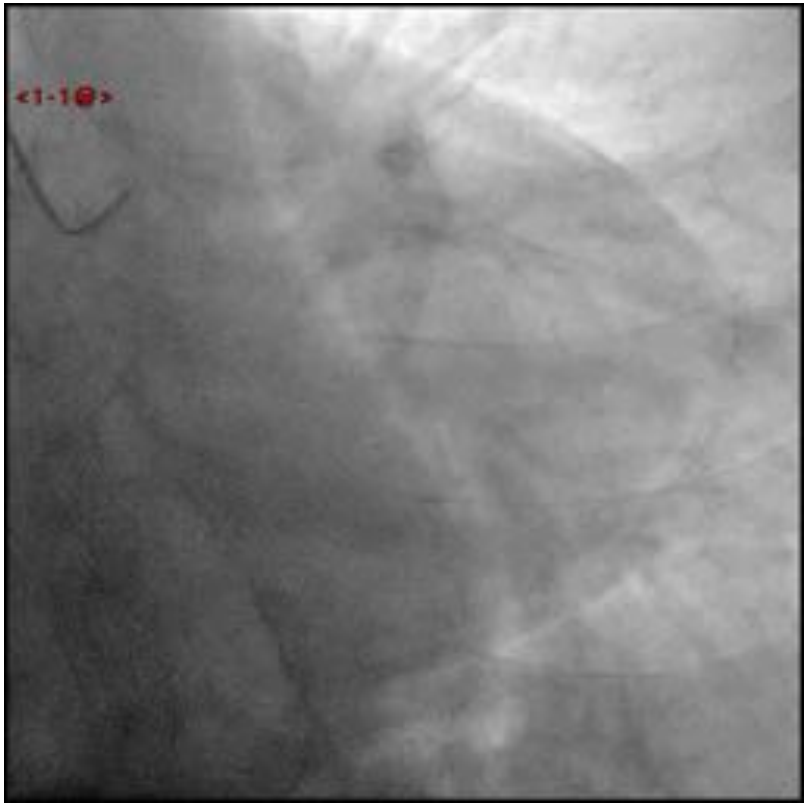
Les situations dans lesquelles l'OCT est recommandée :

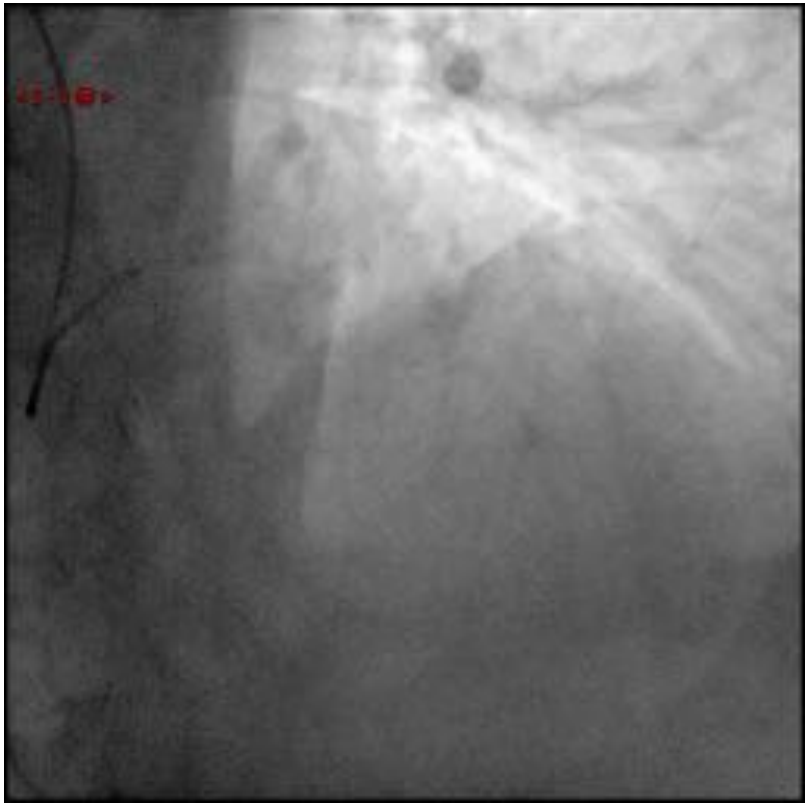
- Thromboses de stent
- Angioplastie des lésions du TC

Cas Clinique

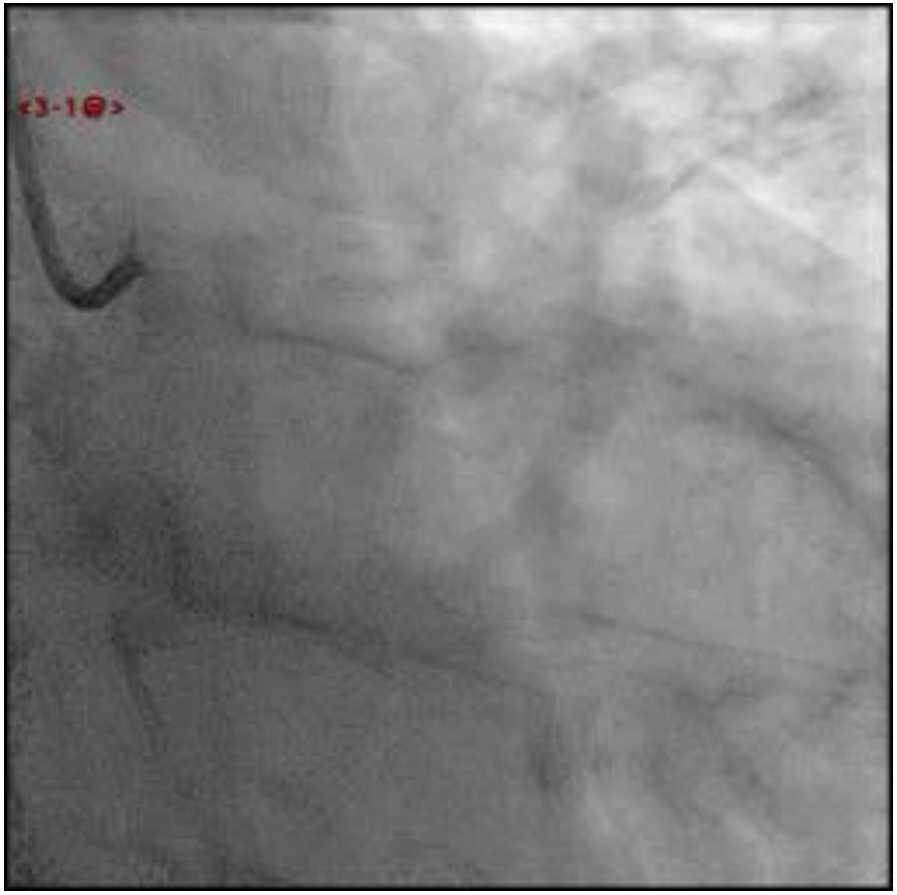
- ♂ 74 ans
- FDRCV : HTA et tabac
- ATCD :
  - AOMI,
  - exogénose chronique,
  - carcinome épidermoïde bronchique (lobe supérieur Dt récusé au plan chirurgical et traité par chimiothérapie)
- Angor d'effort documenté (EE positive)
- Coronarographie

Angiographie initiale (1)





Angiographie initiale

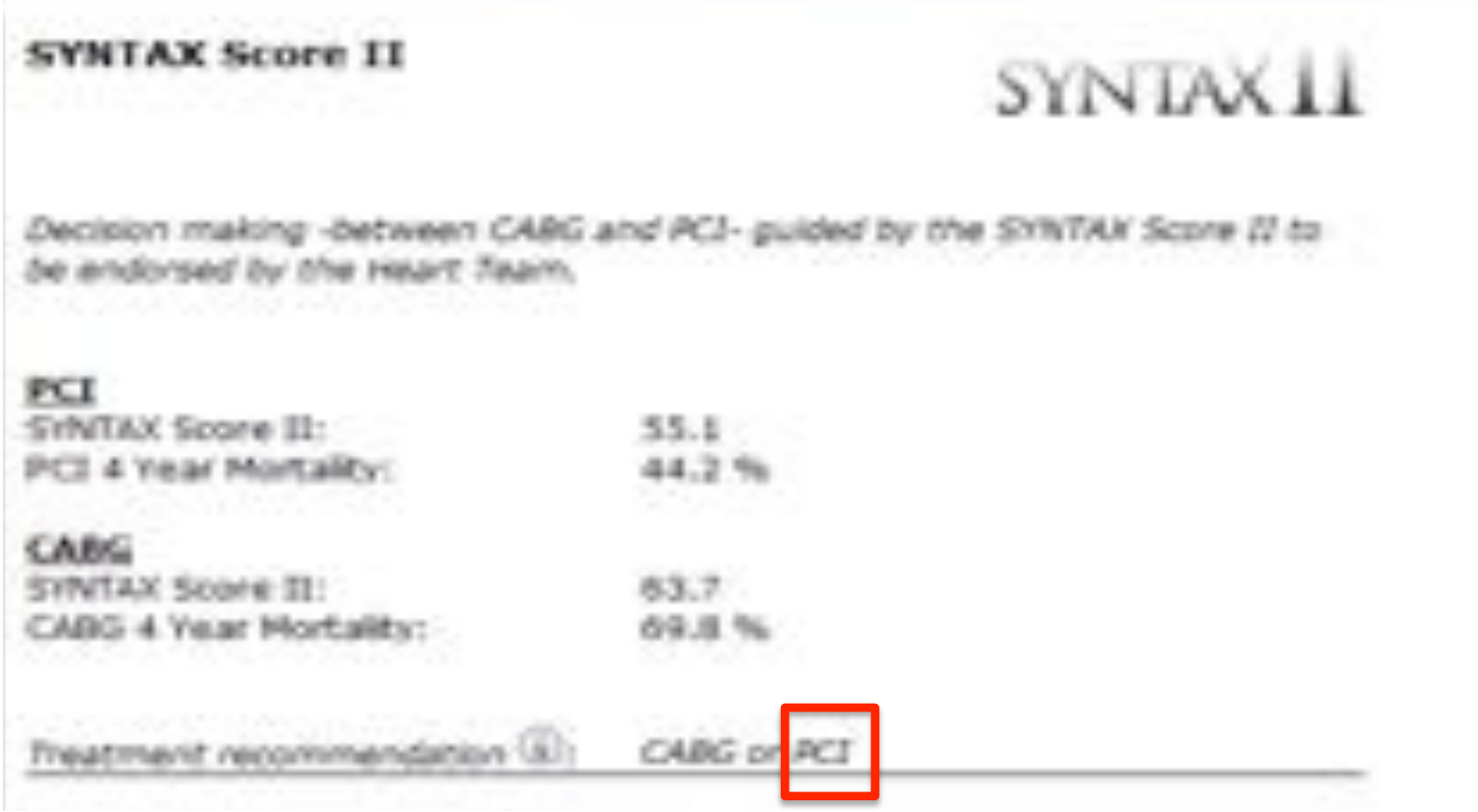


Angiographie initiale (2)

FEVG 53%

Cas Clinique

- Discussion Heart Team: récusé pour une revascularisation chirurgicale



SYNTAX Score II

SYNTAX II

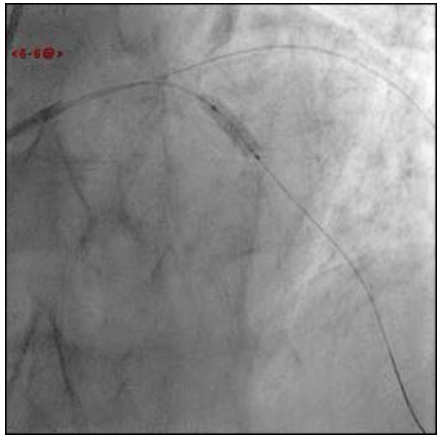
Decision making -between CABG and PCI- guided by the SYNTAX Score II to be endorsed by the Heart Team.

PCI
SYNTAX Score II: 55.1
PCI 4 Year Mortality: 44.2 %

CABG
SYNTAX Score II: 63.7
CABG 4 Year Mortality: 69.8 %

Treatment recommendation: CABG or PCI

Angioplastie IVA : Resolute Onyx Medtronic 3.5 X 12 mm

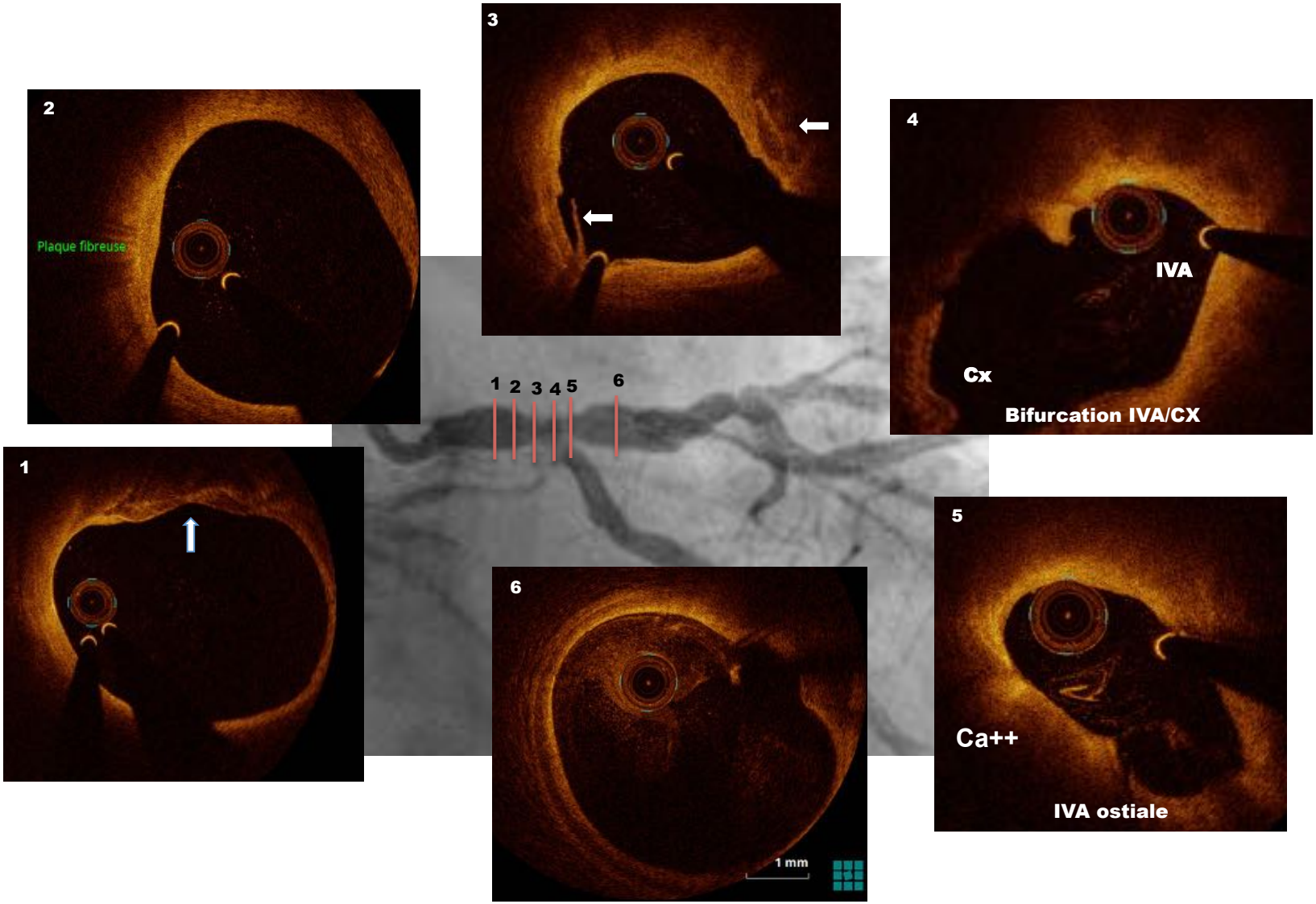




Angioplastie marginale : Resolute Onyx Medtronic 3.0 X 12 mm



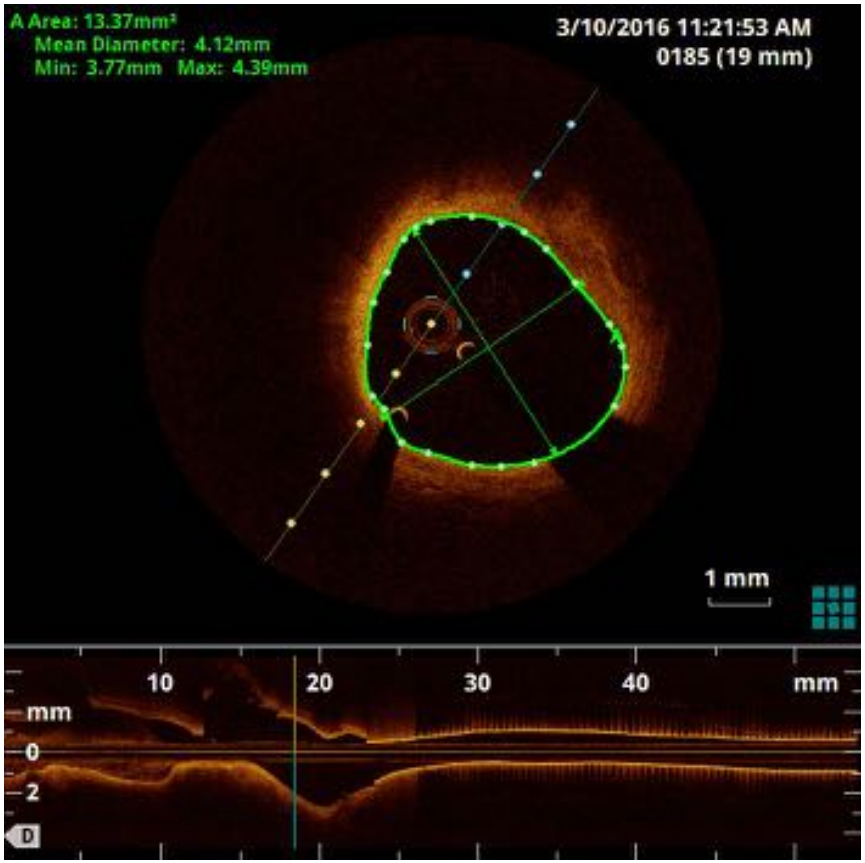
Mesure FFR de la lésion du TC

Analyse OCT pré-angioplastie

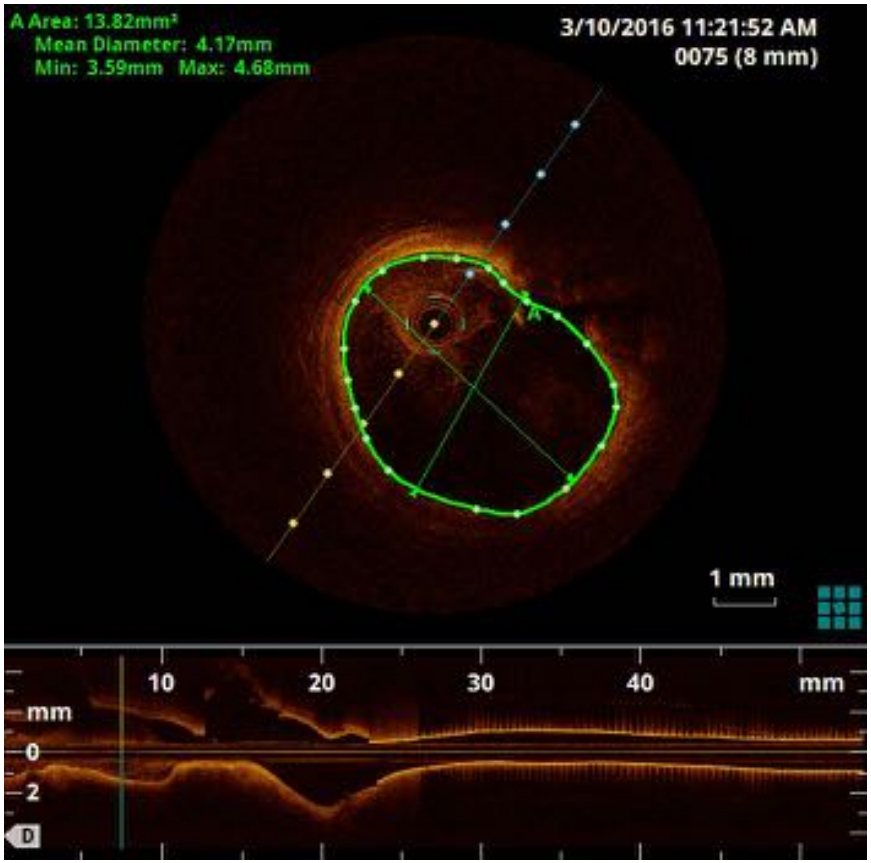


Analyse quantitative OCT

Tronc Commun distal



IVA proximale

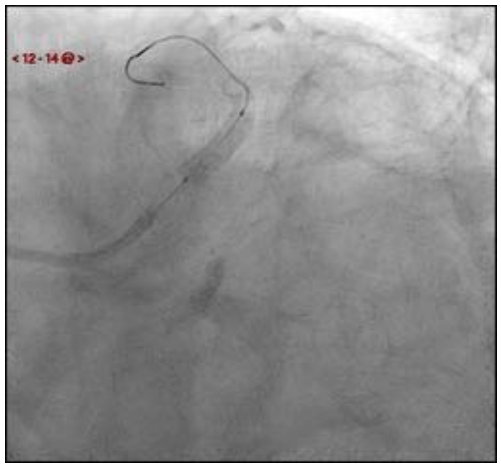


EBC consensus :

- **The MV stent should be sized according to the distal MV reference diameter.**

Lassen JF et al. EuroIntervention 2014;10:545-560.

Stenting TC/IVA ostiale : DES 4.0 x 16 mm, 18 atm

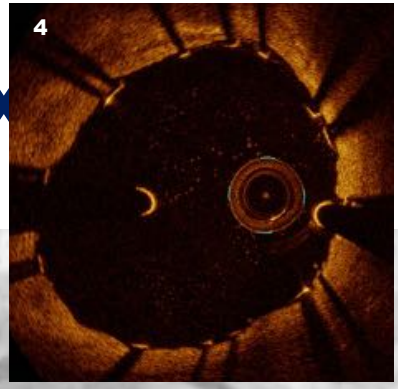


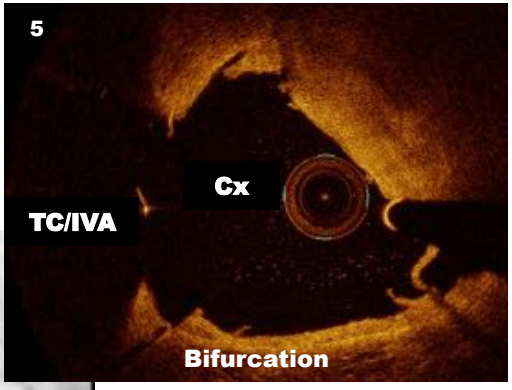
Angioplastie Cx ostiale : ballon 3.0 x 20 mm, 18 atm

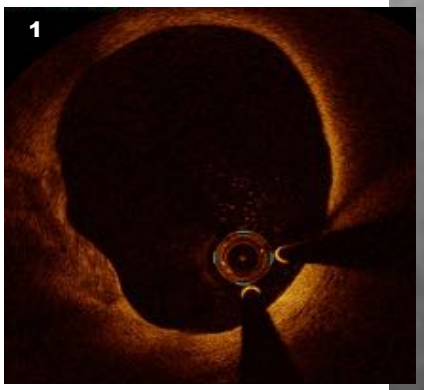
Contrôle angiographique

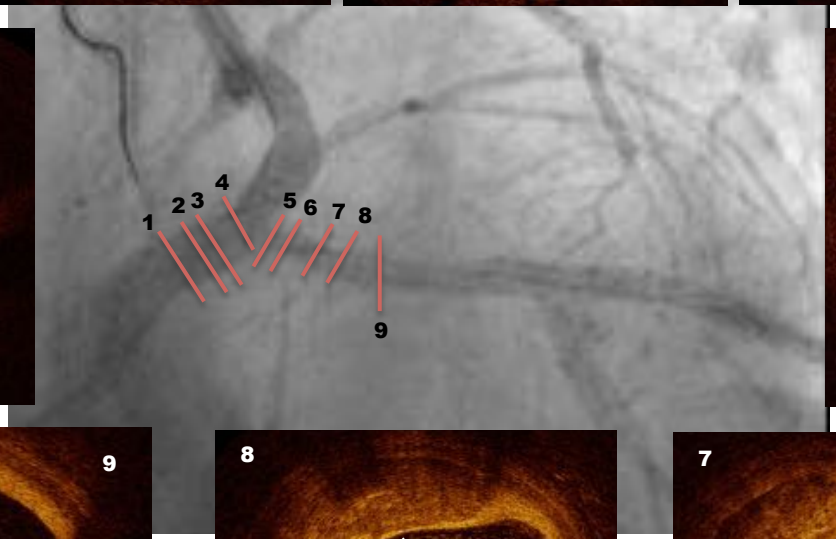

2
Malapposition

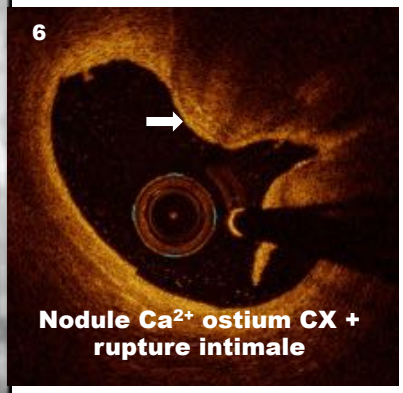

3
Malapposition

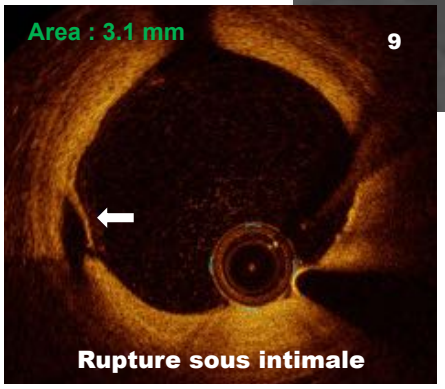

4

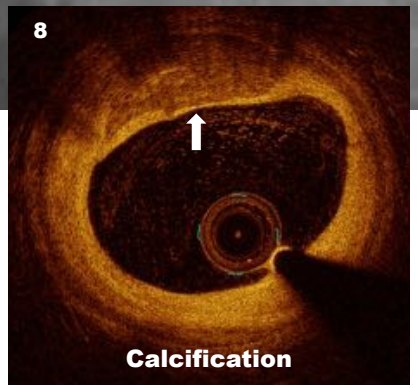

5
Cx
TC/IVA
Bifurcation

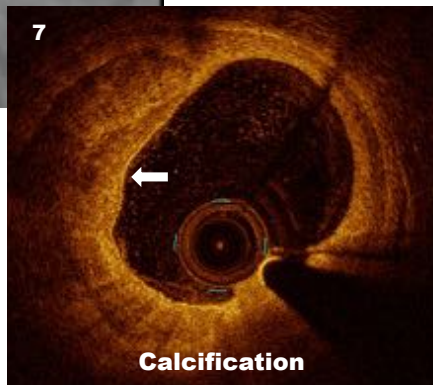

1


1
2
3
4
5
6
7
8
9

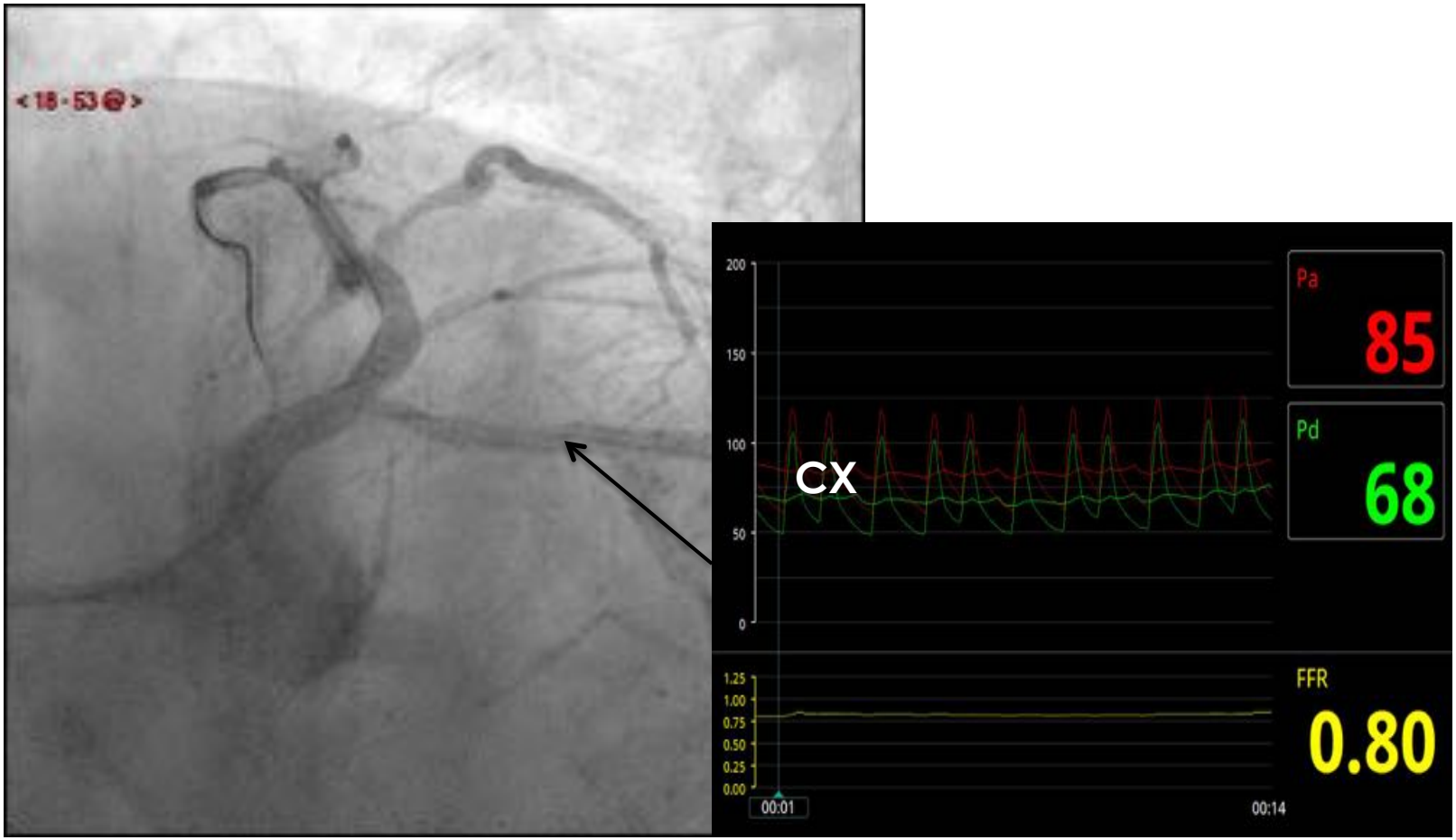

6
Nodule Ca2+ ostium CX +
rupture intimale


Area : 3.1 mm
9
Rupture sous intimale


8
Calcification


7
Calcification

Mesure FFR : post ballon CX ostiale

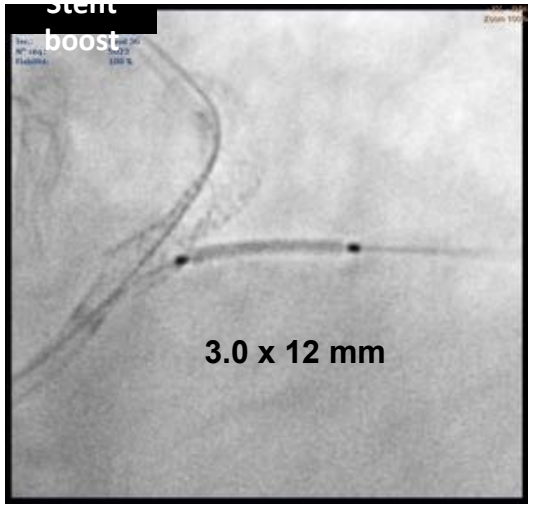


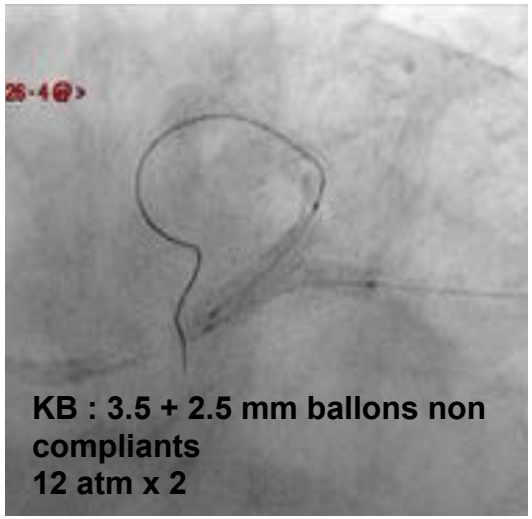
EBC consensus :

- **Large size branches with ostial disease extending > 5 mm from the carena are likely to require a two-stent strategy.**

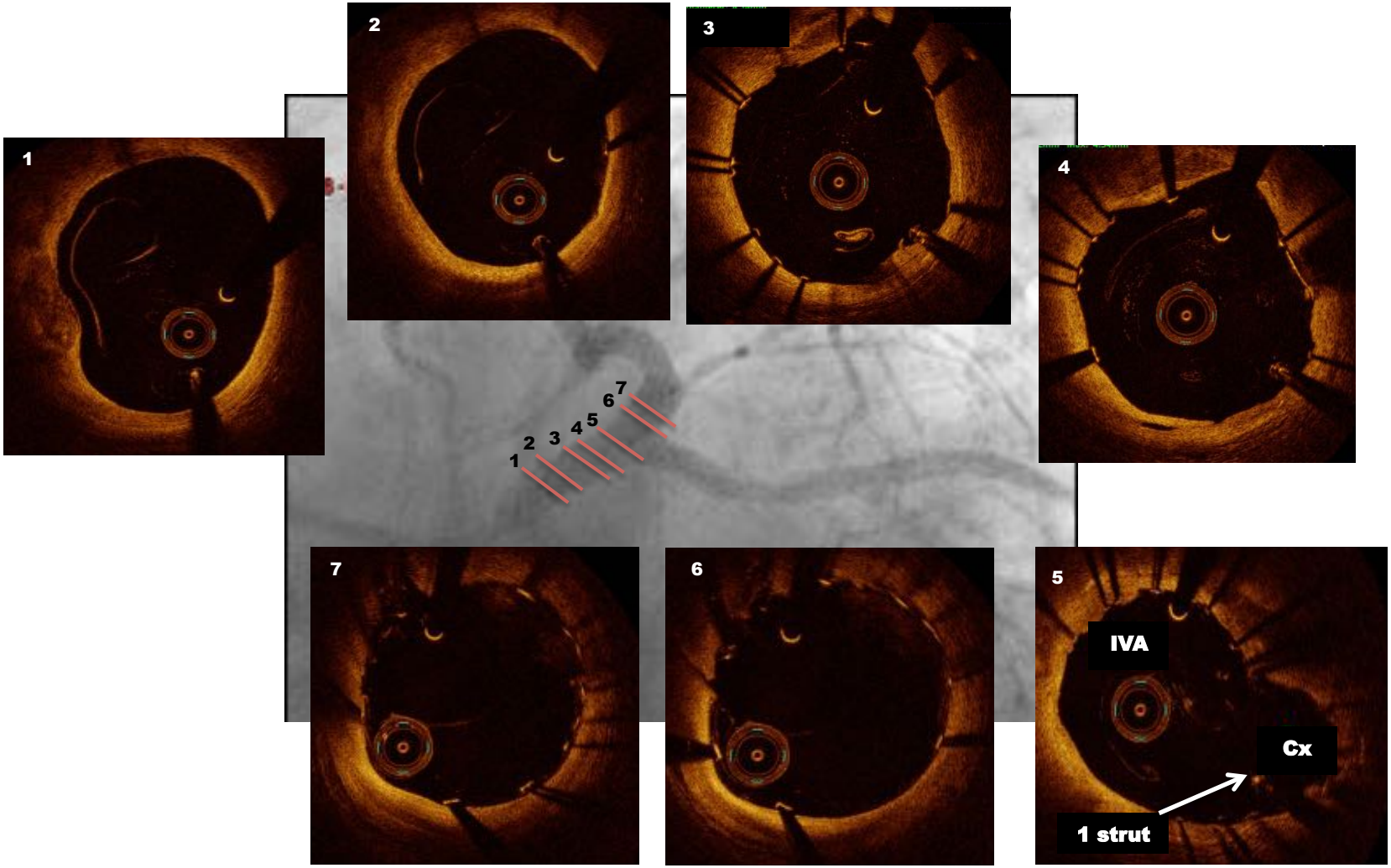
Lassen JF et al. EuroIntervention 2014;10:545-560.

T Stenting ostium CX puis Kissing

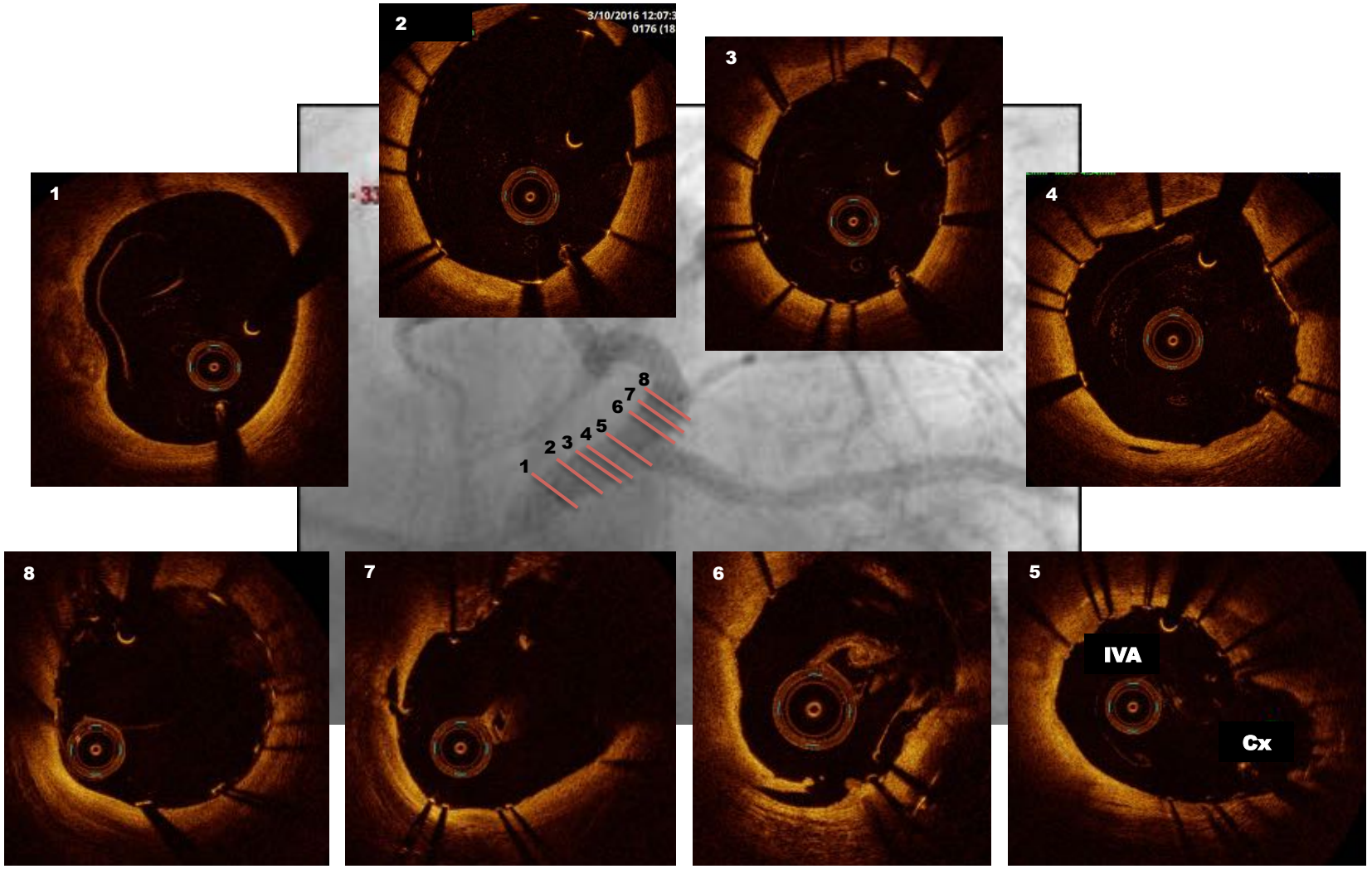




Analyse OCT finale



Analyse OCT finale…

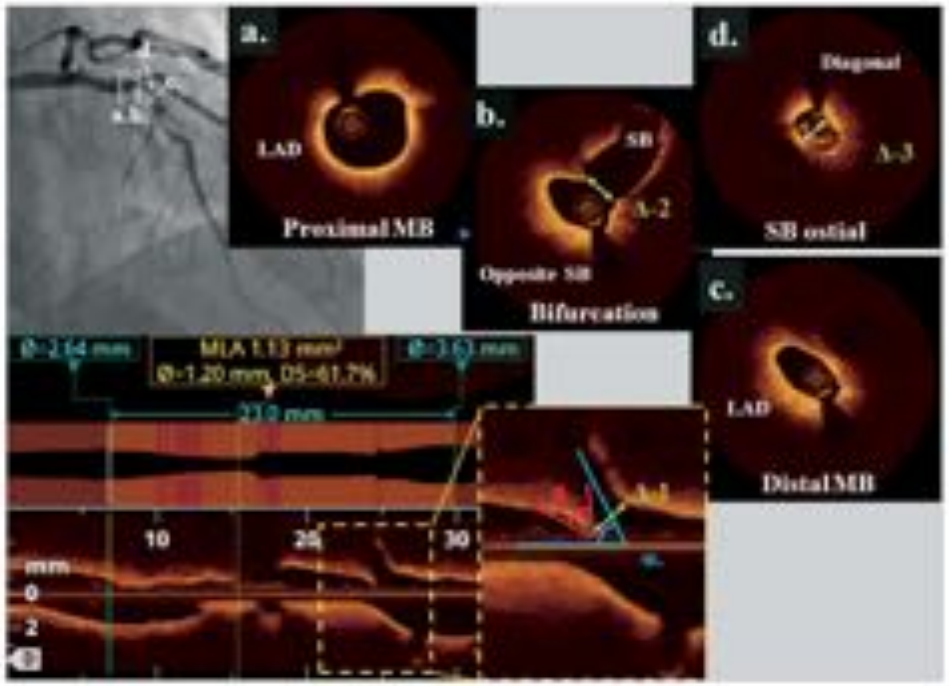


Conclusion

- Pas de dogme ni de stratégie unique
- Stratégie guidée par une imagerie endocoronaire pré- et post-PCI :
- **OCT pré :**
  - Vérifier la géométrie circulaire ou non du TC : index d'ellipticité
  - Mesurer les dimensions exactes du TC
- **OCT post :**
  - Contrôler le déploiement optimal du stent
  - Contrôler la malappostion des mailles
- **Et….ajuster la stratégie au cas par cas :**
  - POT, Re-POT, KBI, ….
  - ……dans l'intérêt du Pt

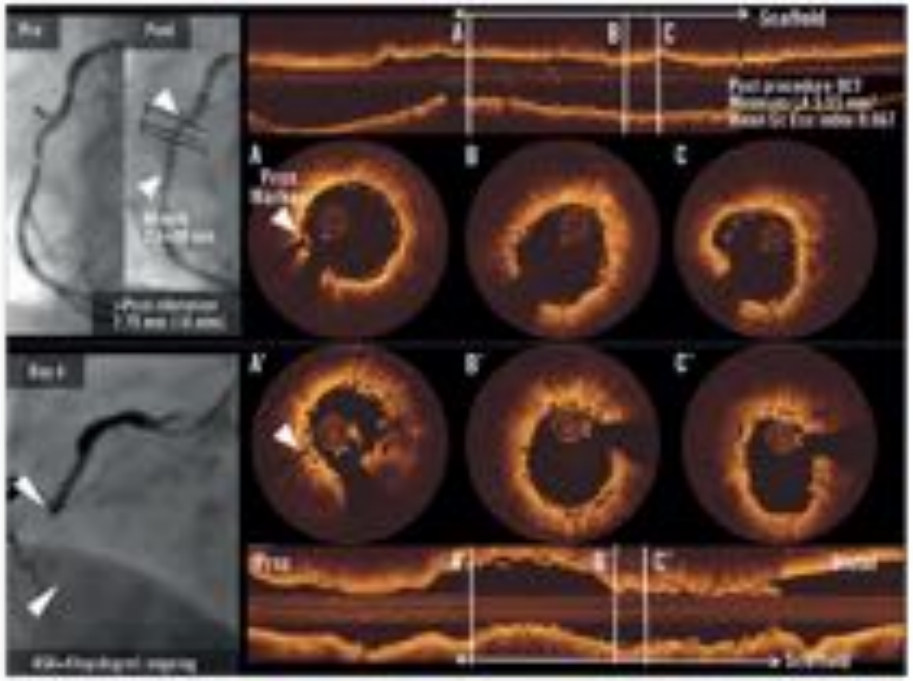
Potential benefit of OCT in …

Bifurcation stenting



Ramsing Holmes N et al.
Eurointervention 2015;11:V64-V70.

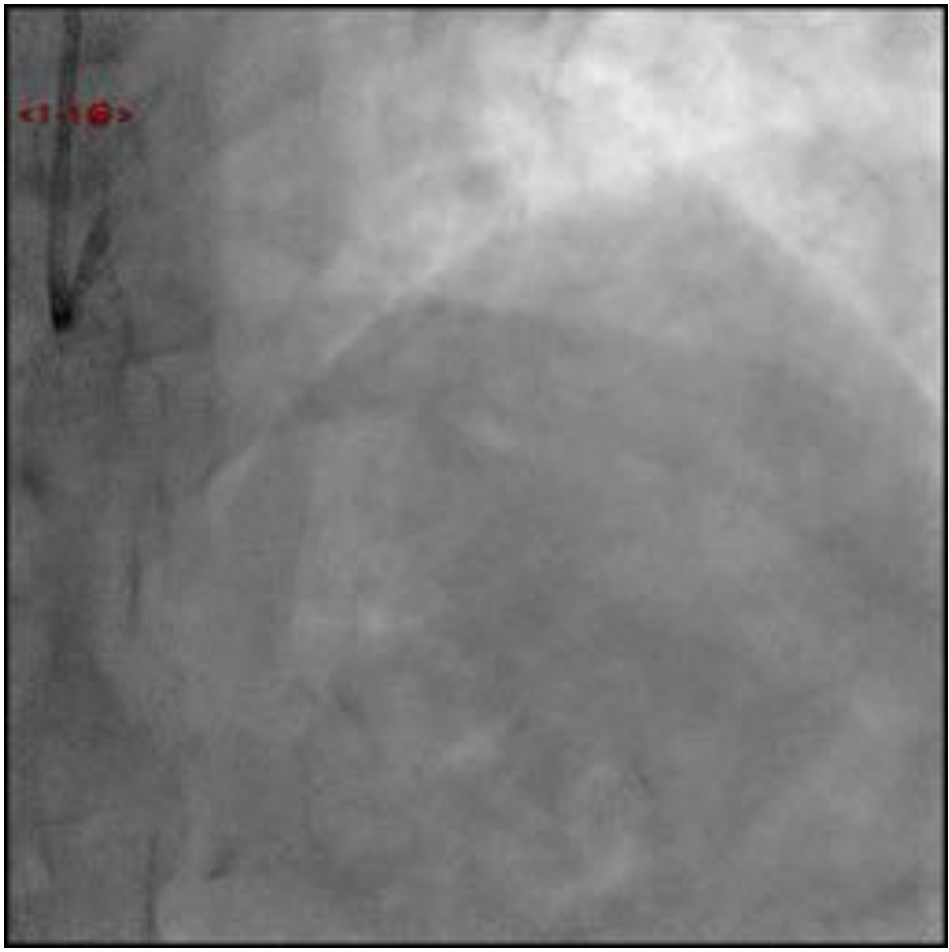
BVS implantation



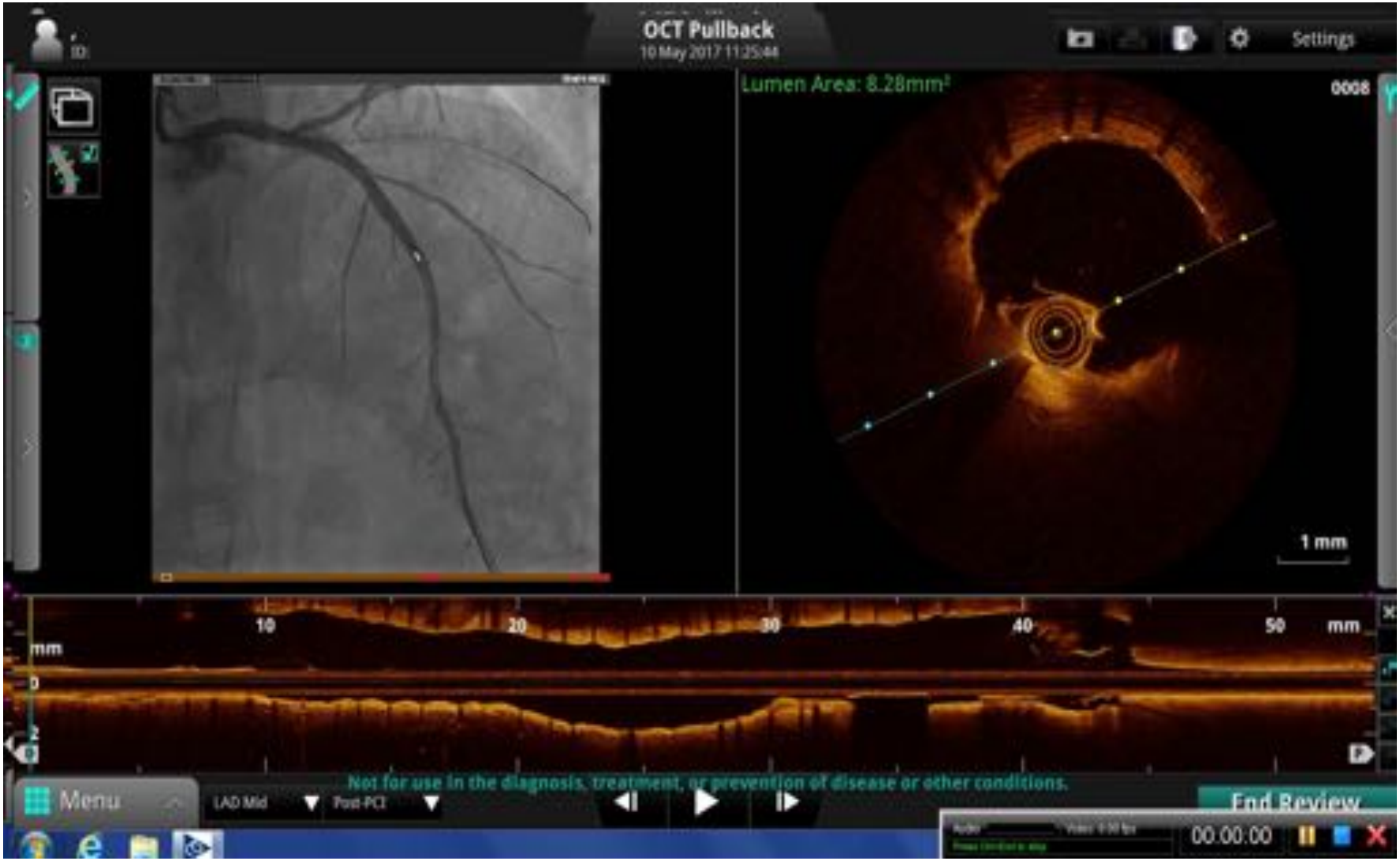
Onuma Y et al.
Eurointervention 2016;12:1090-1101.

Apport de l'OPTIS dans les lésions de bifurcation

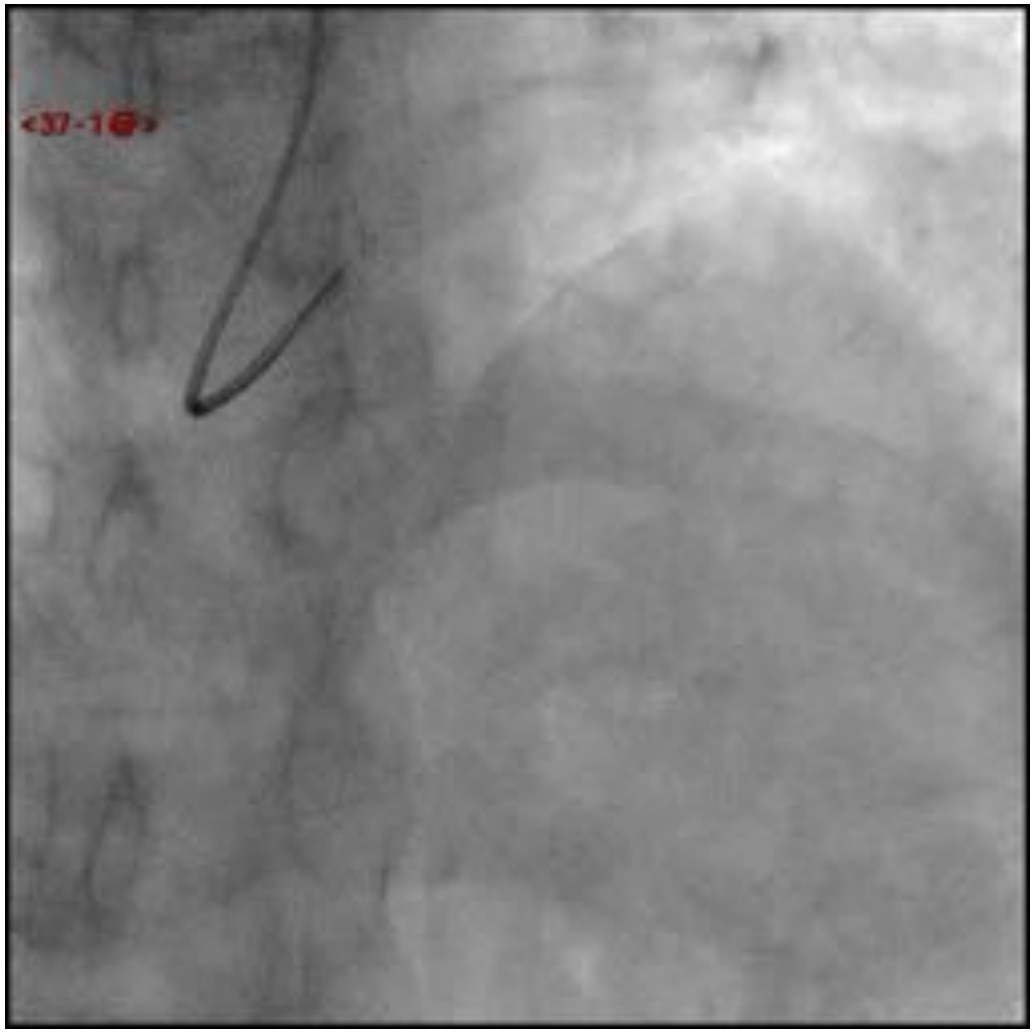
- Pt âgé de 64 ans
- Diabète, tabac, HCT
- Angor stable
- Scinti : défaut de fixation antéro-apical (15%), réversible au repos
- Lésion IVA2 (FFR 0.79) et 1ère diagonale (FFR 0.75)



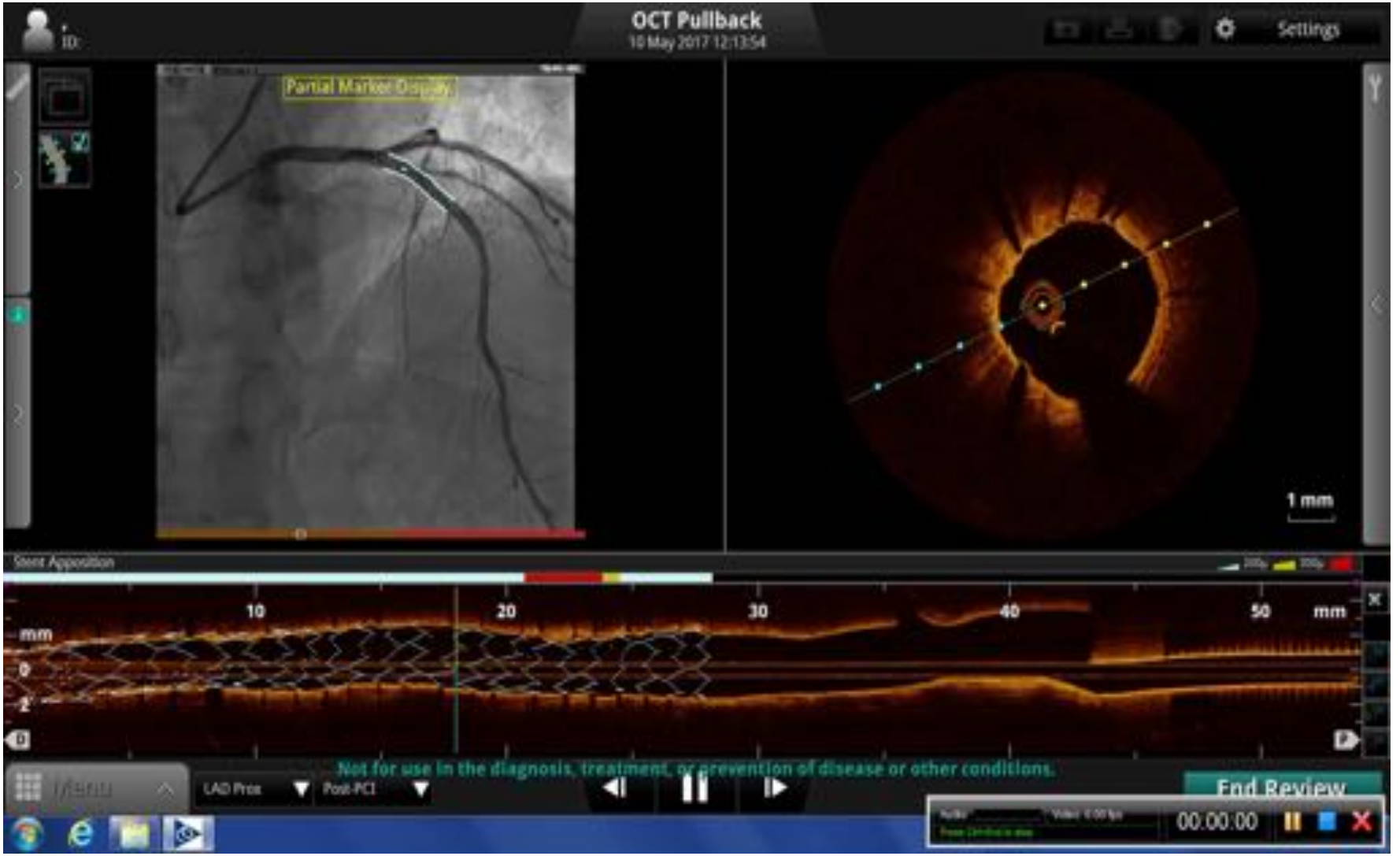
Apport de l'OPTIS dans les lésions de bifurcation



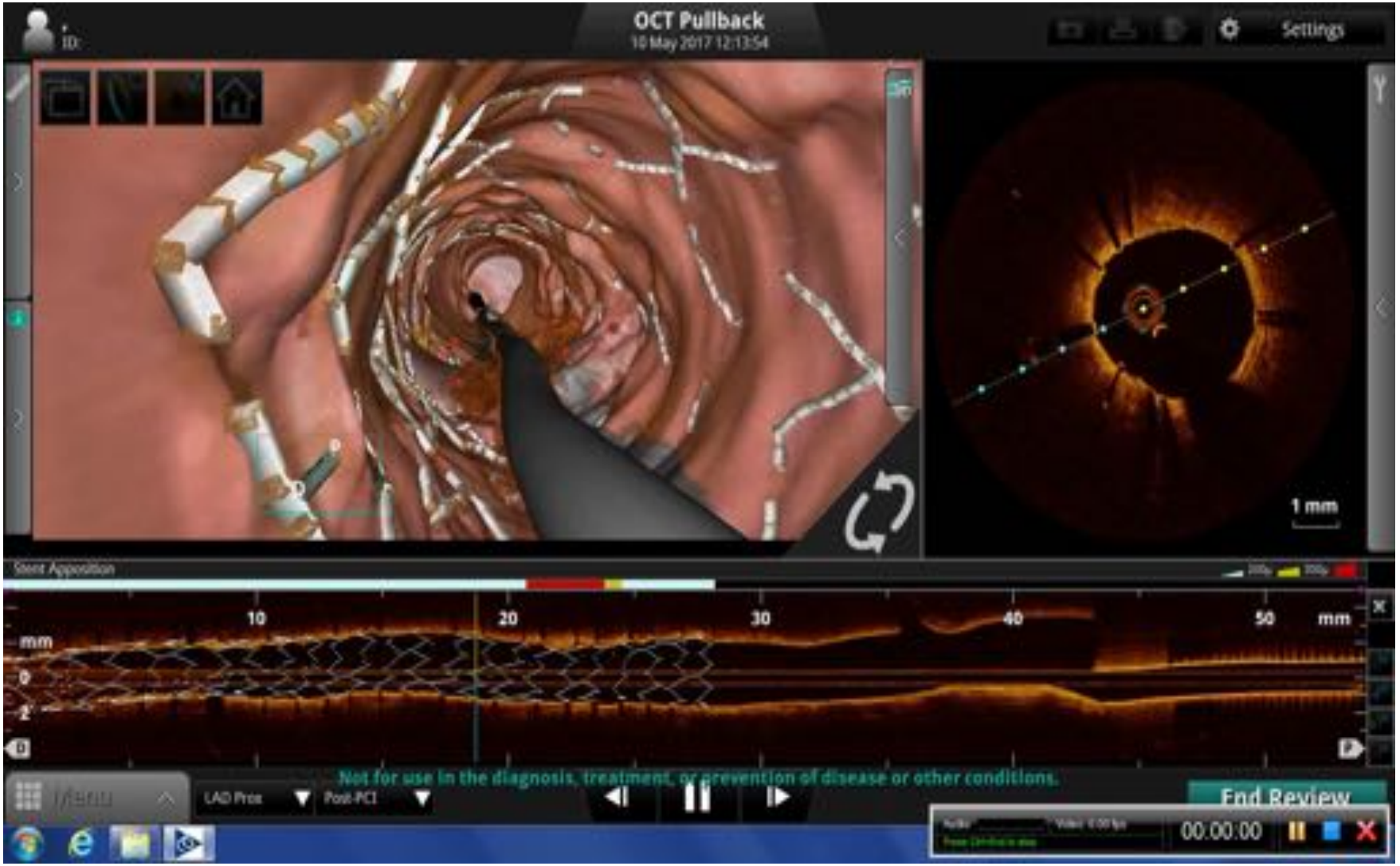
Apport de l'OPTIS dans les lésions de bifurcation



Apport de l'OPTIS dans les lésions de bifurcation



Apport de l'OPTIS dans les lésions de bifurcation



OCT for guidance in bifurcation lesion treatment

Provides crucial information in guiding bifurcation PCI

Before stenting :

- OCT may be used for assessment of :
  - proximal and distal landing zones
  - lesion composition and distribution
  - results of predilatation
  - side branch ostium measurement
  - sizing and positioning of stents

OCT for guidance in bifurcation lesion treatment

Provides crucial information in guiding bifurcation PCI

After stenting :

- OCT may be used for assessment of :
  - adequate stent expansion
  - wire positions
  - incomplete stent apposition (malapposition)
  - stent distortion
  - proximal geometric deformation
  - SB ostium strut obstruction

With the potential to correct any suboptimal result

Que disent les guidelines ?

- Main vessel (MV) stenting with provisional SB treatment, if needed, is recommended as the preferred technique for the majority of bifurcation lesions
- Large SBs with significant ostial disease extending further into the SB are likely to require a two-stent strategy
- T-stenting is appropriate for near 90 degree bifurcations

- The POT may be used in cases with large differences in reference diameter between proximal and distal MV
- The POT might be used to aid difficult recrossing into a SB with either a wire or a balloon
- POT may be of particular importance in LMCA bifurcation treatment

- Non-compliant balloons are recommended for kissing inflations
- Final kissing balloon dilatation is mandatory in any two-stent technique
- Final post-dilatation of the proximal MV segment may be considered for reducing malapposition of multiple strut layers and for correction of proximal stent distortion after kissing balloon inflation
- Provisional stenting is the preferred strategy in LMCA bifurcation lesions

- Intracoronary imaging is recommended to ensure adequate stent and vessel expansion in all LMCA bifurcation segments

Lassen JF et al. EuroIntervention 2014;10:545-560.

ESC Guidelines for Revascularisation

Recommendations	Class[a]	Level[b]	Ref.[c]
FFR to identify haemodynamically relevant coronary lesion(s) in stable patients when evidence of ischaemia is not available.	I	A	50,51,713
FFR-guided PCI in patients with multivessel disease.	IIa	B	54
IVUS in selected patients to optimize stent implantation.	IIa	B	702,703,706
IVUS to assess severity and optimize treatment of unprotected left main lesions.	IIa	B	705
IVUS or OCT to assess mechanisms of stent failure.	IIa	C	
OCT in selected patients to optimize stent implantation.	IIb	C	

Upgrade already required !

L'OCT en pratique dans ma pratique

Intérêts :

- Mieux appréhender la lésion pour ajuster la stratégie de revascularisation (approches spécifiques à certaines situations)

Applications cliniques multiples :

- Erosion de plaque dans le SCA
- Dissection spontanée ou hématome intramural du sujet jeune
- Resténose intrastent
- Thrombose de stent
- Lésions du TC (et probablement les bifurcations)

Objectif unique :

- Optimiser le résultat de l'angioplastie

Conclusion

- OCT has several applications of interest in the management of angioplasty, particularly for ACS
- **Pre-PCI OCT** can help to identify predictors of periprocedural complications (TCFA, thrombus), or lesions requiring a specific approach (plaque erosion or SCAD)
- **Post-PCI OCT** can identify findings associated with MACE (stent under-expansion, residual narrowing, edge dissection, …)
- OCT can also identify and treat the causes of **stent failure**
- The findings of the DOCTORS study suggest that OCT provided useful information beyond that obtained by angiography alone for the guidance of PCI in ACS.
- The OCT findings impacted directly on physician decision-making, leading to a **change in procedural strategy in half of cases**, and was associated with **higher FFR at the end of the procedure** than PCI guided by fluoroscopy alone.

DOCTORS : take home message

- DOCTORS is the 1st RDZ trial to investigate the use of OCT on top of angiographic guidance during PCI in patients with ACS.
- OCT provided useful information beyond that obtained by angiography alone.
- The OCT findings impacted directly on physician decision-making, leading to a change in procedural strategy in half of cases, and was associated with higher FFR at the end of the procedure than PCI guided by fluoroscopy alone.
- This improvement was driven mainly by optimization of stent expansion.
- The benefit was obtained at the cost of a longer procedure with higher fluoroscopy time and more contrast medium, but without an increase in peri-procedural MI or kidney dysfunction.
- Additional prospective studies with clinical endpoints are required before considering incorporating OCT guidance for standard use in patients with ACS.

Informations potentielles apportées par l'OCT dans l'identification des lésions responsables de SCA

- Identification des lésions responsables : volume de plaque important, contenu lipidique, chape fibreuse fine, et rupture de plaque.
- Aucune de ces caractéristiques ne permet d'identifier avec certitude l'évolution d'une lésion.
- Autres éléments physiopathologique en cause dans les SCA (érosion de la plaque, nodules Ca++,…).
- Applications cliniques multiples : intérêts diagnostiques et thérapeutiques évidents
- Bénéfice clinique reste à établir

Apport et Intérêt de l'OCT

- Résolution 10 fois supérieure à celle de l'IVUS 15 µm vs 150 µm
- Mise en œuvre simple, acquisition rapide des images
- Interprétation fiable et reproductible des images
- **Applications cliniques potentielles dans les SCA :**
  1. Analyse de la plaque athéromateuse et de sa vulnérabilité :
     - Sa composition : lipidique ou fibreuse, Ca++, TCFA,
     - Son volume
  2. Intérêts diagnostiques et thérapeutiques :
     - SCA, hématome intramural, thromboses de stent
  3. Optimisation de l'angioplastie & stenting
     - Analyse quantitative de la lésion (Ø, longueur)
     - Présence de calcifications et leur étendue (athérectomie rotative)
     - Présence de thrombus (thrboaspiration, anti GP IIb-IIIa)
     - Couverture de la lésion et des dissections de bord
     - Stent : sous déploiement, malapposition, endothélialisation